Vermont Department of Environmental Conservation

Agency of Natural Resources

Responsiveness Summary to Public Comments Regarding:

- **Lake Memphremagog, Tomifobia and Coaticook (Basin 17) Tactical Basin Plan**
- **Lake Memphremagog Phosphorus Total Maximum Daily Load**
- **Lake Memphremagog Wastewater Treatment Plant Wasteload Allocation**

On May 16, 2017, the Vermont Department of Environmental Conservation (DEC) of the Agency of Natural Resources (ANR) released a final draft of the Basin 17 Water Quality Management, or Tactical Basin Plan, a final draft phosphorus Total Maximum Daily Load and associated wastewater treatment plant wasteload allocation for a public comment period. The public comment period, which ended on June 16, 2016, included several public meetings which each covered all three draft documents.

The meetings were:

- May 22nd, 2017, 6:30 p.m., Emory Hebard State Office Building, Newport.
- May 30th, 2017, 7:00 p.m., Brighton Municipal Building, Brighton.
- May 31st, 2017, 6:30 p.m., Common House, Sterling College, Craftsbury.

Additional public comment was received at a Quebec Vermont Steering Committee on Lake Memphremagog meeting held on May 16th held at the Hermitage Country Club in Magog Quebec and at the NVDA executive board meeting held on May 25th at the NVDA office in St. Johnsbury and through direct correspondence.

The DEC prepared this responsiveness summary to address specific comments and questions and to indicate how the plans have been modified. Comments may have been paraphrased or quoted in part, and combined when they pertained to both the TMDL and Tactical Basin Plan. The full text of the comments provided is available for review by contacting the Watershed Management Division. Comments are organized by chapter of the TMDL with reference to the location in the Tactical Basin Plan where this is also relevant followed by comments that are only relevant to the Tactical Basin Plan.

Comments relevant to both the TMDL and Tactical Basin Plan

1. **TMDL General Comment (**Robert Houriet Letter - Summary):

A prefatory note regarding the bewildering amount and range of information that the Vermont Department of Conservation has released for citizen review re plans to address and remedy phosphorous pollution in the four river systems which compose the greater Memphremegog

Basin. The DEC should not have made this irrelevant and confusing "document dump" upon lay readers with the release of 5/11/17 DRAFT TACTICAL BASIN PLAN; TMDL PLAN FOR Lake Champlain; as well attached were links to Modeling Documentation for the TMDL and to a document that supposedly covered TMDL's for Memphremagog. The full text of the DRAFT TACTICAL BASIN PLAN Is proceeded by a summary. Only two single- spaced pages it is a laundry list of no special order or ranking of subjects -- all but the salient factors that contribute most to phosphorous runoff. It mis-positions the "cart" before the "horse" Indeed it is all "cart" and very little "horse" at all. Our commentary addressees what the revised Summary still lacks: in terms of what we contend are the essential facts citizens of the NEK deserve to know (in understandable context) about the state of water degradation in the Memphremagog Basin.

Response: *The Agency has provided information to the public through several different documents as well as public meetings to get input during the development of the TMDL and to support public comment on the Draft TMDL. The level of technical detail in each of these documents varied based on the intended audience and the modeling documentation was developed for those members of the public or professionals who were interested in the details of the modeling necessary to support the TMDL. At numerous public meetings during the development of the Draft TMDL only a few questions were raised on the modeling details. There was generally more interest in the implementation plan for the TMDL so this was the focus for the final public meetings on the Draft TMDL. The Agency appreciates the comments on the Tactical Basin Plan executive summary which was amended to add information about the total loading reductions required to meet the TMDL as well as the loading estimated to come from major land uses in the basin.*

2. **Comment (**Robert Houriet Letter): Court Options to Review. Though with all citizen comments, final resort to Environmental Court remains an option in the event the Agency does not incorporate petitioned changes. While the DEC's decision itself is protected by discretion from court challenge there remains an open question: if agency failure to provide a reasonable and comprehensive explanation or rationale for any decision constitute grounds for abuse of administrative authority. For the practical purpose of citizen comment and presumed Agency receptiveness, the *Gulf Network v. EPA* ruling is a moot point. However, it does direct to the Basin's central inadequacy in failing to explain policy-freighted determinations. While such decisions *pe se* are not reviewable by the courts, an inadequate explanation for the rationale may be.

   Response: *The Agency has provided extensive documentation of modeling decisions made to support the TMDL. In response to specific comments and questions received during the public comment period for the DRAFT TMDL, the Agency has provided additional explanation included in the responsiveness summary, the revised TMDL and TMDL modeling documentation.*

3. **Comment:** (Fritz Gerhardt Email.) Units: should be consistent in TMDL between pounds or kilograms, and units were incorrect in many of the tables

   Response: *Units were changed in the TMDL to pounds and unit labels were corrected in tables where this was necessary.*

TMDL Chapter 4 Sources of phosphorus to Lake Memphremagog

4. **Comment: (**Fritz Gerhardt Email.) Not sure why natural lands are combined; maybe separate, add water and "other". Names for land uses should be consistent throughout the document including backroads and dirt roads, stream channel erosion and streams.
5. **Comment: (**Robert Houriet Letter): Natural Source of Phosphorous. In the Pie Chart allocation of P sources, a large sliver (11.7%) is dubbed "Natural Sources."

   Natural Sources is a grab-bag category, unprecedented in Vermont and Quebec. It lumps together streams, forests and wetlands into one unmarketable bushel so to speak of apples, oranges and tomatoes.

   We ask in revision that the DEC follow the same separate budgeting in Lake Champlain TMDL's that set out discrete line items for streams forests and wetlands. "Natural" is a semantic pitfall. In their pristine state streams qualified as 'natural;" but stream banks of accumulated P from decades of excess fertilization (post World War II) certainly aren't.

   Response: *The Agency agrees that the category title of "natural" could be misleading. This term has been replaced in the TMDL and Tactical Basin Plan with the category of "other". Where it appears to be helpful, the Agency also separated out the individual land uses. The Agency also reviewed the documents and made changes to terms to consistently use "dirt roads" and "stream channel erosion" throughout.*

TMDL Chapter 5.1.1 In-lake Model Development

6. **Comment (**Robert Houriet Letter): I-2 CARRYING CAPACITY *Failure to present a public-understandable P budget, needed is one that would give due consideration to the "carrying" or "assimilative" capacity; take into account , the effect of internal release from the sedimented column at the bottom of Memphremegog (main lake) or in South Bay.*

- The deposition of load from the three of the four tributaries should be in South Bay, not in greater Memphremegog. The P budget for the basin should not be predicated on concentrations in the main lake, (reduced by hydrological mixing in the Bathtub of the open Lake) but rather at the point of deposition, at the mouths of the Black and Barton Rivers entry into South Bay. This is where (to mix a metaphor) "the rubber meets the road."
- Unlike St. Albans and Missiquoi Bays, there have been no studies of internal loading in South Bay.
- We ask that like studies of internal loading in South Bay be listed for funding in the Tactical Basin Plan. We recommend Vermont EPSCor as prime consultant for the project.
- In the meantime the Basin's total allocated load should be upped to reflect an increased margin of safety in the face of unresolved uncertainties regarding the rate of

internal release in South Bay. At present the 17 Basin Plan makes no standard allowance – five per cent – as the usual MOS.

Response: *Currently South Bay meets its water quality criteria for phosphorus and so the lake segment to which this TMDL applies is Lake Memphremagog in Vermont. The contributions of the Black and Barton Rivers make up a large amount of the phosphorus that reaches Lake Memphremagog, so these have been included in the development of the TMDL. The Agency included retention in South bay (described below) and then further sedimentation in the main lake as applied in the calibrated Bathtub model.*

The Agency evaluated the potential for resuspension of phosphorus in South Bay in several ways. The most significant of these was a direct estimate of the phosphorus loading leaving South Bay by sampling the bay at its outlet and comparing this to the phosphorus loading coming into the Bay through the two major tributaries. This mass balance calculation showed a substantial loss of phosphorus in South Bay or in wetlands between sampling points on the Black and Barton Rivers and South Bay that may also act to store phosphorus. In addition to this, dissolved oxygen levels measured at different depths in South Bay and Vermont portions of Lake Memphremagog show these waters are consistently oxygenated through the entire water column which greatly limits the possibility of the significant loading of phosphorous being released from sediments back into the water column. Phosphorus concentrations were also sampled at one meter above the bottom and these levels did not show any sign of significant internal loading. Finally, the Bathtub model showed that there was a substantial loss of phosphorus in the lake verses the flux of phosphorus to the lake from major tributaries providing evidence that there is not internal loading occurring in the Vermont portions of Lake Memphremagog. Based on this evaluation the Agency has left the MOS as 8% as originally proposed.

7. **Comment (**Robert Houriet Letter): Curiously, the Plan (and map) omit concentrations from the Canadian side though they must be available if not easily from the EPA. Again the Agency writer is vague and off-handed in remarking (in paraphrase) that Quebec's s water quality might have improved slightly in comparison to Vermont 's although the difference could be due to inconsistencies in Quebec's modeling some of its minor tributaries, and therefore discounted.

   QUESTION. What values of Quebec is the DEC questioning? Twenty Five percent lower than what?

   QUESTION to the DEC: what do you see as possible sources of inconsistency in modeling, water sampling, and computation of load?

   Do you the see the need in Memphremegog for the same kind of treaty agreement as supervised by the Joint International Commission that sets commitments in proportionate share of the phosphorous load in Missiquoi ? If not, why not?

Response: *The reasons for not being able to estimate loading in Quebec tributaries is because the Quebec sampling program was not designed to estimate loading as was the sampling program designed for the major tributaries in the Vermont portion of the watershed. The Quebec tributary sampling program is effective at meeting its objectives which include identifying phosphorus and other pollutant source areas and working with municipalities and landowners to address these. However, when the Agency worked with partners in Quebec to evaluate if it was possible to use this data to estimate loading, it was apparent that based on the available dataset it was not possible to estimate phosphorus loading with sufficient accuracy to be used to calibrate the phosphorus export model.*

The Agency worked closely with Quebec partners in developing the TMDL including leading a coordinated chloride monitoring effort and taking split phosphorus samples so that laboratory results could be compared. As noted in the modeling documentation, there was a difference in the trends observed for in-lake concentrations in Quebec and Vermont, with Quebec in-lake data showing a reduction of roughly 25% over a timeframe that the Vermont data remained relatively consistent. The Agency chose a modeling timeframe from 1999 through 2012 where both the Vermont and Quebec in lake phosphorus values remained relatively consistent to minimize the impact that these differences may have on the lake model. The Agency is continuing to work with the Province of Quebec to understand the differences in trends that were observed in our datasets. The Province of Quebec and Agency have different sampling protocols and laboratory methods which are being evaluated to understand what may have caused this difference.

The Agency and Province of Quebec have not recommended a treaty agreement supervised by the International Joint Commission for the Lake Memphremagog TMDL. One reason for this is that the Quebec portions of the Lake currently meet their phosphorus guidelines unlike the situation in Missisquoi Bay. The Agency and Province of Quebec and partners in each country continue to work together through the Quebec Vermont Steering Committee on Lake Memphremagog on phosphorus reduction efforts.

8. **Comment** (Fritz Gerhardt -email): The TMDL doesn't clearly explain WHY chloride was modeled. Can you explain why briefly?
   Response: *Two sentences were added to the TMDL to provide some background information on how chloride modeling was used to estimate exchange between lake segments.*

TMDL Chapter 5.1.2 Watershed Model Development.

9. **Comment (**Robert Houriet Letter): There is a Lack of sufficient justification and empirical evidence to validate modeling assumptions in deduction of settling and retention of sediment-bound P by ponds and lakes from the final load deposition in South Bay or Lake Memphremegog. First off, the DEC's summary of final loads for the basin's four tributaries are a misleading estimate of P loading since mitigated by speculative factors of settling and retention. The main modeling device that serves to make this study's results incomparable is

subtraction from total load of phosphate that (supposedly) settles out harmlessly in sedimented bottoms of ponds and lakes before final deposition in South Bay.

We observe underscore that some Agency modeling decisions were unfounded by empirical calibration and validation marked by "synoptic "testing of TP concentration – in particular at the outlet Clyde River outlet in Newport. (a modeling decision entirely within the expertise of the Agency's discretion.)

There should be sub-budgets for each sub-basin. For example for the Clyde (the basin with the highest retention from settling of P bound sediment) the sub-budget should itemize the amount and source of retention at each stage of the Clyde's descent to Memphremegog. This should include the amount kg or lbs removed from Pensioner's Pond, Charleston Pond locally known as Electric Light pond, Little Salem Pond, Big Salem Lake, and Clyde Pond.

Response: *The overall concept of TP retention in lakes is a long-held scientific certainty in lake science that has been applied for decades. The upland lake retention model that was used in the land use export model is used widely in many studies and was based on a study by Larsen and Mercier in 1976. The Agency evaluated this retention model vs others that have been published during the collaborative model development and then as the model was refined to produce the final TMDL. This retention model best represented the differences in loading that was observed in the Clyde River vs the Black and Barton Rivers and so was the approach that was used in the TMDL model. This is a calibration step that may have gone unnoticed by the commenter based on the comments provided.*

The Agency included a map in the modeling documentation (Figure 19) that shows the estimated retention applied to each area of the watershed and Table A3 in Appendix A of the modeling documentation that includes the percent retention amounts used for each body of water in the land use export model. The Agency agrees that the impact of this upland retention across each major basin was not explicitly shown in the TMDL document so the following table was added showing the impact of this upland retention in the estimation of delivered phosphorus to South Bay or Lake Memphremagog. This table highlights the need to include a factor for upland retention to explain the large difference in loading form the Clyde River as compared to the other three major tributaries.

Watershed	Total modeled Load (Kg) No upland lake sedimentation	Total modeled Load (Kg) with upland lake sedimentation	Measured Load (kg)
Black River	21942	21551	22622
Barton River	22165	19639	18858
South Bay Direct	992	985	
Clyde River	13564	6489	6420
Johns River	1537	1537	1316

Main Lake Direct	2963	2963	

10. **Comment (**Robert Houriet Letter): The 'Flip' From Sink to Source**.** DEC's has worked out retention equations for each settling pond along the Clyde's route to the lake. Granted that the DEC considered variables of flow, depth and current in working out these equations. Yet we question if the DEC took into account not only variation of retention rates of the above ponds and Big Salem, but overall the process of retention – especially in wetlands; with attention to the possibility the process could " flip" – that is, reverse itself from being a positive factor for removal, to a negative phenomenon that adds to the phosphate load. Has the DEC determined if in fact any of the ponds in Clyde's line of descent have become or are nearing saturation so that they can no longer serve as "sinks" to retain P, but are instead ae augmenting P concentration?

    Still we contend it would be more "science sound" to validate the huge assumptions of this Sedimentation Model empirically by comparing P concentrations and flux between Little Salem Pond and Big Salem. The LEM's sedimentation equataions could be tested by comparing results from water entering Little Salem and that at the outflow of Big Salem. In the absence of such collaboration, we ask that the DEC increase its MOS, and thus decrease the amount of speculative TP that has been cut from total basin load. We petition the DEC to perform the above revisions as a matter of responsible public policy: that it is preferable for the public to know with grim exactness the extent of water degradation rather than given palliative analysis that may understate the problem

    Response: *There are several challenges with the commenters request for "comparing concentration and flux for TP at the Little Salem inlet to the Big Salem outlet". This includes the fact that there is not sufficient water quality data to directly calculate loading flowing into these lakes from the Clyde River and the other direct tributaries. While we could use the land use export model to estimate loading to Salem and Little Salem, given the large amount of potential retention in lakes above Salem and Little Salem this would be confounding with regards to understanding retention in these two lakes specifically. Finally, we do not have a sufficient dataset for Little Salem Lake to support such an analysis on this lake.*

    As noted previously DEC calibrated the retention equations based on the measured loading at the four major tributaries and believes the approach selected is sound. The commenter suggests that lakes that are currently acting as sinks may flip from a sink to a source at some future time. With efforts to reduce watershed loading described in the TMDL and Tactical Basin Plan the potential for lakes to suffer from low dissolved oxygen levels is expected to decrease so the Agency sees no reason that lakes in the basin will have reduced retention over the TMDL implementation timeframe.

11. **Comment (**Robert Houriet Letter): There is a lack of sufficient rationale for selection of the land export model over that of the SWAT model. No where do we find in any of the aforesaid documents any word of SWAT as being considered or presumed the more likely candidate to

model the Memphremegog basin. Precedent is questionable for application of the Land Export Model to a dynamic river basin. compared to SWAT whose applications to river systems are global. By contrast, the Land Export Model is simpler has less "moving parts". Foremost, it does not and cannot collect data on a daily basis; or on a farmstead level of HUC-12 level of resolution. (Note that the DL in the EPA's TMDL refers to Daily Limit.)

The point is that the calculus of SWAT's daily cumulative estimate is bound to exceed in total pounds of P that of LEM's. By depending on annual averages LEM excludes peaks of P runoff from early snowmelt prior to the May. These peaks marked by 500 to 1,000 ug/liter readings of Total P if detected at all by LEM's limited May to October periods, are minimized by averaging. In short, LEM is structured to reflect a statistical underestimate of total basin load.

Response: *The Agency agrees that SWAT models are an appropriate tool for estimating phosphorus loading for the purposes of developing phosphorus TMDLs but that for many reasons the use of the land use export model was appropriate and sufficient for the development of the Phosphorus TMDL for Lake Memphremagog.*

First, there are significant costs associated with the use and calibration of a SWAT model, especially on an international watershed where input datasets are not necessarily compatible. Additional resources are needed for the creation of the necessary inputs to the SWAT model. The Agency participated in a collaborative process to develop a watershed model for the Lake Memphremagog watershed in coordination with partners with the Quebec Vermont Steering Committee on Lake Memphremagog. Through this collaborative effort, eight different modeling programs were evaluated including: DRAINMOD, Annualized Agricultural Non-point Source Pollution Model, Watershed Ecosystem Nutrient Dynamics, Areal Non-point Source Environment Response Simulation, Arc View Soil and Water Assessment Tool (SWAT) 2000, Chemicals Runoff and Erosion from Agricultural Management Systems, Outil de Diagnostic des Exportatnions de phosphore, and Wisconsin Lake Modeling Suite. The Arc View SWAT model was not chosen because we did not have some of the necessary inputs that a SWAT model requires and a SWAT model requires extensive calibration for which sufficient funding was not available at that time. Based in the input from the group, a land use export model with consideration for lake sedimentation and hydrologic soil groups for cropland was selected. The modeling approach was considered sufficient based on the goals of the study.

Land use export models are commonly used to support the development of phosphorus TMDL's. In EPA Region 1 alone, the states of Massachusetts, Maine, New Hampshire and Connecticut commonly use land use export models in the development of lake phosphorus TMDLs. This approach has also been widely used across the country. It's unclear the meaning of the commenters distinction between a "lake" vs a "river" TMDL since the TMDL for Lake Memphremagog is for the lake. As explained in the TMDL, the concern is on the annual loading to the lake and the majority of the lakes where land use export models were applied also have significant tributary inputs. Although some applications of land use export models have little

instream data against which to evaluate the model, the Lake Memphremagog application has a tremendous amount of instream TP data against which to calibrate both the upstream lake retention as well as the total loading at the mouths of the rivers. This level of data significantly increases the utility of this model approach.

The Agency disagrees with the commenters contention that "the calculus of SWAT's daily cumulative estimate is bound to exceed in total pounds of P that of LEM's". The land use export model was calibrated to measured loading at four major and 24 minor tributaries. This measured loading was not calculated as the commentator suggests as the "product of annually average mean concentrations and annually average flow rates" but was calculated based on regression between discharge and phosphorus concentration. For the major tributaries, the fact that loading rates are higher on the rising limb of the hydrograph was also factored in. The sampling period for the major tributaries was from as soon as ice was off major rivers through December, in most years, so the commenters contention that "By depending on annual averages LEM excludes peaks of P runoff from early snowmelt prior to the May" appears unfounded.

12. **Comment (**Robert Houriet Letter): DEC'S Meager Comparison: LEM v. SWAT

The above thus far, is our take on functional differences of LEM v. SWAT. The DEC in both published and in power point presentations attempted some functional comparison. But in our view the DEC analysis that the Agency puts forward publicly is too simplified to be excused as a clumsy attempt to deliver a Reader's Digest version to the public unlettered in computer modeling applications. In fact DEC's main theme of its rationale for choosing LEM over SWAT is LEM's 'simplicity." Conceded it does have fewer "moving parts" than SWAT and thus is cheaper to implement to Memphremegog.

But this facile justification contains presumptions. The Memphremegog Basin hardly presents a lower degree of complexity than Missisquoi Bay; likewise to the Rock River to which modified SWAT programs have been successfully applied. If DEC decided to model "on the cheap" (and that's debatable) *what moving parts of the SWAT model does LEM dispenses with?*

DEC admits that LEM dispenses with several functions that SWAT computation includes, namely slope and adjacency to a waterbody. But along with soil type, they make up two of the big three factors in determining whether runoff from a field in continuous corn silage can be diagnosed as innocuous (on level land on a back hill farm) or targeted as pernicious source of runoff.

Without algorithims for slope and water connectivity, neither LEM or SWAT can de-limit the source of P runoff to those particular plots, small in total area, that account for the bulk of P runoff.

Response: *It's true that a SWAT model requires many more resources and inputs that were not required for the land use export model. In part, these include information on rainfall,*

temperature, fertilizer and manure applications, tilling, grazing, and crop rotation information. However, the Agency contends that the use of the land use export model was sufficient in estimating TP loading to the lake. Regarding the identification of high TP loading areas in the watershed, the Agency used water sampling data, not water quality modeling estimates, completed at over 150 sites across the Lake Memphremagog watershed. These data identify phosphorus source areas which in many cases have isolated source areas down to watersheds of a few square miles. If one were to use a more detailed modeling approach such as a SWAT framework, predicted areas of high export would still need to be verified with instream monitoring to "ground-truth" model outputs. This water sampling program has been done in coordination with Agency partners and through a Lake Memphremagog Agricultural Working Group and Regional Conservation Partnership Program grant through the Orleans County NRCD. This group has been working with farmers in the high export target subwatersheds to further identify source areas and practices to be implemented. The Agency feels that this approach is as effective if not more effective than using a SWAT model to identify source areas that account for the bulk of phosphorus runoff.

13. **Comment (**Robert Houriet Letter): **Sources of LEM'S Coefficients**. Both SWAT and LEM models depend upon the application of coefficients, ratios of P load relative to load and land use. SWAT coefficients are ARS tested, and conform with established values and standards of NRSC research. But we learn that coefficients that drive LEM are vaguely taken from the "literature." In a few cases such as classes of soil the specific source of the literature are cited (e.g. Aubert Michaud, Quebec.) But there is no comprehensive bibliography of coefficient sources. It is thus impossible to judge (a key part of peer review) whether the research from which the coefficient is derived is both current or regionally applicable; if it is out of date (Walker, 1998) or originates from New Zealand rather from New Hampshire.

    Response: *References for the literature values which were used as a basis of the land use export model are referenced in the modeling documentation in Table 13 but due to an oversight the full references were not included the references section of this document. The modeling documentation has been updated to include these references. The literature values for phosphorus export values were then calibrated based on the measured loading in tributaries which limits the impact of the choice of the initial export coefficient used.*

14. **Comment: (**Robert Houriet Letter): The wetlands category bears closer scrutiny. If wetlands are considered in the overall load, what studies does the Land Export Model use to determine among the basin's wetlands which ones operate as sources rather than as sinks or filters? It would seem that of all the basin's wetlands, the great Barton Marsh at the outlet of the Barton River and under the stewardship of the state as a WMA, would deserve close scrutiny. We ask in revision that the DEC pay greater attention to the more complex and problematic dynamics of the Barton mash, and adjust an TP concentration level for South Bay from a single value biased toward the Black River, to one that takes the Barton Marsh into proportionate account.

Lastly, the Basin plan does remark (p. 47) that "sedimentation of South Bay is expanding rapidly at the mouths of the Black and Barton rivers." In revision could the DEC expatiated on this? How rapidly measured in what time frame? And where precisely and how measured? How much deviation does the Barton Marsh show from conventional rates of eutrophication? Is it wise for the DEC to assume that sedimentation in this particular case can be written off as benign, and deducted from a total assessment of water degradation? We ask that DEC at least furnish explanation for its position.

Response: *The Agency agrees that there is uncertainty about phosphorus loading from wetlands. The modeling documentation states: "Through the technical committee (of the Quebec Vermont steering committee on Lake Memphremagog) there was significant discussion around the estimate for wetland loading. A literature review shows loading estimates that range from negative (net retention of phosphorus) to the values used in the Smi model which were at the high end of the range." The reference for this literature review was added to the modeling documentation. Given the complexity involved in the wide array of wetlands in the basin, and that the Agency did not have the ability to distinguish the potential for individual wetlands to store or release phosphorus, which may even change for wetlands from year to year, the Agency selected an intermediate phosphorus export value and then relied on the calibration process to adjust this higher or lower based on measured loading values.*

The Agency reviewed historical aerial photos of the outlets of the Barton and Black Rivers to observe growth in the deltas of these rivers but made no attempt to quantify the rates of expansion other than to note that this supports the loss of phosphorus in these locations. Much of these wetlands are managed by the state of Vermont as part of the South Bay wildlife refuge and while sedimentation of these wetlands may be a concern it is not the focus of the Lake Memphremagog TMDL. These wetlands are identified in the tactical basin plans for further study to evaluate the reclassification of these wetlands as Class 1 wetlands.

15. **Comment (**Robert Houriet Letter): There is a lack of explanation for why coefficient for corn silage was not broken out from general category of cropland uses. The 17 Basin Plan did provide a pie-chart covering the entire basin that divides P runoff from all sources. Cropland, Pasture and Hay were assigned respective percentage of the total Pie. However the umbrella term "Cropland" was never – in the course of the entire dossier of 17 Basin studies – differentiated into conventional components: corn, grains, soybeans, vegetables. Comparable basin studies in Vermont and Quebec provide discrete categories for continuous corn silage. That It makes up the lion's share of total Cropland runoff is well-established nationally.

    To highlight what we are asking for officially: a fuller explanation of the omission of the coefficient for continuous corn, This request is like prior ones of this Comment (the SWAT v. LEM model choice, deduction of sedimented P from total load) similar in that they all

represent rightful demands supported by court rulings narrowing the field of action against Agency decisions (or non decisions) that can be found arbitrary or capricious.

Response: *The Agency agrees that corn silage is a significant source of phosphorus to Lake Memphremagog and estimates that this makes up the majority of the 7398 kg of loading that was estimated to come from cropland. The majority of cropland in the watershed is corn silage and the export coefficients used to estimate loading were based on studies of corn silage (Michaud et all 2006). The small percentages of cropland in other crops were not broken out individually and the corn silage loading rate was applied to these other croplands; although, due to the small acreages of these other land uses this should not have a significant impact on the TMDL. Also, the loading rates from annual croplands and BMPs applied to croplands are not substantially different so there is little reason to break these out individually. The commenter also makes reference to the importance of corn silage in the Rock River watershed. The agency would note the area of cropland including corn silage is just 1.9% of the Lake Memphremagog watershed which is a much smaller percentage of cropland than is in the Rock River watershed.*

TMDL Chapter 6 Establishing Allocations and TBP Chapter 3 Implementing Basin priorities to restore surface waters.

16. **Comment** (Newport Meeting): Some of the practices in the TMDL and basin plan are not legally required and I don't think many people are going to make these changes without enforcement. For example, many people are still going to use phosphorus fertilizer on their lawns even though this is illegal because it is still available in stores and there is no enforcement of this law.

17. **Comment** (Craftsbury Meeting): Act 64 regulations are going to drive businesses out of Vermont and cause farms to go out of business or cause the failure of small farms which will then be bought up by larger farms which may exacerbate the phosphorus loading issues.

Response: *While Act 64 includes many key regulations that are necessary to meet the TMDL load reduction targets, this law was passed by the legislature prior to the Lake Memphremagog TMDL and tactical basin planning process. The Basin 17 Tactical basin plan includes many strategies to support municipalities, businesses, and farmers in meeting these new regulations by providing technical and in some cases financial support in ways that are also targeted to maximize phosphorus reductions that can be achieved through compliance of these regulations. Clean water is an economic benefit, and declining water quality results in declining property value and loss of tourism and so the restoration of water quality in Lake Memphremagog will also have a positive economic benefit to the region.*

TMDL Chapter 6 Establishing Allocations and TBP Chapter 3-B Stormwater runoff and Erosion from Roads

18. **Comment** (Brighton Meeting): How does the TMDL and Draft Tactical Basin plan address erosion and culverts on lumber company roads and private roads which make up a majority of roads in some portions of the watershed including the Averill Lakes Watersheds? Is there

funding and technical assistance that can be focused on addressing runoff from these private roads?

Response: *There was funding for private roads with formal road associations though the Better Backroads program but the Better roads program is no longer able to support this work. Some Ecosystem Restoration Program funding has been provided to address runoff from private roads although the focus for these funds are on public lands. We can provide technical support to private road associations. The Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont provide some standards that may help especially for those lands under the current use program including spacing of water diversions on logging roads during and immediately after logging, and guidance for soil stabilization to establish ground cover.*

19. **Comment** (NVDA meeting): How do dirt roads contribute to phosphorus loading and why would vegetation along reduce phosphorus loading levels since when it dies it will release phosphorus?

    Response: *Dirt has phosphorus attached to it and so when this erodes into surface waters it brings phosphorus along with it. Vegetation in ditches along roads help to prevent erosion of the ditches during rain events and so help to reduce phosphorus loading to surface waters.*

TMDL Chapter 6 Establishing Allocations and TBP Chapter 3-C Agricultural runoff

20. **Comment** (Brighton Meeting): How will you work with farmers who may not be aware of the Required Agricultural Practices (RAP's) and who are not focused on addressing water quality issues?

    Response: *There has been a lot of outreach about the RAP's by the Agency of Agriculture. In addition to this a Regional Conservation Partnership Program grant allows the Orleans County Natural Resources Conservation District to do outreach to farmers directly in areas of the watershed to try to get them into nutrient management training classes and help them to understand the new RAP's and resources available to help them meet these.*

21. **Comment** (Craftsbury Meeting): How does the TMDL address the large acreage of conversion of forest land to cropland which I estimate at about 300 acres nearby Craftsbury in recent years, as this would significantly increase phosphorus loading.

    Response: *This land use conversation would increase phosphorus loading as noted and increased BMP applications would be needed to match this loading to meet TMDL reduction targets. Stricter erosion limits from croplands in the RAPs should reduce the impact of these conversions to some degree. There are also significant acreages of old hay and pasture land that are converting back to forest that may balance out the loading at some level. There is no simple way to estimate the amount of clearing for new cropland or reforestation of existing cropland that is likely to take place over the next 20 years so this was not estimated in the TMDL.*

22. **Comment (**Robert Houriet Letter): The $670,000 budget of the Conservation District. Of that amount -- what percentage is passed on to farmers directly ? How much to meet cost of setting up and maintaining buffer strips, to reimburse cash lost from adopting cover crops and

rotations? How much of the S670,000 is allocated for the District's organizational overhead? How much for salaries and expenses of staff and field workers?

We concur with the thrust in the tactical basin plan that the RCPP practices are "being targeted to areas which have been identified through water quality sampling as sources areas to maximize phosphorus reduction impacts of these projects and follow up sampling is being done to demonstrate the impacts of these projects." in keeping with the unique aim of SWAT – to refine focus on Critical Source Areas, identify "hot spots" on the map and to match up BMP's with land sites. This is what SWAT does best thanks to the power of computerized system analysis.

DEC maintains LEM can target CSA's with the guidance of "water quality sampling". In our view it is highly unlikely that water tests alone can scope out CSA's on the farmstead level.. SWAT water tests are used to validate the modeling – not to sub-plant the cross indexing that SWAT enables.

In any case it takes more than a single grab sample to prove a calibration. From our survey of the DEC's data bank of water monitoring, it doesn't appear among the four tributaries of the basin there are enough recent tests to make CSA selections with any statistical confidence. Most of the La Rosa tests are without flow rates and disabled from making a flux estimate. The great majority of the tests are no recent than 2012.

Request: could the Agency clarify it assertion that it can target CSA's with the guidance of "water quality sampling ." If there are other tests, possibly through the voluntary program that have not been entered into the DEC data bank of water tests, please explain. The Agency should append them to the 17 Basin Plan. As noted in Part One these should include tests at the mouth of the Barton River into South Bay.

Response: *The budget for the Regional Conservation Partnership Program grant is $674,000 of which $313,700 or 47% is financial assistance directly to farmers to implement best management practices. $102,250 or 15% is TA for NRCS staff, and $258,050 or 38% is for Technical Assistance by the Orleans County Natural Resources Conservation District. Of the technical assistance for the Orleans County Natural Resources Conservation District more than $140,000 or 20% of the grant total is targeted for developing 16 nutrient management plans for farms through a nutrient management planning course which could be considered financial assistance to farmers. There is no overhead for the Orleans County Natural Resources Conservation District included in the grant.*

With regards to the second point, the Agency believes that water quality sampling can be used to identify phosphorus source areas that can be effectively used to target outreach to implement practices where these can have the greatest impact. These target areas are highlighted in Figure 2 of the tactical basin plan and will be updated as new sampling data is collected. This sampling data was not based on one sampling point as the commenter suggested but on 8 sampling events per year with two events targeting rain events. For many of

the sites, samples were collected for multiple years. This data is available on the web at: http://dec.vermont.gov/watershed/map/monitor/larosa#view and export LaRosa data. Because additional data is added to this site each year the Agency did not append all this data to the final Basin 17 tactical basin plan as this would be out of date with in a few months. The Agency does not agree with the need to sample the mouth of the Barton River as it flows into South Bay to support the TMDL. Below the current sampling point the Barton River flows through multiple channels and through the wetlands themselves during high flow events on its way to South Bay and so getting a representative sample of phosphorus concentrations from this flow to estimate phosphorus loading would not be practical.

TMDL Chapter 6 Establishing Allocations and TBP Chapter 3- G Wastewater Treatment Facility Loading and the Draft WWTF WLA

23. **Comment** (Quebec and Newport Meetings): While the loading based on the permitted loading is being reduce why do the TMDL and TBP not include reductions in the actual wastewater treatment facility loading from the current phosphorus loading levels from these facilities.
24. **Comment** (NVDA meeting): If WWTF are such a small portion of the Loading why does the TMDL propose reductions in phosphorus loadings in WWTF permits?
25. **Comment** (Fritz Gerhardt): The WLA proposed in the TMDL doesn't reduce annual P loading at all (or only minimally as confirmed by Table 10). To some extent, the text implies that the TMDL will reduce WWTF loading by 33% but that really is not the case. Rather, the maximum allowed is reduced 33%, but, since the WWTFs currently don't or rarely exceed these maximum permitted loads, this 33% reduction does not translate into any meaningful load reductions into the lake. I understand the rationale for not focusing on reductions by WWTF (cost: benefit) but I think this should be clearly stated and explained. I suspect there are going to be those who have a major problem with not requiring any reductions in P loading from WWTFs.

Response: *The proposed wastewater treatment facility wasteload allocation would be higher than the current average loading for facilities and so would not require actual loading reductions from the facilities in the watershed; however, the TMDL does reduce the allowed future grown in loading under the current permits. Reducing actual loading from wastewater treatment facilities was not proposed in the TMDL because the costs of upgrades for facilities in the watershed to achieve such phosphorus load reductions is quite high given the limited reduction in phosphorus loading that such upgrades would achieve and the small contribution that WWTFs make up. WWTF permits were not left "as is" however because that would allow for a larger increase in WWTF loading than the WLA in the final TMDL which includes a 33% reduction in the annual permitted loading.*

TMDL Chapter 7 Establishing Allocations and TBP Chapter 3 - Implementing Basin priorities to restore surface waters.

26. **Comment** (Newport Meeting): How much will implementing the TMDL cost?
27. **Comment** (NVDA Meeting): How much will it cost specifically for implementing the Lake Memphremagog TMDL. There needs to be funding for implementing the Lake Memphremagog TMDL that is similar to the financial support available in the Lake Champlain Basin.

Response: *As noted in the Tactical Basin plan "this current tactical basin plan cannot yet articulate a precise estimation of the total cost of implementation to achieve the full completion of TMDL activities. However, the following information provides a cost perspective based on a statewide view of clean water funding needs, and a sector-specific estimated cost per unit reduction for phosphorus.*

The State of Vermont Treasurer's report describes the full costs of implementing Act 64 to achieve clean water for the entire State of Vermont. Figures available as of this writing suggest a total statewide cost of $2.31B, and a total gap, derived from currently available clean water funding, of $1.34B." The integration of water quality sampling to target implementation projects where they can have the greatest impact should reduce costs in meeting load reduction targets for the Lake Memphremagog watershed. Funding through the Clean Water Initiative has been targeted state wide and so there is similar financial support in the Lake Memphremagog watershed as there is in the Lake Champlain watershed under this program. There is also a targeted regional conservation partnership program grant for $674,000 targeted in the Lake Memphremagog watershed.

28. **Comment** (Brighton Meeting): Is a 20-year timeframe reasonable for this TMDL? Do you feel this is too short and that it will take longer to meet the TMDL targets or is a 20-year timeframe too Long?

    Response: *The 20-year timeframe was chosen because there is a 20-year timeframe for implementing several the regulations targeting phosphorus reduction practices. The scale of the implementation that is necessary to meet TMDL reduction targets requires the 20-year implementation timeframe which will allow for four tactical basin planning cycles.*

    TMDL References:

29. **Comment (**Robert Houriet Letter): Requested Amendment to Revised Plan: a bibliography of "literature" authors or sources of monographs from which the Basin adopts Coefficients and other values used to compute a nutrient budget, sedimentation and retention rates.

    We note that the Land Export model as adopted for the Memphremegog is more eclectic than the SWAT model heavily backed up by ARS methodology applied consistently across state lines. Consequently the novelty of DEC's adoption of LEM makes it incumbent on Vermont to certify the authority of the authors of coefficients and key modeling assumptions: not by vague reference that such sources are taken from the "literature, " but in a revised appendix a a comprehensive bibliography specifying sources and monographs. .

    For instance if the Plan had inserted a numerical coefficient for continuous corn silage the Agency could have by footnote referenced APEX model of the USDA, by listed it in the bibliography.

    Response: *References were added to the final modeling documentation for the phosphorus export coefficients, as well as the lake retention models used in the land use export model.*

Comments relevant only to the Tactical Basin Plan

TBP Executive Summary

30. **Comment (**Robert Houriet Letter): Petitioned Request: foremost in Executive Summary, we ask for a clear, differentiation of Total P in the Vermont part of Memphremagog from its Quebec counterpart – in ug/liter, annual mean concentration; likewise a boxed tabular comparison of Fitch Bay (Que) with South Bay (Vt.) Comparative TP's and other water sampling results.

    Correct the Summary draft that forces the reader to calculate on their own that the Vermont half of the lake is 16.8 ug/liter. Rather, the present draft taxes the reader to do the math from what the clues DEC provides: that Vermont concentration is 20 per cent over the water quality threshold of 14 ug/l.

    Response: *In the Agency's opinion adding concentration information in the Quebec portions of the lake into the summary would not help the public understand the TMDL and so has reserved this information for the modeling documentation for those that want to get into the details of the Bathtub model for which this data was used. The Agency feels that the public understands the magnitude of a percentage reduction more than a reduction from one concentration to another as a better measure of the magnitude of reductions required. As such the Agency has not made the requested change.*

TBP Chapter 2 Tactical basin plan - Water resource assessments and Sub-Basin Prioritization:

31. **Comment** (Peggy Barter email): In table 2 on page 19 Seymour Lake is listed as FAIR for AIS. I wonder why as there are no invasive species in Seymour?
    Response: *There was a mistake in the table in the Draft Plan and this has been fixed in the final plan to show Lake Seymour as good for AIS.*

32. **Comment** (May 31 Craftsbury)**:** What about the impacts from the application of sodium chloride on roads? The State of Vermont uses millions of gallons of brine each year starting just a few years ago and I would like to know what the impacts are from this.

    Response: *DEC has measured chloride levels to help develop a model of water movement in Lake Memphremagog and the levels of chloride were over an order of magnitude lower than the level which impacts aquatic biota in streams. NorthWoods Stewardship Center did monitoring of smaller streams nearly 10 years ago through the LaRosa volunteer monitoring program and only one very small stream adjacent to a town garage had levels close to that where we are concerned about impacts to aquatic biota. The State has measured gradually increasing levels of chloride in Lake Champlain and so this may also be a concern for Lake Memphremagog over the long term but based on water quality sampling this isn't an a priority for addressing water quality issues in this basin over the next 5 years.*

33. **Comment** (Peter Lyon email): It appears that when comparing plans across the State that the one/major difference in Basin 17 is the Coventry landfill. Perhaps a detailed understanding of the biological monitoring program would help however it would seem important that you insert

a couple of items in your plan, one being a very regular/detailed (monthly?) monitoring program and the second stating that the monitoring would be executed by professionals in this state space.

Also, since it has been stated that contamination has occurred from the Nadeau site it merits recognition in your plan with reference to how it was mitigated and what steps have occurred to ensure more problems will not surface in the future.

It goes without saying that the proximity to the Black River which is a short distance from the lake sure creates the potential for a major disaster.

34. **Comment** (Nick Eckerracz email): What are the contingency plans to clean up the Coventry landfill when it fails (it is plastic lined; it will fail, perhaps after an earthquake /as you know, a big one has been predicted for some time).

    Response: *The section of the tactical plan that addresses the Coventry landfill was expanded to better explain the current monitoring program which is in place and is quite extensive and done by professionals.*

35. **Comment** (Nick Eckerracz email and site visit): Why is there never any mention of the potential super fund site at the location of the former Barton Village dump on the Barton River: When I was a Selectman and was writing our first solid waste management plan, I mentioned it in a footnote; I was concerned that I would become a pariah for reminding our locality that we have a potential hazard there: now I don't care.) I am not talking about the former land fill. The old dump was at the bank of the river at the end of the corn field which is now just south of the interstate. You can still see drums on the bank of the river. It was used for several of the neighboring towns, but more importantly, Ethan Allen dumped all of their waste drums there. It was in operation for many, many years.
    Response: *After visiting the site of the former Barton Village Dump and taking some pictures of the site, we have contacted the Solid Waste Program to see if they had records of a hazardous waste site in this location. We also looked through the records of the Ethan Allen Hazardous waste site and there was no information that suggested that large amounts of waste were trucked to other locations including the Barton Village site as much of the waste from this facility was dumped on site as is noted in the Basin Assessment Report.*

TBP Chapter 3-B Stormwater runoff and Erosion from Roads

36. **Comment** (Brighton Meeting): There is a culvert on the largest stream that flows into Little Averill lake that blocks fish passage and should be upgraded.

    Response: *This culvert was added to the list of priority culverts for replacement in the Tactical basin plan.*

TBP Chapter 3-D Limiting Phosphorus and Sediment Runoff from Managed Forests

37. **Comment** (Sarah Damsell): The Draft plan says that the Conservation District has two portable Skidder bridges when we only have one. We (NRCDs) are planning to have a skidder bridge cost share program next year.

Response: *The Final plan was updated to say one Bridge.*

TBP Chapter 3-E Unstable Stream Channels and Aquatic Habitat

38. **Comment** (NVDA meeting): Shouldn't the stream bank erosion loading be tied into the adjacent land use and not addressed as a separate loading source?

Response: *Streambank erosion was calculated independently of the adjacent land use and so was not apportioned to the adjacent land use. One reason for this is that streambank erosion may be caused by system wide adjustments caused by upstream or downstream actions and so might not be caused by the immediate adjacent land use. The solutions to addressing streambank instability are also the same across many land uses and so was identified as a separate loading source with a unique BMP for restoring equilibrium conditions.*

39. **Comment** (Craftsbury Meeting): You said that you have been planting large areas of buffers along streams and I wanted to make the comment that you should be doing this in a way that is likely to be successful over the long term. We have lots of beavers along the Black River and so it would be a shame to have all these trees disappear soon after they are planted.

Response: *We do expect some loss of trees when doing these buffer plantings but partners also evaluate the potential for beavers and in some cases, partners try to mitigate this issue using tubes or species of trees beavers are less likely to eat. Also there is a monitoring component of many of the buffer planting projects to go back and evaluate survival rates to make sure enough of the trees are surviving to provide water quality benefits.*

TBP Chapter 3- H Restoring Flow Altered Waterbodies

40. **Comment** (NVDA meeting): The water level of Norton Pond has been elevated and this has caused erosion of the lakeshore. Will this be addressed through the PSB hearings?
41. **Comment** (Brighton Meeting): Water levels are a big concern for residents of Little and great Averill, and Norton ponds and may be one factor in increasing nutrient levels in these lakes. We appreciate the work the department has done in recent years to support a revised management of water levels for these lakes before the public service board.

Response: *As noted in the Tactical Basin Plan "The Agency of Natural Resources has recommended modifying the dams to function with a crest control to restore more natural water level fluctuations on these waterbodies and natural flows in the streams below the dams to support important ecological functions of these waterbodies. The Agency will continue to advocate for a management approach for of these dams that will restore water quality conditions and habitat in the lakes and the outlet streams." The proceedings are still before the PSB so the outcome of this process is not available at this time. The Agency would note that there may be other causes of erosion on Norton Pond. There are also recent studies that have shown increasing nutrient trends in a number of remote oligotrophic lakes and so factors other than water level fluctuations may be responsible for the increasing nutrient trends noted by the commenter.*