



MYSTIC RIVER WATERSHED ASSOCIATION
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October 31, 2003

Mr. Kevin Brander, P.E.
DEP CSO Coordinator
1 Winter Street, 5th Floor
Boston, Massachusetts 02108

RE: Comments on the MWRA Final Variance Report for CSO Abatement for the Alewife Brook and Upper Mystic River

Dear Mr. Brander:

The Mystic River Watershed Association (MyRWA) welcomes this opportunity to comment on the MWRA Final Variance Report for CSO Abatement for the Alewife Brook and Upper Mystic River.

MyRWA is a nonprofit grassroots organization committed to the protection and restoration of the natural resources in the 21 communities comprising the Mystic River basin, which includes Alewife Brook. We have over 200 members, including local organizations that work to protect portions of the watershed as well as individuals. We have a stated goal of "fishable and swimmable" waters by 2010. It is from this perspective that we submit the following comments.

We would like to thank the Massachusetts Department of Environmental Protection (DEP) and the Massachusetts Water Resources Authority (MWRA) for their efforts to characterize biological and chemical constituents in stormwater, receiving water, and CSO discharges through their sample collection and analysis. We appreciate DEP's and MWRA's commitment to communicating about issues in this report with stakeholders, including local residents and community groups such as ours. We want to emphasize that we support the MWRA and Cambridge completing their plans as outlined in the recent Notice of Project Change. We believe that all of our comments are consistent with completion of their projects and the pursuit of our more ambitious water quality standards.

While we applaud the efforts already underway to eliminate CSOs, **we feel strongly that the conclusions regarding the use designation for the waters are not supported by this report.** The major conclusion in question is the recommendation to downgrade the Alewife Brook and Upper Mystic River from a Class B to a Class B_{CSO} use designation. The Final Variance Report presents a modeling analysis to show that these

water bodies would not achieve Class B water quality standards even if all the CSOs were eliminated. Because these water bodies are so degraded by other sources, MWRA argues that complete CSO elimination is not worthwhile. MyRWA believes that the Final Variance Report does not adequately address the criteria for changing a use designation, it relies on insufficient data, and it employs inaccurate modeling assumptions. **We request that DEP extend the variance, with conditions that will specify the information needed to make a final determination about the water designation for the Alewife Brook and Upper Mystic River.**

Downgrading from a Class B to Class B_{CSO} runs counter to the purpose of water quality standards, as stated in the federal regulations. Section 40 CFR 131.2 of the federal regulations concerning water quality standards states that:

“Such standards serve the dual purposes of establishing the water quality goals for a specific water body and serve as the regulatory basis for the establishment of water-quality-based treatment controls and strategies beyond the technologically-based levels of treatment required by sections 301(b) and 306 of the Act.”

To authorize CSOs flowing into these water bodies several times annually is not an appropriate goal. Moreover, such authorization disregards the urban neighborhood communities that continue to have raw sewage in their basements and backyards and that presently use these water bodies for passive and active recreation. This contact between neighbors and CSO-contaminated floodwaters constitutes primary contact and warrants Class B standards rather than B_{CSO}.

MyRWA recognizes that eliminating CSOs and achieving Class B water quality standards for the Alewife Brook and the upper Mystic River presents large complex multi-jurisdictional and multifaceted problems. In the face of all these complexities, Cambridge has committed to eliminating CSO flows. In addition, there are other regulations that will have a significant effect on the water quality for these two water bodies. The letters issued to municipalities abutting the Alewife and Upper Mystic River under Section 308 of the Clean Water Act initiated a process and schedule to identify and eliminate illegal sources of contamination. The actions required under the 308 process have not been fully implemented or enforced. The USEPA Phase II Storm Water program just started this year. Many factors affecting Alewife and Mystic water quality will change over the coming years in relation to the Phase II program.

Consequently, MyRWA recommends that the DEP extend the Variance for these two water bodies for at least the length of time it will take to complete Cambridge’s CSO projects. This new Variance should contain provisions to

- Collect the needed data to improve and validate MWRA’s models;
- Collect the data required to distinguish between CSO and non-CSO bacteria sources;
- Assess the effects of more complete enforcement of the 308 letters issued to communities abutting the Alewife Brook and the Upper Mystic River, as well as implementation of Phase II Storm water program; and
- Investigate more fully the complex dynamics of inflow and infiltration.

This letter discusses the following issues in support of MyRWA's request that DEP extend the Variance:

Regulatory Issues

- The relationship between flooding and the associated exposures to contaminated floodwaters *must* be considered in making a final use designation decision.
- The Final Variance Report does not adequately address the criteria that must be applied to reduce a use designation. Any decision on the final designation is therefore premature.
- The economic analyses are not sufficient to support a decision to downgrade the use designation.
- Arguments supporting reclassifying to Class Bcso with triggers are not persuasive.

Data Issues

- The Final Variance Report presents data in inconsistent and possibly misleading ways.
- Some data presented may be in error; more information on methods is needed to assess the data quality.
- Additional water quality data are needed to assess the accuracy of MWRA's analyses.

Modeling Issues

- It is unreasonable to use a constant mean fecal coliform concentration to model all "clean" stormwater inputs to Alewife Brook.
- MWRA does not sufficiently justify the mean fecal coliform value they use to model "clean stormwater" or reconcile their assumptions and predictions with actual data that indicate that MWRA's predictions are overestimates.
- MWRA assumptions about dry-weather and wet-weather fecal coliform levels within Alewife Brook are inconsistent with data collected by the MyRWA under its DEP-approved QAPP.
- There are insufficient data to confirm that the MWRA model is accurate, and actual data are frequently inconsistent with model predictions.

- Information is needed on flow rates as well as volume.

Regulatory Issues:

The relationship between flooding and the associated exposures to contaminated floodwaters *must* be considered in making a final use designation decision.

Information presented by residents and other commenters has shown that residents in East Arlington experience significant flooding during the large rainstorms that also cause CSOs to activate. These residents are exposed to waters with high bacteria concentrations in their houses and backyards. Even though exposure to floodwaters is not usually considered in use designations, this exposure certainly constitutes “primary contact”. Avoiding exposure to the contaminated floodwaters is not practical except at enormous expense to these residents. The water quality standards for these rivers must therefore be protective for primary contact, requiring a Class B designation.

It has been suggested that residents accepted the risks of these exposures when they purchased homes in areas prone to flooding, and that publicly-funded actions to reduce their exposures are not warranted. MyRWA strongly disagrees with this point of view. Residents, some of whom purchased homes in the area many years ago, were likely *not* aware of the potential for exposure to contaminated floodwaters. First, they may have expected less frequent and severe flooding than is now occurring. The FEMA floodmaps are seriously out-of-date. They are now being updated, and are generally expected to show a larger floodplain than the existing maps show. There is some evidence that the number of large storms has increased, and extensive development in the Alewife area is increasing the flood levels from a given size storm.

Second, residents are only now becoming aware of the high levels of bacteria in the floodwaters, and are being urged to avoid exposure. Bacteria contamination is invisible. Many residents have testified that they have not known to avoid contact with the floodwaters. DEP and the City of Cambridge are making commendable efforts to ensure that residents understand the dangers and know how to minimize their exposures. It is not reasonable to assume that residents knew about the likelihood that they would be exposed to contaminated floodwaters when they purchased their homes, and therefore knowingly accepted these risks. The public health impacts of CSO discharges must be given great weight in making a decision about the final goals for the quality of Alewife Brook and the Upper Mystic.

State and federal rules and guidance on CSOs are predicated in part on the assumption that persons can avoid the waterbody during times of CSO discharges. Consequently, the guidance is inapplicable to a situation such as Alewife Brook where people live in close proximity to the water and are subject to local flooding by CSO-contaminated water. The situation is very different than a beach with CSOs that can be avoided the few times per year when the CSOs discharge. We are unaware of any other

place in Massachusetts where DEP has granted a Class B_{CSO} or (for saltwater) SB_{CSO} designation where homes are flooded by CSO waters. Establishing such a designation for Alewife Brook would set a very bad precedent for the State.

The Final Variance Report does not adequately address the criteria that must be applied to reduce a use designation. Any decision on the final designation is therefore premature.

MWRA analyses of the impacts and costs of its Long-Term Control Plan, even if accurate, do not support a decision to reduce the use designation in Alewife Brook and the Upper Mystic. This is because the analyses do not take explicit account of steps that municipalities and the public can and will take to reduce bacteria contamination (e.g., efforts due to US EPA's Phase II storm water program and letters sent under Section 308 of the Clean Water Act to municipalities abutting the Alewife Brook and Upper Mystic River to address illegal connections, inflow, and infiltration).

EPA's regulations and guidance clearly require that a reduction in use designation occur, *only* if, all actions to control the relevant pollutants taken together, are not sufficient to achieve the standards for the existing designation. To remove a designated use, the state must show that the use is not attainable, or that one of the factors listed in 40 CFR 131.10(g) applies. A state *cannot* conclude that a use is unattainable if "such uses will be attained by implementing effluent limitations under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices of non-point source control" (40 CFR 131.10 (h)(2)). In light of this requirement, EPA's guidance suggests that conditions in variances include "Evaluation of whether further environmental benefits could be attained in the water body or watershed by supplementing CSO controls with other environmentally beneficial projects linked to the CSO receiving water body." (U.S. EPA, *Guidance: Coordinating CSO Long-Term Planning with Water Quality Standards Reviews*, EPA-833-R-01-002, July 31, 2001, p. 35.)

The MWRA analyses do not address the combined effects of various efforts underway to control bacteria contamination, and therefore do not support the determination required by 40 CFR 131.10 (h)(2). To support a redesignation, it would be necessary to make reasonable projections of the impact of these other efforts on non-CSO bacteria levels over the next 10 to 15 years, and *then* determine what the contribution of continuing CSO discharges would be to meeting or failing to meet the Class B standards. This is the type of analysis required by the TMDL process as well. It does not make good policy to look at each source of a pollutant separately, ignoring the potential to address the other sources. It compounds the bad policy to then argue that controlling the single source is insufficient for the water body to meet its designation and conclude that it is not cost-effective to control that single source.

Given the low levels of bacteria found in many of MyRWA's samples of discharges, it is evident that relatively "clean" storm water can be achieved with the appropriate efforts, and in fact often is achieved now. No change in the use designation should be considered until much more has been done to locate the sources of high concentrations of bacteria and correct them. They may be illegal connections, collapsed

pipes, leaky pipes, or concentrated bacteria pollutants in surface runoff. All can and should be addressed without downgrading the water quality designation.

MWRA's analysis of financial impacts is not adequate to support a use redesignation.

The only factor listed in 40 CFR 131.10(g) that would allow DEP to remove a designated use and that is relevant to Alewife Brook and the Upper Mystic is the "substantial and widespread economic and social impact" test. The MWRA report on financial impacts is not sufficient to support a finding of substantial and widespread impacts, however. The analysis may overstate the costs of eliminating CSOs and does not apply EPA's guidance for assessing economic impacts correctly.

First, eliminating CSOs may prove to be less expensive than assumed in MWRA's analysis of alternatives. Both Cambridge and Somerville have indicated that they anticipate eliminating CSOs to Alewife Brook eventually, although they have not specified a schedule for doing so. Cambridge is continuing to evaluate the options for separating CAM002 and more work is underway on characterizing the sewer system. This work should continue, with a focus on refining the options for eliminating all CSOs and reassessing the associated costs. The costs estimated by MWRA for the control alternatives considered may be accurate. (MyRWA has not made an independent evaluation of those engineering cost estimates.) However, it is likely that continued characterization of the sewer system, along with the simultaneous actions to address bacteria contamination under Phase II storm water requirements and enforcement actions under letters issued under section 308 of the Clean Water Act, will reveal other, cheaper alternatives to eliminate CSOs.

The evaluation of policies to address water quality in the Alewife Brook and the Upper Mystic should consider the following factors, for example:

- Metering of Cambridge CSOs has shown an increase in the size of storm needed to trip a CSO. Simple cleaning of sewer pipes seems to have added enough capacity to noticeably reduce CSO activations and volumes. Clearly, MWRA should clean all of its area sewers.
- While rain barrels are not likely to have an effect on CSOs, a larger program featuring ground infiltration (through swales, drywells, etc.) could help in areas with pervious soils to prevent runoff water from ever reaching combined sewers.
- DEP should consider ways to charge for pollution, to create stronger incentives for communities to address sources of contamination. For example, there could be tiered rates with separate prices on infiltration, daily sewage, and storm inflow. MWRA could set higher rates on inflow/infiltration, and use the funds raised to pay for community projects to reduce I&I, reducing the activation of CSOs. This would also involve charging for polluted stormwater, based on loadings.

- DEP should conduct a TMDL-type analysis of water flowing into the MWRA system. All sources of extra water need to be attacked with equal fervor.

In addition, the financial impacts analysis ignores the potential that households and communities will reduce their water use in the face of rising rates, and thus pay for less than the 61,000 gpy assumed in the analysis.

Second, MWRA bases its financial analysis on the impact of the highest annual cost that would be incurred by MWRA ratepayers under the proposed Long-Term Control Plan. The analysis should instead be based on the annualized cost of each alternative over a 20-year period. The use of an annualized cost, rather than a maximum one-year cost, recognizes that large one-time costs can be financed and the burden spread out over a number of years.

Third, the results of the financial analysis, even with costs that may be overstated, do not demonstrate substantial and widespread economic impacts. We believe that the calculations based on anything other than wastewater costs assuming a usage of 61,000 gpy are irrelevant to this analysis. The usage of 90,000 gpy is not supported by the data on actual use. In addition, there is no justification for adding together the costs of water and wastewater treatment, just because the two services happen to be provided by the same party. The costs of providing water should not be included in the assessment of the financial impacts of CSO controls. Based on the appropriate calculation (wastewater costs only, at 61,000 gpy), the MWRA analysis results in only a weak finding of potential impacts for Chelsea, the lowest income community considered. (The lowest category in EPA's "Assessment of Substantial Impacts" matrix where impacts are "likely to be substantial" is for costs between 1.0 and 2.0 percent of median household income (the calculation of 1.2 percent for Chelsea falls into the less burdensome end of that range) in municipalities with a secondary score of less than 1.5 (Chelsea's is just below the cutoff at 1.4). At worst, the impacts for Chelsea are characterized under the EPA guidance for these analyses as "may be difficult for some consumers, but more information is needed." (U.S. EPA, *Interim Economic Guidance for Water Quality Standards: Workbook*, EPA-823-B-95-002, March 1995.) Impacts are not substantial for other Mystic River watershed communities.

Even if impacts were found to be substantial, EPA's Interim Economic Guidance points out that the state would also have to demonstrate that the substantial impacts are widespread before proposing a waste quality standards revision. A finding that impacts might be substantial in one community does not constitute a finding of "substantial and widespread economic and social impact."

The documentation of the financial analysis is not sufficient for MyRWA to provide a more appropriate calculation of economic impacts. We request that MWRA provide:

- The incremental increase in rates that would apply due to the recommended Long-Term Control Plan and the other alternatives, as well as the rate that would apply in the absence of the CSO control alternatives;
- The method used to calculate a maximum annual cost;
- A justification for use of a 6 percent discount rate, which seems very low for a nominal rate. (Total costs are very sensitive to the choice of a discount rate, and are higher the lower the discount rate used to calculate a net present value.);
- An explanation of how the costs of CSO control would in fact be distributed across communities;
- The method used to translate the cost of alternatives into rates for each community;
- A calculation of the secondary test results using the full range of criteria, without eliminating two criteria based on Proposition 2 ½ (which can be overridden);

A finding of “substantial and widespread social and economic impacts” is the only basis on which DEP could recommend a redesignation to Class B_{CSO}. Given the importance of the financial impacts analysis, MyRWA requests that a more thorough analysis of impacts be undertaken. For example, we recommend that actual average usage per household in each community be used to calculate costs per household, rather than a weighted average for all MWRA communities. It is possible that use per household in smaller dwellings in Chelsea is less than use per household in suburban communities with larger dwellings. Using an average may therefore overstate impacts in Chelsea.

We also request a much more rigorous standard than used in the Final Variance Report for reaching conclusions about the results of the analysis. We consider the logic used to support a determination of widespread impact, as presented for Boston, for example, in Attachment A of Appendix G, to be very weak. The analysis using EPA’s guidelines indicates that “...substantial impact as a result of the implementation of the recommended plan for CSO control is unclear...” [But] the information presented above illustrates the fact that Boston is currently experiencing economic stress. Thus, implementation of the CSO control projects would result in substantial and widespread social and economic impacts on the residents of the city.” The “information presented above” includes comparisons of Boston’s 2000, 2001 or 2002 unemployment rates, percentage of subsidized housing units, high school graduation rates, poverty rates, teen birth rates, and amount of state aid received with averages for the rest of the state. A comparison with other Massachusetts communities says nothing about how financially-stressed Boston residents are in any absolute sense. Moreover, current poor financial conditions are unlikely to continue over the 30-year period considered in the MWRA analysis, and should not unduly influence a finding of substantial impacts. Finally, EPA recommends use of *changes* in the factors analyzed above to assess how widespread possible economic impacts are, which is not how these factors are considered in the Final Variance Report. (U.S. EPA, *Interim Economic Guidance for Water Quality Standards: Workbook*, EPA-823-B-95-002, March 1995.)

Finally, financial impacts should be considered first in setting the schedule for attaining water quality goals, before they are used as a basis for downgrading those goals. EPA's guidance allows for consideration of financial impacts in establishing a schedule in the Long-Term Control Plan. DEP should consider extending the schedule for the Long-Term Control Plan to reduce any substantial financial impacts. Only if a longer schedule is not sufficient to reduce impacts to an acceptable level should financial impacts support a Class B_{CSO} recommendation. The only case in which this outcome is possible is if the continuing annual costs of steps taken to eliminate CSOs plus the *amortized* cost of capital investments are high enough together to impose substantial and widespread impacts.

Arguments supporting reclassifying to Class B_{CSO} with triggers are not persuasive.

MyRWA considered carefully the option of applying a B_{CSO} designation now, with triggers to reopen the issue later. We concluded that it is *not* appropriate to downgrade the use designation to Class B_{CSO} now and consider upgrading to Class B later, when sources of bacteria contamination other than CSOs have been addressed. We believe that this approach shifts the “burden of proof” from the proponents of a B_{CSO} designation to the proponents of a B designation, and undermines the clear intent of EPA's stringent requirements for changing a use designation. No change in designation should be made *unless and until* all of the criteria for a redesignation have been met. It is not adequate to reclassify now and then consider some of the criteria for redesignation sometime later, in evaluating whether the designation should be upgraded again. This approach would seriously undermine the requirements DEP and EPA have established for redesignations.

There are practical as well as legal reasons why a “B_{CSO} with triggers” approach is not appropriate. First, the required triennial review of water quality standards is not adequate in practice to ensure that the use designation of the Alewife would be reconsidered in a timely fashion. DEP's review is seriously overdue now, and, when finally done, is likely to fall well short of a full review of the use designation of each water body. Second, any triggers that MyRWA could envision as part of a B_{CSO} redesignation would reduce the pressure on all parties to move forward to control bacteria levels. There would be an inherent disincentive, for example, to pursue illegal connections, if to do so would result in triggering a requirement that CSOs also be eliminated.

MyRWA recognizes that it will take many years to address all the sources of bacteria contamination, including the current Long-Term Control Plan for CSOs. Some argue that variances are intended to be temporary, and should not be left in place over many years. There is a natural desire to recognize the current reality – that CSOs will exist for some years to come – in the use designation, and end the temporary variance status. For all the reasons cited previously, however, continuing the variance with strong requirements for continued investigation of alternatives, costs, and impacts is far better than allowing a premature use redesignation. EPA clearly recognized that variances may be in place for years, until Long-Term Control Plans are implemented and their effects

evaluated: “Once the agreed-to portion of the LTCP is implemented and the effect on water quality is evaluated, the state will be better able to judge whether the use can be attained with additional controls, or it needs to revise the water quality standards. Given the extended duration that EPA anticipates for implementation of many LTCPs, longer term variances for specific pollutants associated with particular CSO outfalls may be warranted, based on the demonstrations described above, subject to triennial review to determine continuing appropriateness.” (U.S. EPA, *Guidance: Coordinating CSO Long-Term Planning with Water Quality Standards Reviews*, EPA-833-R-01-002, July 31, 2001, p. 35.) A simple desire to be done with the variance is no argument for ignoring the strict standards for downgrading a use designation.

Data Issues:

The data presented in the Final Variance Report have many inadequacies, including insufficient data displayed for evaluation, inconsistent use of averaging techniques that seem to bias conclusions, and insufficient QA/QC methods.

The Final Variance Report presents data in inconsistent and possibly misleading ways.

Table 4-3 provides examples of insufficient and possibly misleading information. First, the data should be expressed as the average \pm standard deviation with the number of samples in parentheses -- for example, 15 ± 5 (n=6). Second, this Table presents the arithmetic average for bacteria for both individual storms and the overall average. Bacteria data are notoriously variable, as the authors note in their discussion of box plots on page 4-9. It is unclear why the authors chose to use proper statistical methods to report their water quality monitoring data (i.e., box plots and the geometric mean) but used arithmetic averages for the stormwater data. To justify using arithmetic means, all of the data must be presented. The central tendency of the stormwater data may be better explained with the geometric mean or median. If so, the fecal coliform level estimates for stormwater would be much lower than MWRA reports (i.e., 16,235 cfu/100 mL).

DEP should specify how the data are to be interpreted. There should be a consistent standard for all of the datasets – stormwater, receiving water, and CSO discharge. The most reasonable method (based on the natural variability of bacteria in water samples) is the box plot for data display and either the geometric mean or the median for data interpretation and comparison. It is inappropriate to compare the arithmetic mean of stormwater bacteria levels with the geometric mean of receiving water levels.

Some data presented may be in error; more information on methods is needed to assess the data quality.

The Enterococcus levels reported in Table 4-3 seem unusually high. Enterococcus levels are typically lower than Fecal Coliform levels. It is not possible to determine whether there is an actual difference between the Enterococcus and the Fecal

Coliform levels in these data or if the differences are an artifact of how the statistics are calculated. Since MWRA did not report all the necessary data, it is impossible to determine whether the high averages are due to one or two unusually high measurements that are not representative of the whole.

To clarify some of these data issues, MWRA should describe their bacteria colony enumeration and QA/QC methods. Typically, when there are too many colonies to count accurately on a filter, the laboratory will report the result as “too numerous to count” or some maximum detection limits such as “> 200,000 cfu/100 mL”. On page 4-6, the authors indicate a reading of “1,070,000 colonies/100 mL” in a CSO sample. Even if the lab analyst filtered just 1 mL of sample, this would imply 1,000 colonies on the filter, which is too many to count accurately. Depending on the accuracy of the colony counts, the concentrations reported by the authors could be in serious error. Compounding this with the error of using the arithmetic mean rather than the geometric mean could significantly undermine the conclusions that MWRA draws from their modeling results (e.g., Figure 4-26).

Additional water quality data are needed to assess the accuracy of MWRA’s analyses.

Lastly, the receiving water quality data summarized in the report and used to calibrate the models should be presented in an appendix. Without these data and a clear explanation of how they were used to generate the numbers used to calibrate their models, it will be impossible for DEP to evaluate the veracity of MWRA’s modeling effort.

Modeling Issues:

MyRWA recognizes the difficulties associated with coupling a hydrologic model and a contaminant model. It is an especially huge task in the convoluted Alewife Brook subwatershed, a system that combines natural and human-infrastructure systems, has numerous CSOs and illegal hookups to storm water drains, and unintentional cross-connections between sanitary and storm water systems. We also recognize that doing it accurately is an especially difficult and data intensive task, and we appreciate MWRA’s continued efforts to improve the ability to predict bacterial levels.

Given the current state of the analyses, however, MWRA has prematurely, and perhaps incorrectly, concluded that a Class B standard is not reasonable for the Alewife Brook and Upper Mystic River.

MyRWA has evidence from its DEP-approved sampling program which shows that key assumptions used to drive the MWRA water quality model for Alewife Brook and the Upper Mystic River are inaccurate. Consequently, the model itself is inaccurate. Enough serious uncertainty remains about potential water quality in Alewife Brook that

the current modeling data should not be accepted as a case for lowering the water quality standard of Alewife Brook and the Upper Mystic River.

It is unreasonable to use a constant mean fecal coliform concentration to model all “clean” storm water inputs to Alewife Brook.

Bacterial loading to Alewife Brook from a given stormwater pipe is a function of both concentration (C; counts/100 ml) and flow rate (Q; m³/sec):

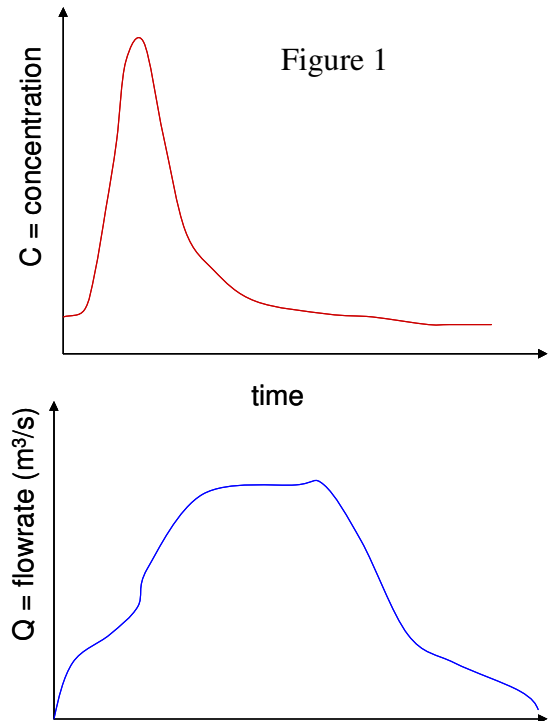
$$\text{“Mass” (or number) of bacteria} = C(t) * Q(t)$$

Both Q and C vary with time (Figure 1 – conceptual drawings of flow concentration and flow rate). There are likely to be high bacteria concentrations during the “first flush” of a rain storm due to build-up of bacteria/sewage since the last rain event. In the Alewife Brook system, because of cross connection between sanitary and stormwater sewer lines, there will also likely be higher bacteria levels in stormwater from some pipes than in truly “clean” stormwater. However, even with actual sewage present in some stormwater pipes, the bacterial concentrations will necessarily decrease over the course of a storm because of dilution from increasing flow and flushing.

MWRA has chosen to use a constant fecal coliform concentration of 16,235 counts/100 ml to model *all* stormwater inputs into Alewife Brook (Table 4-7). This value is the arithmetic mean of fecal coliform concentrations obtained during 7 sampling events at 10 locations (Tables 4-1 and 4-2, MWRA report; not all sites were sampled during all 7 events). MWRA notes that the general approach to collecting these samples was to collect during the first flush and sustained flow stages.

Using a constant, arithmetic mean for the clean stormwater bacteria concentration may substantially exaggerate the loading of bacteria to Alewife Brook. Using an arithmetic mean (as opposed to a geometric mean), with several of the samples being “first flushes”, would have the tendency to overstate the bacterial concentration. (MWRA does use geometric means in other segments of their report, for example to look at how well the model fits measured data (Figure 4-5).) By assuming that this concentration remains constant throughout the storm, MWRA’s model is likely predicting a much greater mass of bacteria delivered to Alewife Brook.

In addition, MWRA applies this high-biased concentration to *all* pipes contributing stormwater to Alewife Brook. This approach fails to account for relatively clean stormwater entering Alewife Brook; instead, every drop of water that runs through



a stormwater drain is assumed to “pick up” 16,235 counts/100ml of fecal coliform en route to the brook. Considering that Alewife Brook is a fairly small stream that drains a fairly large area, the vast majority of water in the Alewife Brook during a significant storm event is very “young” water (i.e., water that has fallen during that storm, the vast majority of which flowed through stormwater pipes to reach the Brook). Therefore, in MWRA’s model, there is relatively little “old” water in Alewife Brook to dilute the incoming bacterial counts, and no stormwater-piped clean “young” water arriving in the Brook. It is not surprising, then, that the MWRA model predicts high bacterial counts throughout storm events even without CSOs.

MWRA has presented no data to indicate that their constant-concentration approach accurately represents the real situation. The individual bacterial measurements used to obtain the arithmetic mean are not presented in the report, so it is not possible to assess how well this average value, applied as a constant, represents the real world situation. In addition, no flow rates from pipes are presented.

A more accurate way to model mass input of fecal coliform to Alewife Brook would be to allow C to vary with time (as shown in Figure 1). Such a model is data intensive, requiring information on both flow and concentration as functions of time. If it is necessary to use a constant concentration for fecal coliform, at the very least MWRA should calculate and use a “weighted average” from representative pipes, i.e.,

$$C_{\text{weighted average}} = \frac{\sum C_i(t_i) \cdot Q_i(t_i) \Delta t}{\sum Q_i(t_i) \cdot \Delta t}$$

where C_i and Q_i are the average (geometric mean or arithmetic mean) concentration and flow rate as functions of time, respectively. It is not clear that MWRA has considered these options. If the MWRA considered a weighted average approach, they have not sufficiently explained why they omitted it.

MWRA does not sufficiently justify the mean fecal coliform value they use to model “clean stormwater” or reconcile their assumptions and predictions with actual data that indicate that MWRA’s predictions are overestimates.

During rain storms in 2002 and 2003, MyRWA’s Mystic Monitoring Network (MMN) sampled 32 stormwater pipes that empty into Alewife Brook following an EPA approved protocol. An EPA approved lab was used to analyze these samples for fecal coliform (Figure 2). Most pipes were sampled at least twice. In general, fecal coliform concentrations in MyRWA samples are substantially lower than the “clean stormwater” value used in the MWRA model.

MyRWA also measured fecal coliform concentrations as a function of time during two separate storm events (Figure 3). Over four hours of observations during two significant rain events, MyRWA’s fecal coliform measurements at eight storm drains were generally a factor of 4 to 15 less than the MWRA “clean stormwater” model value.

Figure 2

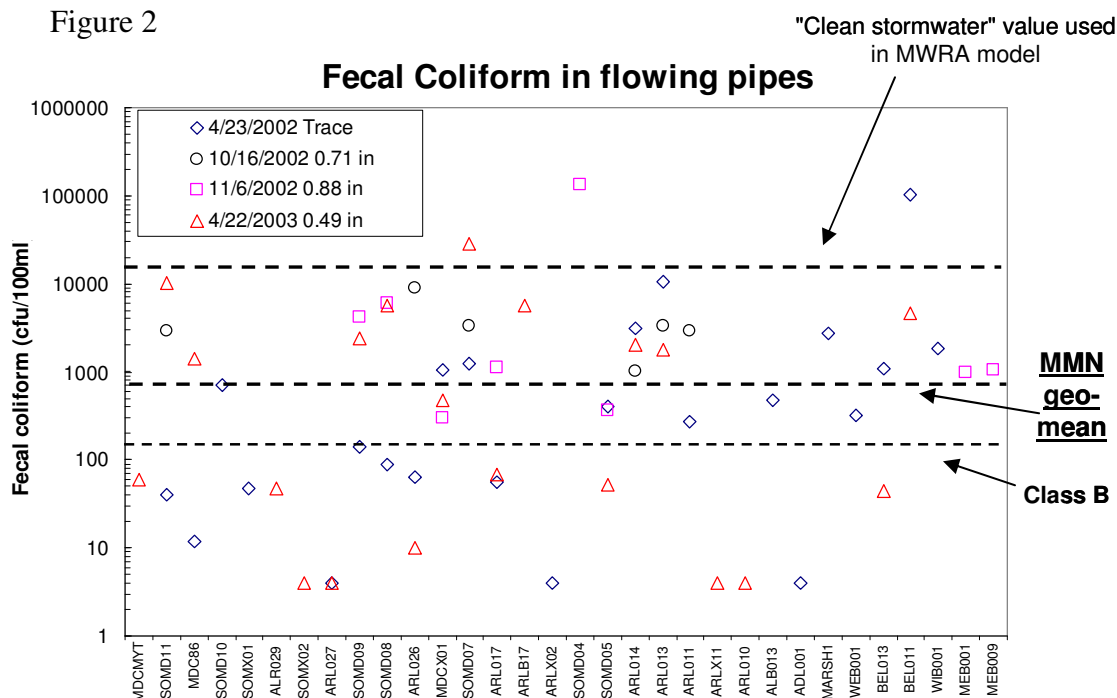
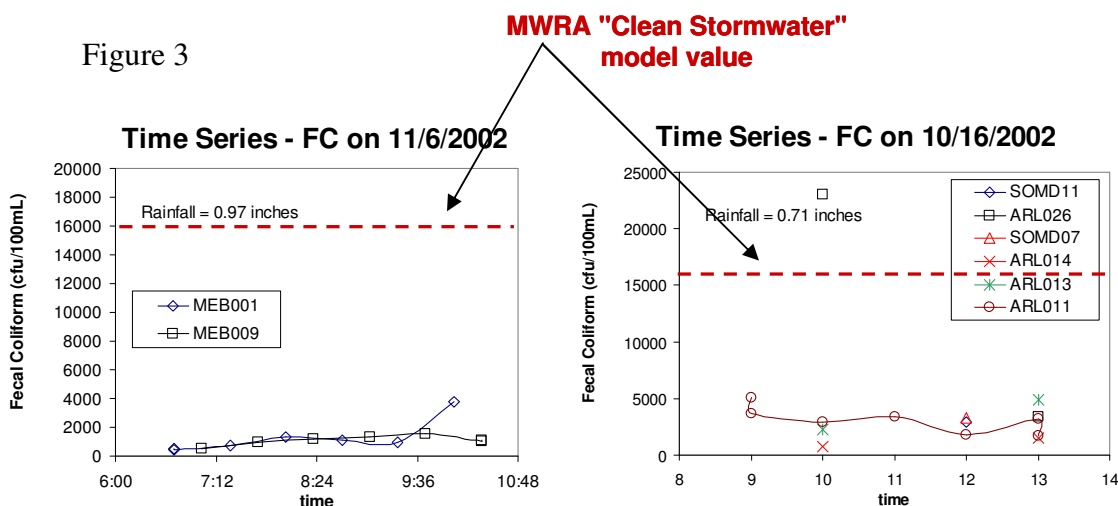


Figure 3



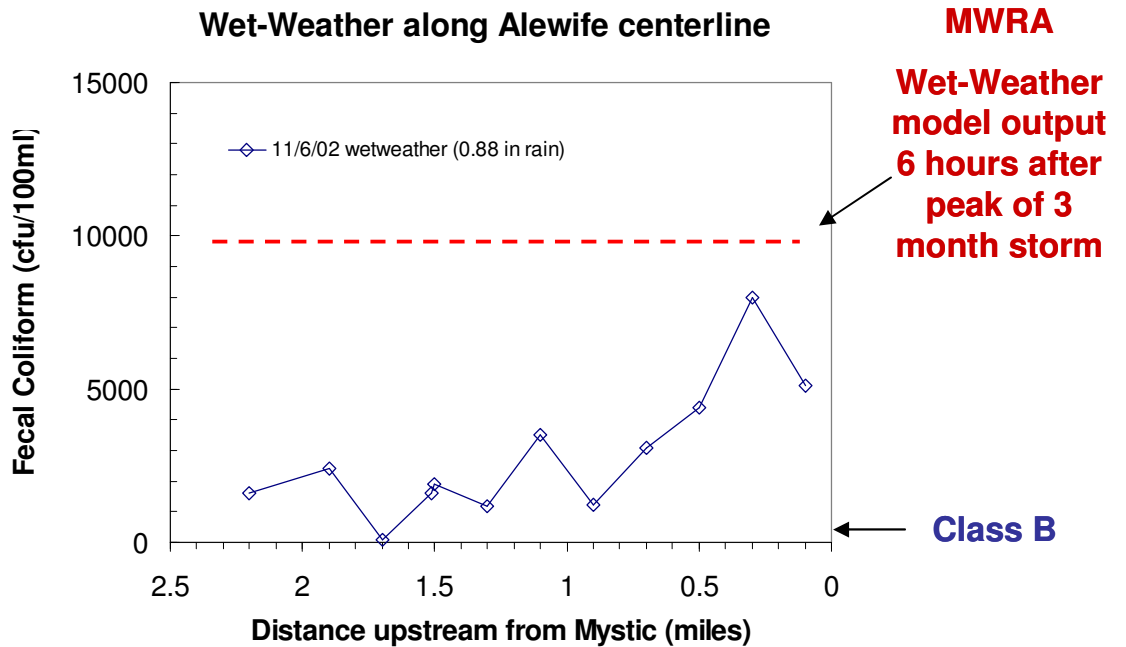
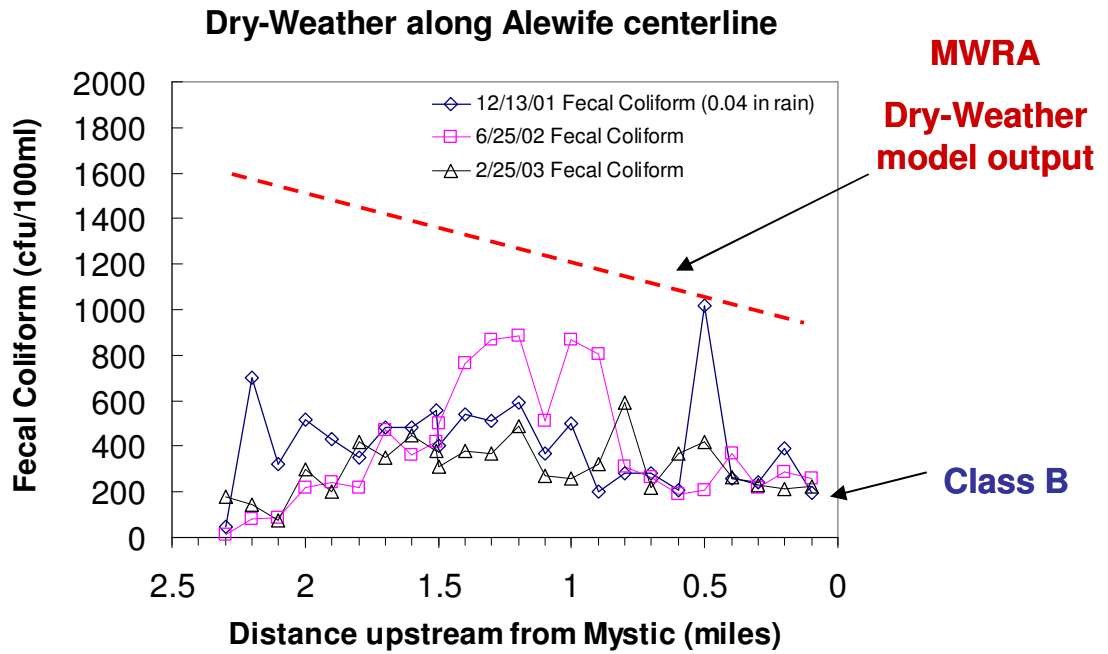
It is clear from Figures 2 and 3 that MWRA's constant-concentration fecal coliform model substantially overestimates fecal coliform concentrations in a number of pipes emptying into Alewife Brook. Because MyRWA does not have flow rate data for these pipes, however, we cannot quantify the degree to which MWRA is overestimating fecal coliform loading to Alewife Brook.

MWRA should explain the large discrepancies between the MyRWA's sampling data and the modeling results before any action is taken on lowering Alewife Brook's water quality designation. Based on our observations, it is certainly conceivable that MWRA could be overestimating bacterial counts in Alewife Brook by more than an order of magnitude.

MWRA assumptions about dry-weather and wet-weather in-stream fecal coliform levels in Alewife Brook are inconsistent with MyRWA's sampling data.

MyRWA conducted sampling on three dry-weather days along the centerline of the Alewife Brook at one-tenth mile intervals (see Figure 4). Remarkably, our sample results are closer to Class B standards than to the MWRA modeled output.

MyRWA also conducted wet weather sampling at one-tenth mile intervals along the Alewife Brook (see Figure 5). More analysis is needed to make consistent comparisons between MyRWA's sampling data and MWRA's modeling results, taking into account storm magnitudes and the time after peak. However, this preliminary comparison suggests that wet-weather in-stream bacteria levels may also be overstated in MWRA's model analysis.



There are insufficient MWRA data to confirm that their model is accurate, and actual data are frequently inconsistent with model predictions.

The Final Variance Report’s modeling contains insufficient data to assess how well the modeled fecal coliform concentrations agree with real world measurements. In

those instances where MWRA does explore the model's agreement with measured observations, they often provide too few data and/or measurements that do not agree well with model predictions. Examples in the Report include: Figure 4-6 illustrating under-prediction, Figure 4-8 illustrating over-prediction, Figure 4-7 containing no data from Alewife Brook, and Figure 4-10, which has only one data point. Basing a decision to downgrade the designation of Alewife Brook and the Upper Mystic River on largely unsubstantiated modeling results is not acceptable.

Information is needed on flow rates as well as volume.

The MWRA Final Report contains regression lines showing good agreement between predicted and measured volumes of stormwater flowing past a measurement point. However, MWRA does not assess the agreement between modeled and measured flow rates. Figures in 3-18 and 3-19 show comparisons, and while model results do seem to capture the trends, regressions of $Q_{\text{predicted}}$ vs. Q_{measured} would be more instructive.

Based on the comments provided in this letter, we recommend that DEP not change the Class B designation and instead extend the Variance. The Variance should include enhanced requirements for monitoring and analysis to support a review of water quality standards that meets state and federal requirements for use designations.

Thank you for the opportunity to comment on this important project. Please not hesitate to contact me if you have any questions about these comments.

Sincerely,

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