Missisquoi River Basin Association

Water Quality Monitoring Program

Summary of Results 2005-2007

Missisquoi River Basin Overview:

The Missisquoi River runs across the northwestern part of Vermont and into southern Quebec. The river begins in Lowell and flows approximately 80 miles into the Missisquoi Bay. The Missisquoi River watershed is comprised of forests, agricultural land, and some urban and suburban developments. At 25%, agriculture is the dominant *non-forested* land use land cover. The water quality in Missisquoi Bay is at risk due to the enrichment of nutrients from the watershed and toxic algae blooms that result. Therefore, the Missisquoi River watershed is currently the focus of several monitoring and restoration efforts to identify nutrient sources and minimize nutrient input to the river and bay.

Program Overview:

The Missisquoi River Basin Association is a non-profit organization focused on the restoration of the Missisquoi River and its tributaries. The Water Quality Monitoring program is a volunteer-run sampling program that takes place each summer throughout the basin. Through partnership with the Vermont Department of Environmental Conservation LaRosa Analytical Services Partnership Program, the MRBA has access to the State of Vermont's analytical laboratory to process and analyze the water samples taken in the field.

The goal of the monitoring project is multifaceted. This volunteer program allows community members to learn about the environment of the Missisquoi River Basin, to learn about conservation and restoration of the environment, and to learn how to take water quality samples and interpret the results. In addition, the program collects valuable data that may eventually aid in the determination of specific problem areas at which to focus restoration efforts.

Methods:

Trained citizen volunteers collected water samples biweekly at between 19 and 20 sites depending on the year. These sites were located throughout the Missisquoi River Basin along the mainstem of the Missisquoi River and its tributaries. Refer to table 1 for a list of sample sites and their corresponding sample years. Figures 1-3 show the location of each site labeled by their corresponding identifying code.

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Mainstem Sites	Code	Years
Westfield - Loop Road - Below Mineral Springs Brook	M-WL	2005, 2006, 2007
Troy - Citizens Dam	M-TCD	2005, 2006, 2007
North Troy - Below Big Falls	M-NTBF	2005, 2006, 2007
East Richford - Near QC Border	M-ER	2005, 2006, 2007
Richford - Davis Park	M-RDP	2005
Richford - Below North Branch Marvin Road	M-RM	2006, 2007
East Berkshire - Below Trout River	M-EB	2005, 2006, 2007
Enosburg - Lawyers Landing	M-ELL	2005
Enosburg Falls - Below Town	M-EF	2005, 2006, 2007
North Sheldon - Above Black Creek - Kane Road	M-NS	2005, 2006, 2007
Sheldon Junction - Bridge	M-SJ	2005
Highgate - Dam at Highgate Falls	M-HD	2005, 2006, 2007
Swanton - Johns Bridge	M-SJB	2005
Swanton - Marble Mill - Below Dam	M-SMM	2005
Swanton - Monument Road	M-SMR	2005, 2006, 2007

Table 1a. List of mainstem sample sites with identifying code and sampling years

Tributary Sites	Code	Years
Lowell - Burgess Branch Route 58	T-LBB	2005, 2006, 2007
Troy - Jay Branch - Vielleux Road	T-TJB	2006, 2007
Newport Center - Mud Creek - Route 105	T-NCMC	2006, 2007
North Troy - Mud Creek - Bear Mountain Road	T-NTMC	2005, 2006, 2007
Richford - North Branch - Pinnacle Road	T-RNB	2006, 2007
East Berkshire - Trout River - Near Mouth - Route 118	T-EBTR	2005, 2006, 2007
Enosburg - Tyler Branch - Duffy Hill Road	T-ETBDH	2005, 2006, 2007
East Fairfield - Black Creek	T-EFBC	2007
Sheldon - Mouth of Black Creek - Bouchard Road	T-SBC	2005, 2006, 2007
Highgate - Hungerford Brook Route 207	T-HHB	2006, 2007

Table 1b. List of tributary sample sites with identifying code and sampling years

Volunteers received training in accordance with the Quality Assurance Project Plan for taking grab samples for total phosphorus, total nitrogen, total suspended solids, and turbidity. Samples were kept cold during transport and storage before analysis. Samplers also completed a field data sheet at each site noting who took the sample, where, and when, as well as flow and weather observations. The US EPA provided portable conductivity meters for volunteers to measure the conductivity at each site and the results were also recorded on the data sheet. In order to interpret the results from the state laboratory it was necessary to organize and manage the data using Microsoft® Access© and Microsoft® Excel©, which allowed for further geographic analysis in ESRI® ArcGIS©.

Results and Discussion:

Figures 1-3 show the results of the geographic analysis of the monitoring data. Each figure shows the results for total nitrogen, total phosphorus, and turbidity respectively. No such analysis was done for the total suspended solids because there was only one year of data. These figures show the overall averages of all samples taken in the three year period from June 1, 2005 until October 18, 2007. The low, med, and high qualifiers represent the lowest third, middle third, and highest third of the data distribution.

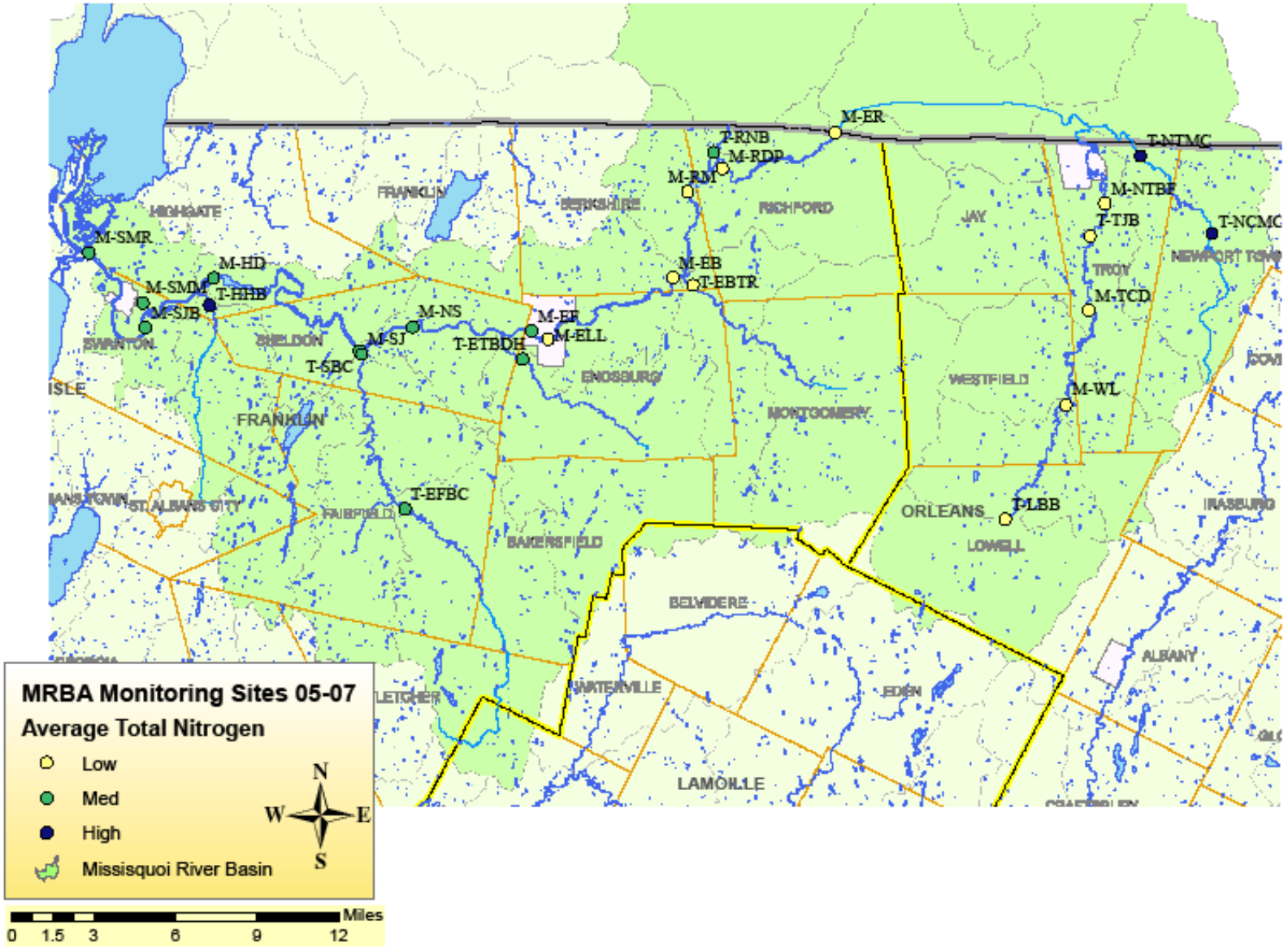

Figure 1. 2005-2007 average total nitrogen (see table 1 for site code key and years sampled)

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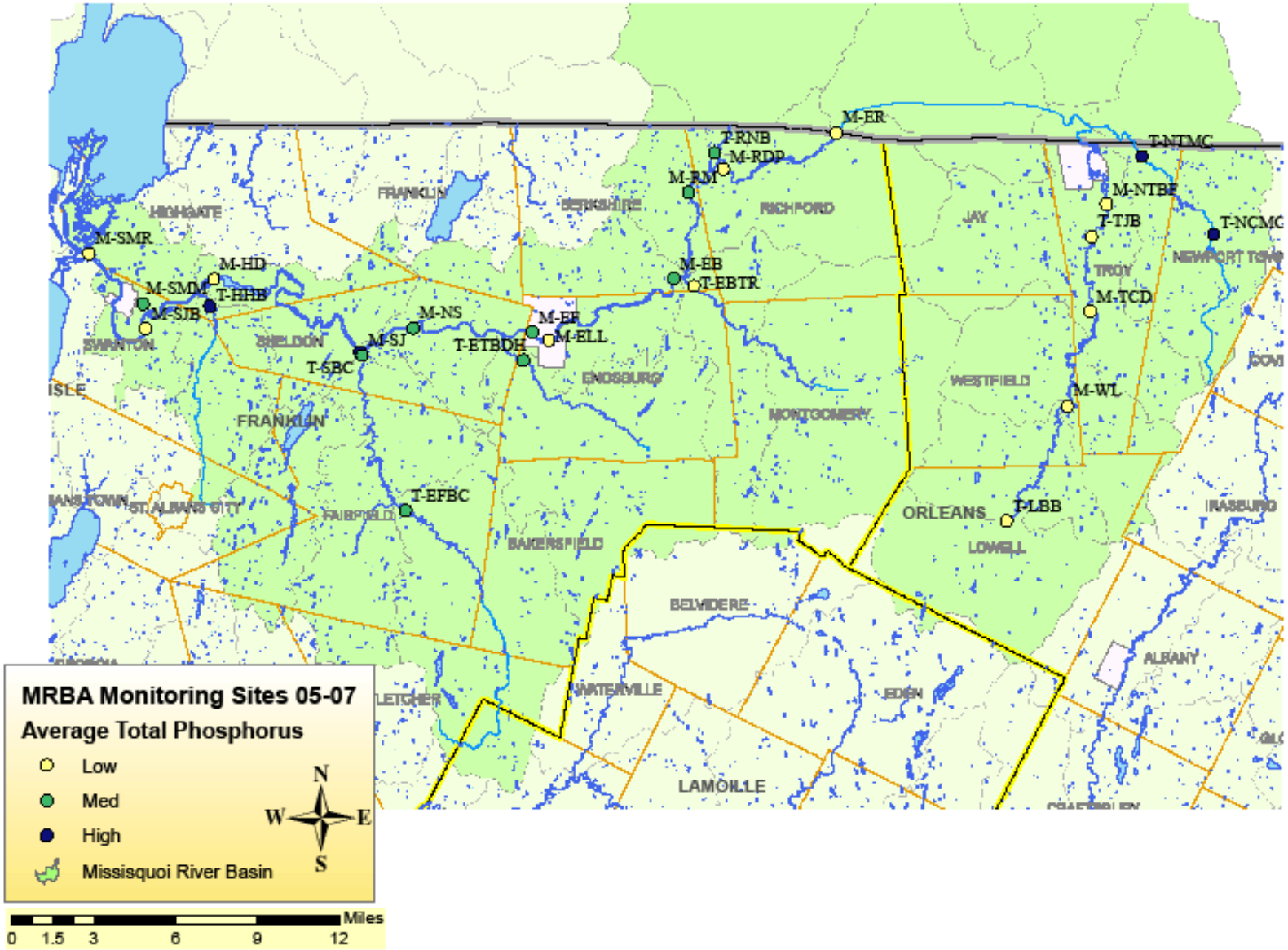

Figure 2. 2005-2007 average total phosphorus

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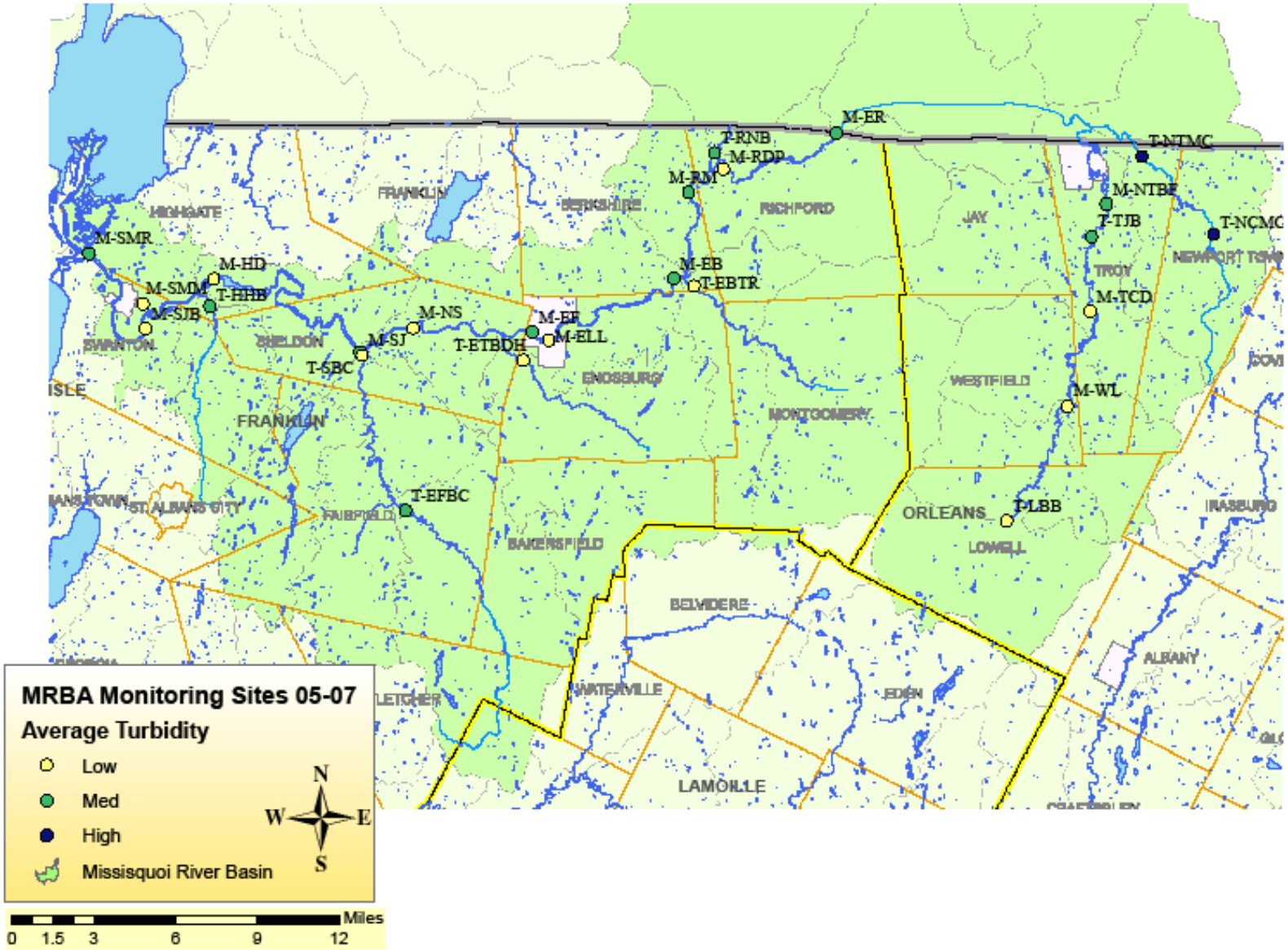

Figure 3. 2005-2007 average turbidity

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It is obvious that there are some sites that consistently measured in the highest third of the distribution including, the Mud Creek sites in Newport and Troy, the North Branch site in Richford, the Black Creek in Sheldon, and Hungerford Brook in Highgate. The tributary sites seem to show higher concentrations of nitrogen and phosphorus than the mainstem sites. There is also some correlation between the phosphorus results and the turbidity results. The sites that showed higher concentrations of phosphorus tend to show either medium or high turbidity results.

Figures 4-6 show the yearly average concentrations for total nitrogen, total phosphorus, and turbidity for tributary and mainstem sites. The tributary sites generally showed higher values than the mainstem sites for all three tests. However, these tributary sites also showed much more variability. This means that the tributaries did not have consistent results throughout the three years. Further studies comparing these water quality results to the hydrographs of several USGS flow gages in the basin may link higher concentrations with high flows during storm events. In any case, it is likely that tributaries are more sensitive to changes in flow and concentration simply because they are smaller, contain much less water, and are more connected to the landscape in different parts of the basin.

Each of the charts also shows a single black line across the chart area. This is the overall average for all the data collected. This average line further illustrates the difference between the higher values and the lower values. Many of the sites with higher concentrations shown in figures 1-3 have annual averages that exceed the overall average line in figures 4-6. Some of these areas, such as Hungerford Brook, Mud Creek, and Black Creek, are currently being targeted for further monitoring and/or water quality improvement projects as a result of these data.

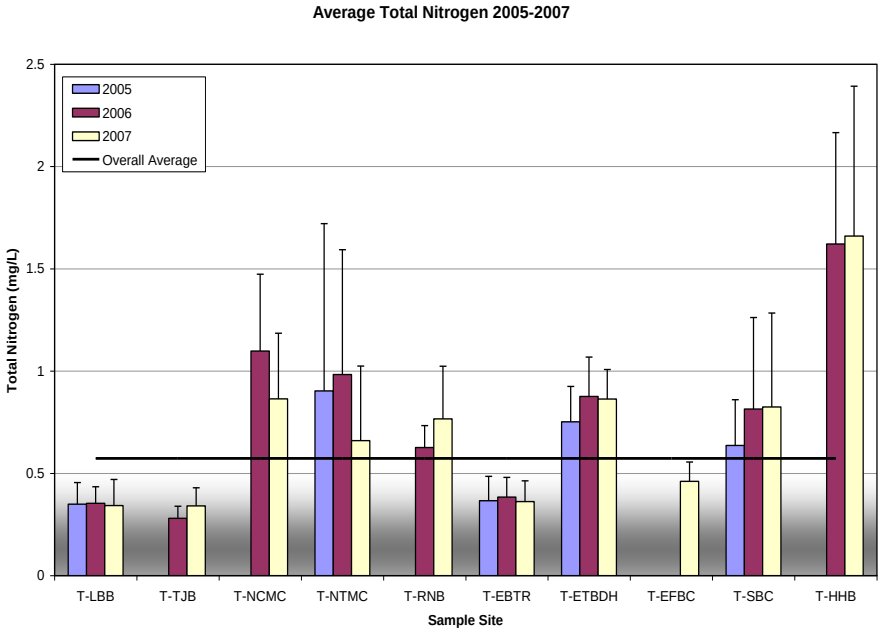

Figure 4a. Tributary average nitrogen (error bars extending from columns show standard deviation)

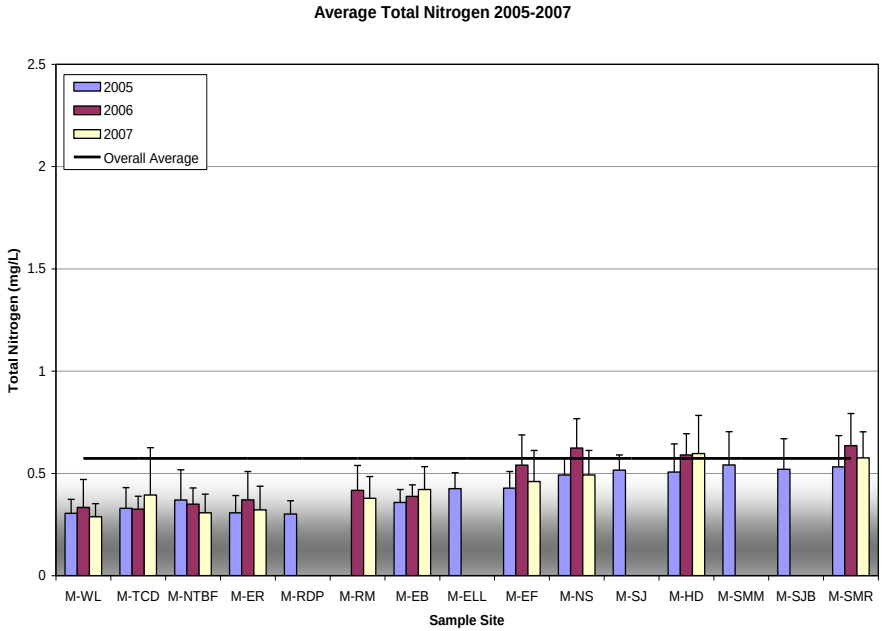

Figure 4b. Mainstem average nitrogen

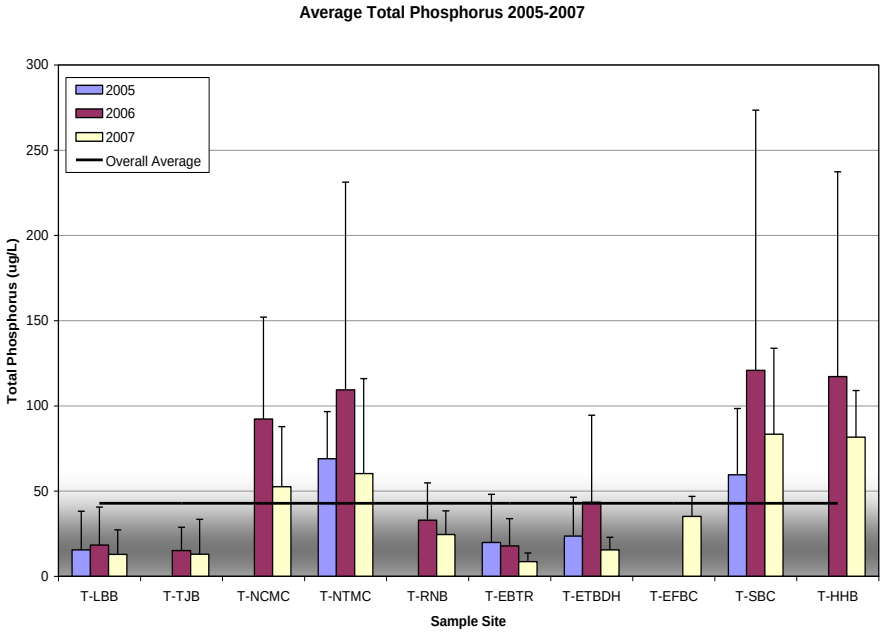

Figure 5a. Tributary average phosphorus

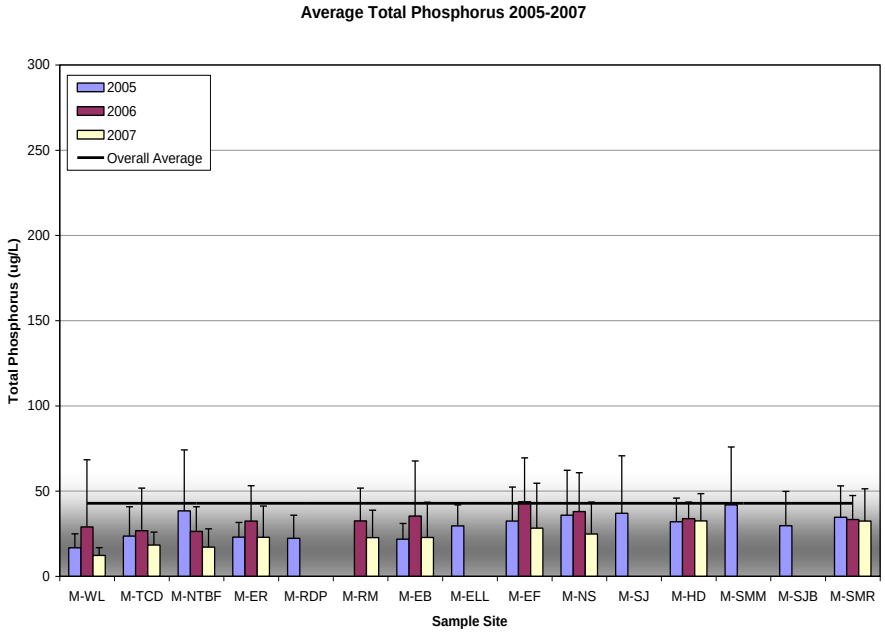

Figure 5b. Mainstem average phosphorus

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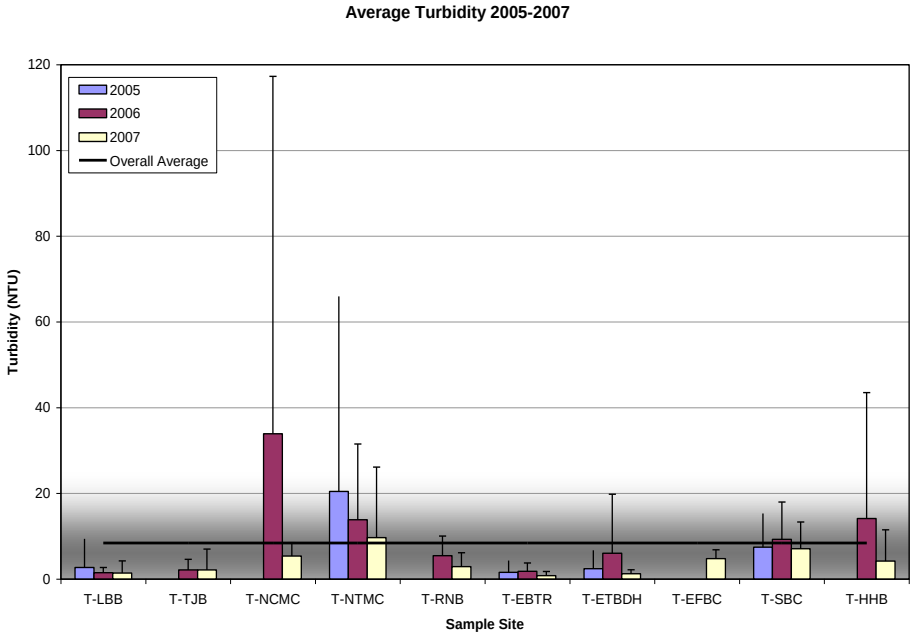

Figure 6a. Tributary average turbidity

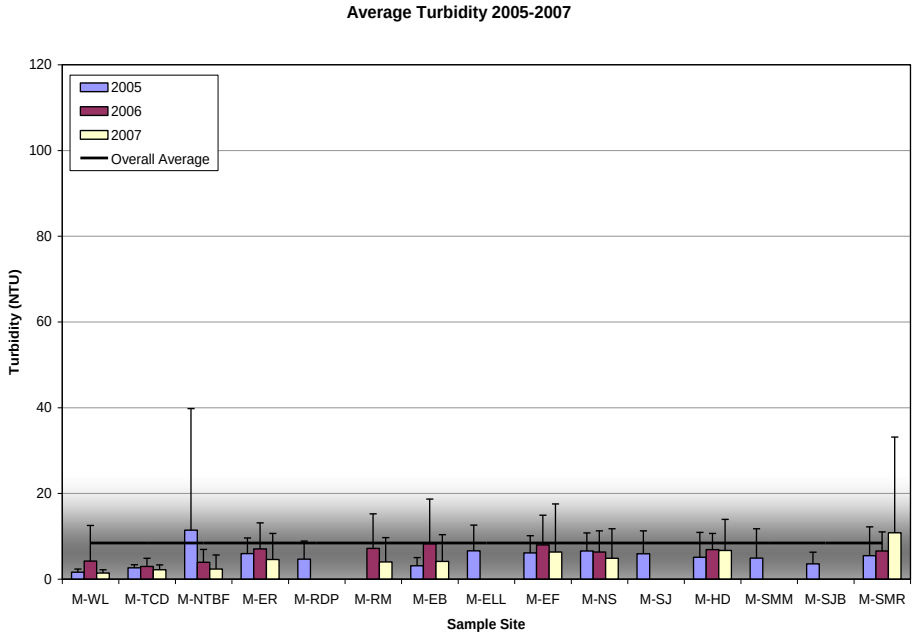

Figure 6b. Mainstem average turbidity

Conclusions:

The MRBA sampling program has proven to be a great success over the past three years. With over two dozen volunteers sampling every two weeks throughout the summer, many samples have been collected and analyzed. The data have been very useful for targeting sites in need of water quality improvement projects due to high concentrations of nutrients and sediment. Some of these projects are already underway in the Missisquoi River Basin. The MRBA Water Quality Monitoring Program, in partnership with the Vermont DEC and the Center for Clean and Clear, continues in 2008 with some new tributary sites to further refine the water quality information in the Missisquoi River Watershed.

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