Allen Brook Water Quality Monitoring
Final Report
2007 - 2010

The Williston Conservation Commission (WCC) is pleased to submit this Final Report to summarize the results of the 2010 sampling season.

In 2010, the WCC sampled 11 locations along the Allen Brook (see Figure 1). The parameters sampled included Total Nitrogen (TN), Total Phosphorus (TP), E. *coli,* Chloride (Cl), and Turbidity (NTU). This was the first season that Cl and NTU were sampled. Three years of data is available for TN, TP, and E. *coli* (for most sites).

Trends in Data

To illustrate and compare the sampling data gathered from 2007-2010 (no samples were taken in 2009), the median concentration of each parameter was calculated for each monitoring site for each year (see Figure 2). Comparing the data in this way brought some interesting trends to light. Below is a summary of the findings for each parameter:

Total Nitrogen & Total Phosphorous:
TN and TP concentrations were greatest in the upstream reach of the Allen Brook (sites AB2 – AB4) and lowest in the downstream reach (sites AB4B – AB8). We would expect to see these results because agricultural land is concentrated in the upstream reach. Also, since TN and TP bind to soil, we would expect to see less TN and TP in the water column as the chemical moves further away from its source (a.k.a. moves downstream). Consequently, we might expect that the greater the concentration of turbidity, the lesser the concentration of TN and TP.

E. *coli*:
Concentrations of E. *coli* were not consistent over the three year sampling period. In 2007 and 2008, concentrations were generally greater in the downstream reach (sites AB4 – AB8); while in 2010, the greater concentrations appeared in the upstream reach (sites ABT1 – AB2). We would guess then that the concentrations are reflective of rain events; however when glancing at the precipitation and flow data for each year (see attached Precipitation and Discharge Comparison Charts), there appears to be no strong correlation between E. *coli* spikes and rain events. Therefore we assume that other unknown factors are affecting E. *coli* concentrations.

Turbidity:
As opposed to TN and TP, the concentration of NTU was generally greater downstream than upstream. While we might expect the level of turbidity to be cumulative in the water column (resulting in greater concentrations downstream vs. upstream), the data clearly shows that this is not the case. Land use activities and rain events may greatly affect the NTU samples. While no trends or explanations are apparent with these sampling results, additional monitoring in future years is required to better understand the data.

Chloride:
As expected, chloride concentrations generally increased as samples were taken further downstream. Concentrations more than doubled from Site AB4 to Site AB8. Additional monitoring in future years is required to identify trends.

State and Federal Water Quality Standards

When comparing our ambient monitoring results with the available state and federal standards (numerical standards do not yet exist for TN and TP), we found that the Allen Brook exceeded standards for E. *coli* and NTU. The Allen Brook did not exceed the federal standards for Cl. Below is a summary of the exceedances for each parameter:

Total Nitrogen & Total Phosphorous:
State and federal numeric criteria for TN and TP are not yet developed.

E. *coli*:
All eleven sampling sites exceeded federal (235 colonies/100mL) and state (77 colonies/100mL) standards for E. *coli* multiple times during each sampling season (see Figure 3). While the frequency of exceedances has been calculated for each site for each sampling year (see Figures 4-6), the combined data (all sampling sites for all sampling years) shows that all sites exceeded E. coli standards between 27% (site AB2) and 88% (sites AB3 and AB8) of the time (see Figure 7).

Turbidity:
The cold water fish habitat standard (10 NTU) for Turbudity was exceeded at seven out of the eleven sampling sites (see Figure 8).

Chloride:
Vermont has not yet developed numeric criteria for Cl, so the federal criteria are used (chronic criteria of 230 mg/L and acute criteria 860 mg/L). No sampling sites exceeded the federal limit in 2010. The maximum concentration of 180 mg/L was found at Site AB8, which is well below the federal standards.

What We Learned

Where trends aren't apparent (E. *coli* and NTU), a better analysis of rain events may help us to better understand the monitoring results.

Higher concentrations for all parameters were found at Site AB4 (with the exception of Cl for obvious reasons). Parameter concentrations tended to shift at Site AB4, which indicates to us the shift from rural land use activities (such as livestock operations) to urban land use activities (such as paving and maintaining a dense network of roads).

The Allen Brook has a serious pollution problem in regards to E. *coli* and NTU. A closer analysis of land use activities along the Allen Brook and adjacent to sampling sites should be conducted. The biological source (human vs. other animal) of E. *coli* contamination should be identified so that remediation efforts can be planned for and implemented.