Coordination of sampling to support trend analysis in the Christina River Basin in Pennsylvania and Delaware.

Problem: Multiple federal, state and local agencies are currently conducting water-quality sampling in the Christina River Basin. The Christina Basin Policy Committee would like to use existing data to evaluate trends in the Basin related to its efforts to improve water quality. A coordinated effort is needed between the Pennsylvania Department of Environmental Protection (PaDEP), Delaware Department of Natural Resources and Environmental Control (DNREC), and the United States Geological Survey (USGS) in order to provide a consistent data set on which statistical analysis can be preformed. To achieve this consistent database, some procedural changes may be required of each agency's water quality-sampling program.

The PaDEP Water Quality Network and DNREC Surface Water Quality Monitoring Program are the major sources of data to be used in determining trends in the Christina Basin. The USGS/Chester County Water Resources Authority Stream Conditions of Chester County Program provides additional information on the upstream portions of the White Clay, Red Clay, and Brandywine Creeks.

Suggested changes necessary to produce a consistent database are outlined below. Each is be discussed relative to the current sampling protocols.

1) PaDEP conducts bi-monthly sampling at one site in the White Clay, Red Clay, and Brandywine Creeks near the Pennsylvania/Delaware border. DNREC conducts monthly sampling at 9 sites in the White Clay Creek Basin, 4 sites in each of the Red Clay and Brandywine Creek Basins. **Suggested Changes: PaDEP consider increasing sampling to monthly. All 3 sites in the PaDEP WQN should be used in the trend analysis. DNREC should select a subset of 1 to 2 sites per basin for trend analysis.**

2) All data considered for trends analysis needs to have streamflow associated with the chemical data. The USGS and PaDEP sites are either at USGS gages or have a measured discharge taken with each sample. The DNREC sites include several sites that are at USGS gage stations. **Suggested Changes: Only the DNREC sites that have discharge data should be used in trend analysis. If there are important stations for trend analysis that are not at gage stations discharge should be measured at the time of sampling.**

3) Nutrient data is the major chemical parameter of concern in the Christina Basin. To evaluate change in the concentrations of nutrients all agencies must be measuring the same constituents. Currently PaDEP and DNREC are measuring total nitrogen, nitrate, nitrite, ammonia, phosphorus, and ortho-phosphate. The USGS is measuring the dissolved phase of these constituents only. **Suggested Changes: The USGS adds the analysis of total nutrient concentrations.**

4) Metal concentration data is being collected by all three agencies but with different detection limits, trend analysis is impossible due to a large number of results below the detection limit. **Suggested Changes: PaDEP changes the analysis to measure metals at a lower detection limit (SAC010 to a SAC013). DNREC and PaDEP may consider doing both dissolved and total metals.**

5) Consensus on a standard method of trend analysis should is needed so that each agencies results will be comparable. **Suggested Changes: All agencies adopt the Seasonal Kendall Trend Analysis for monthly water quality data.**

The changes outlined above will produce a data set that allows all agencies to do trend analysis with comparable results. This will provide a statistically valid comparison of water quality conditions in the entire Christina Basin. Listed below are some other thoughts on ways the Christina Basin Policy Committee could determine if water quality changes are happening in the Basin.

1) The use of continuous water-quality monitoring to determine dissolved oxygen, pH, and temperature patterns and trends. These parameters are collected by all three agencies but are of limited value since each parameter fluctuates diurnally. Continuous-monitors data will determine if improvements in chemical constituents or physical habitat are improving the DO concentrations or water temperatures which may result in improved biological conditions. Monitoring of these parameters may tell us more about improved stream conditions than chemical trends alone. The USGS, in cooperation with Chester County, operates continuous-monitors in the Brandywine Basin and DNREC has several stations with continuous-monitors. There may be an opportunity to coordinate these data and add a few more to give a complete picture of basic physical properties in the Christina Basin.

2) A coordinated method of determining sediment load in the basin is needed. This would involve either the use of a surrogate for sediment (turbidity) or the collection of multiple TSS samples at various discharges. Both come with some problems in cost and staff resources but it may be worth pursuing if we want to document conditions of the streams in the Christina Basin.

3) Most of the sampling is conducted during normal flow conditions. Since sediment and nutrients are the major concern it would be helpful to know what the conditions are over a range of streamflow. The collection of some “storm” samples would give a better idea of the nutrient and sediment loads at these infrequent, but important, events.

4) An evaluation of fish or invertebrates would document the impact of current nutrient concentrations on biological communities and quantify improvement resulting from a reduction in nutrient loads. All three agencies have programs that look at the biological communities but the differences in sampling protocols make it difficult to compare results. There may be some opportunities to improve the coordination of biological sampling to allow better comparisons in the future.