pH QUALIFICATION ANALYSIS

From 7/27/02 - 7/5/03 (inclusive), Streamkeepers and its partner projects measured pH using YSI 60 meters. This was the first year of these meters' deployment, and during that year, some samplers had difficulty obtaining stable readings. The protocol that year involved setting the meter in the shade for a 15-minute warmup prior to sampling, and taking readings when the meter stayed within ± 0.1 pH unit for 30 seconds. However, several samplers noted that if they continued to wait, the meter readings would continue to slowly drift downward, and that if they waited another ten minutes, the pH reading to the nearest tenth would have declined. After further investigation, Streamkeepers revised its protocol the next year to warm up/soak the probes in the stream for 20 minutes prior to sampling, and the stabilization criteria became more stringent: ± 0.01 pH units for 2 minutes. This revised protocol seemed to solve the problem of unstable readings, but it raised the question of whether the data gathered that first year was comparable to the data gathered subsequently. This study addresses that question.

The pH measurements taken from 7/27/02 - 7/5/03 were compared with measurements taken in August 2003 and later when pH measurement procedures were adjusted. The former were coded as Type = 0 measurements and the latter as Type = 1 measurements. Comparisons were made individually for 11 streams for which there was sufficient before and after data to allow valid comparisons and for all the foregoing stream data combined. Three methods were used to make the comparisons. Frequency plots of pH values plotted by Type were compared for each stream and for the combined stream data. The General Linear Models (GLM) procedure was used for two-way analyses of variance using the factors Type (1 = after and 0 = before) and Season (Winter, Spring, Summer, Fall) and Type x Season interactions (unless there was insufficient replication to test for first order interactions). In addition, single classification analyses of variance (ANOVA) were done to compare Types. The latter procedure provided useful plots of the means and confidence intervals for Type comparisons. A Type I error of 0.05 was chosen as the significance value.

Inspection of the frequency distributions of pH values by Type showed a general tendency for the Type = 1 (After) distributions to be skewed to smaller pH values in comparison to the Before values. Results of the analyses of variance are summarized in the table below. Eight of the 12 comparisons were found to be significant at the 0.05 level by both procedures. Two one-way ANOVA procedures were close to significance with p values of 0.053 and 0.058, respectively. In all 12 comparisons the After means were smaller than the Before means (see last column in table).

This ensemble of results suggests that the adjustment procedures applied on August, 2003 and after reduced the pH values obtained.

From the ANOVA obtained for all the streams the After pH values were found to be on the average about 0.2 pH units smaller than the Before values.

SUMMARY OF ANALYSIS OF VARIANCE OF pH DATA

FACTORS = TYPE, SEASON

Legend: GLM = General Linear Models, ANOVA = Analysis of Variance, ns = not significant, ---- = insufficient replication for calculating first order Interaction probabilities. Numbers in bold are significant probabilities.

FACTOR-> STREAM	TYPE GLM	SEASON GLM	TYPE*SEASON GLM	TYPE ANOVA	TYPE MEANS After (1) vs. Before (0)
Bagley	ns	ns	ns	ns	1 < 0
Barnes	ns	ns	----	ns(0.053)	1 < 0
Casselery	ns	ns	----	**0.046**	**1 < 0**
Ennis	**<0.001**	ns	ns	**<0.001**	**1 < 0**
Jimmy	**<0.001**	**<0.001**	**0.009**	**<0.001**	**1 < 0**
Lees	ns	ns	ns	ns	1 < 0
Morse	**<0.001**	ns	**0.006**	**0.013**	**1 < 0**
Salt	ns	**0.027**	ns	ns	1 < 0
Siebert	**0.002**	**<0.001**	ns	**0.016**	**1 < 0**
Sol Duc	**<0.001**	ns	ns	**<0.001**	**1 < 0**
Valley	**0.017**	**0.015**	ns	ns(0.058)	**1 < 0**
All Above	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**1 < 0**