RELATIONSHIPS BETWEEN WATER QUALITY, LAND-USE, AND HABITAT

Analysis and Results

In this section we examine the relationships between water quality and habitat parameters. For data available at the sub-basin level (percent agriculture and percent forest), we tested the correlations using standard Pearson correlation methods (Mathsoft 1999). We tested the correlation of the remaining water quality and habitat parameters using Kendall's rank-based correlation methods as described in the previous. For each test, we used two-sided alternative hypothesis that ? ? 0, where ? is the (population) correlation coefficient parameter. Significance was assessed at the a = 0.05 level. If ? > 0, then there is a positive correlation, if ? < 0, there is a negative correlation (Ott 1993). Discussion of each significant parameter follows.

Riparian/Habitat Score 1

Spring rain

TDS concentrations were significantly negatively correlated with habitat/riparian score (p-value=0.034). TDS concentrations decrease as habitat/riparian score 1 increases.

Base flow

N, kjeldahl concentrations were negatively correlated with habitat/riparian score 1 (p-value =0.032). TDS concentrations were negatively correlated with habitat/riparian score 1 (p-value = 0.0085). As habitat/riparian scores increase, TDS and kjeldahl nitrogen concentrations decrease.

Riparian/Habitat Score 2

Base flow

Kjeldahl nitrogen and total dissolved solid concentrations were both negatively correlated to riparian/habitat score 2 (Nkj p-value = 0.020, TDS p-value = 0.049). As riparian/habitat score 2 increases, we see a significant decrease in kjeldahl nitrogen and total dissolved solid concentrations. Phosphorus and habitat/riparian 2 had a positive correlation (p-value = 0.031). We found no significant correlations between riparian score 2 and nutrient loading rates, temperature, conductivity, dissolved oxygen or pH.

Percent Agriculture

Spring rain

We found a significant positive correlation between pH and percent agriculture (p-value = 0.020). As the percent agriculture increases, so does pH.

Base flow

As percent agriculture increases, percent forested land decreases (p-value = 0.003). Habitat/riparian score 1 and percent agriculture are negatively correlated (p-value = 0.021). As percent agriculture increases, we see decrease in habitat/riparian score 1. Similarly, we found a significantly strong negative correlation between percent agriculture and total

habitat/riparian score (p-value = 0.016), so as percent agriculture increases, total riparian/habitat score decreases.

Summer rain

We found a significant positive correlation between conductivity and percent agriculture (p-value =0.0488). As the percentage of agriculture rises, so does conductivity.

Percent Forest

Base flow

Habitat/riparian scores 1 and 2 are both positively correlated to percent forest (Score 1 p-value = 0.021, Score 2 p-value = 0.037). Dissolved oxygen concentrations and pH are also both positively correlated to percent forest (DO p-value = 0.0423, pH p-value = 0.0423). As the percentage of forested land in the sub-basin increases, so does dissolved oxygen, pH and both habitat/riparian scores.

Summer rain

Dissolved oxygen concentration is significantly positively correlated to percent forest (p-value = 0.0049). As the percentage of forested land increases, so does dissolved oxygen concentrations.

Discussion of Results

Several studies have established relationships between land use and water quality, with a general consensus that the more intense the land is used, the more adverse the effects are upon water quality (Byron and Goldman 1989, Burkart and Kolpin 1993). As discussed in the water quality section of this report, agriculture increases erosion and nutrient input into streams. Furthermore, studies show that watersheds with less forested area tend to have unbalanced flow regimes marked by increased flooding and storm runoff (Kostadinov and Mitrovic 1994). Increased frequency and intensity of flooding and runoff events increases erosion, washing suspended solids and nutrients into the streams. In our study, we found that habitat and riparian scores are correlated to land-use, nutrient concentrations and sedimentation. As a rule, trends in our data show that as habitat/riparian scores got worse, nutrient and sedimentation increased. The only exception to that rule was base flow phosphorus, which increased in concentrations with increasing habitat/riparian score 2.

Several studies discuss the benefits of healthy riparian buffers (Barton et al. 1985, Gregory, et al. 1991, Naiman et al.1993). Riparian zones are crucial to stream health by filtering excess nutrient and sediment runoff, preventing erosion, and providing cooling shade and habitat for organisms.