

Appendix H

Wilcoxon-Mann-Whitney Rank Sum Test between two Pudding River Sites

DEQ used a Wilcoxon-Mann-Whitney Rank Sum analysis in the WQ Hydro program (Aroner, 1997) to evaluate the difference between the bacteria concentration distributions at two sites, Pudding River at Highway 99E (river mile 7.3) and Pudding River at Highway 211 (river mile 21). Because the seasonal patterns in the data collected from these two sites were different, DEQ used this analysis to evaluate whether a bacteria source between the two sites might be responsible for the different seasonal patterns.

The Wilcoxon-Mann-Whitney test is a nonparametric procedure for determining whether one independent group of data tends to produce larger observations than a second independent group of data (Helsel and Hirsch, 2002). The null hypothesis, H_0 , for the test is as follows:

$$H_0: \text{Probability } [x > y]: = 0.5$$

Where x are data from one group and y are from a second group. In other words, this states that the probability of an x value being higher than any given y value is one-half. The alternative hypothesis, H_a , is as follows:

$$H_a: \text{Probability } [x > y]: \neq 0.5 \text{ (2-sided test - } x \text{ might be larger or smaller than } y \text{)}$$

For the analysis, data sets were first thinned to only those dates when a sample was collected at each of the two sites. The analysis (Figure H- 1) indicates that there is no statistically significant difference between the two data sets ($2xP = 0.869$) and that the concentrations measured at each of the two sites on any given day are not likely to differ significantly. The basis for the conclusion that there are no statistically significant differences between the two data sets is the $2xP$ value. Since the $2xP$ value of 0.869 is not less than 0.20, for an 80% confidence level, DEQ cannot reject the null hypothesis that one group does not produce larger observations than the other group. Seasonal patterns, then, are not likely influenced by different bacteria sources.

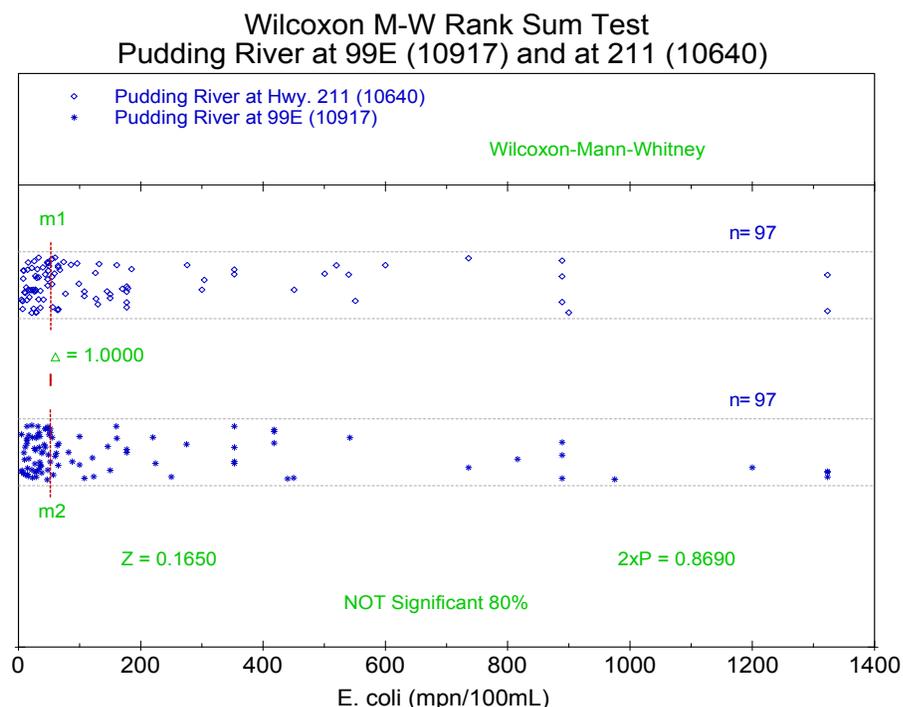


Figure H- 1: Wilcoxon-Mann-Whitney Rank Sum test of data collected from two Pudding River sites, at Highway 211 (river mile 21) and Highway 99E (river mile 7.3). On each sampling event, a sample was collected at each of the two sites.

REFERENCES

Aroner, E.R. 1997. WQHydro – Water Quality/Hydrology Graphics/Analysis System – Environmental Data Analysis Technical Appendix. WQHydro Consulting, Portland, Oregon, 223 pp.

Helsel, D.R. and Hirsch, R.M. 2002. Statistical Methods in Water Resources, U.S. Geological Survey.