Errata Sheet for Slides 22-26 of EPA Webcast, April 10, 2008

"Watershed Effectiveness Monitoring" – Don Meals and Steve Dressing, Tetra Tech, Inc.

An error was discovered in the equation for Minimum Detectable Change. The following information corrects the error and replaces slides 22-26 of the webcast.

Minimum Detectable Change

If the monitoring objective is to detect and document a change in water quality due to implementation, selected sampling frequency should be able to detect the magnitude of the anticipated change within the natural variability of the system being monitored.

For a more detailed discussion of minimum detectable change, please see:

Tetra Tech. 2011. Minimum detectable change analysis, Tech Notes 7, December 2011. Developed for U.S. Environmental Protection Agency by Tetra Tech, Inc., Fairfax, VA, 21 pp. http://www.bae.ncsu.edu/programs/extension/wqg/319monitoring/TechNotes/technote7_MDC.pdf (accessed March 1, 2012).

Slide 22

Minimum Detectable Change

For a Step Change

$$MDC = t_{(n_{pre} + n_{post}-2)} \sqrt{\frac{MSE}{n_{pre}} + \frac{MSE}{n_{post}}}$$

Where:

t = the one-sided 2-sided Student's t value with (n_{pre}+n_{post}-2) degrees of freedom (in this case selected at *p*=.05),

n = the number of samples taken in the pre- and post- groups (The pre- and post-BMP periods can have different sample sizes but should have the same sampling frequency), and

MSE = s_p^2 = Estimate of the pooled Mean Square Error (MSE) or, equivalently, variance (s_p^2) within each period. If post-BMP data are not available, no autocorrelation is present, and no explanatory variables are appropriate, MSE or s_p^2 can be estimated by the variance (square of the standard deviation) of pre-BMP data.

Slide 23

Equation in Slide 23:

$$\mathrm{MDC} = t_{(n_{pre}+n_{post}-2)} \sqrt{\frac{\mathrm{MSE}}{n_{pre}} + \frac{\mathrm{MSE}}{n_{post}}}$$

Minimum Detectable Change

Example:

Based on historical monitoring data from the Arod River, annual mean TSS concentration is 36.9 mg/L, with a standard deviation of 21.2 mg/L.

Evaluate the minimum detectable change for weekly, monthly, and quarterly sampling 1 year before and 1 year after implementation of erosion control measures

Minimum Detectable Change

Weekly sampling (n = 52), MSE = 449.44
t for 102 d.f. at p = 0.05 is 1.6599
MDC = 6.90 mg/L = 100*(6.90/36.9) = 19%

Monthly sampling (n = 12), MSE = 449.44
t for 22 d.f. at p = 0.05 is 1.7171
MDC = 14.86 mg/L = 100*(14.86/36.9) = 40%

Quarterly sampling (n = 4), MSE = 449.44
t for 6 d.f. at p = 0.05 is 1.9432
MDC = 29.13 mg/L = 100*(29.13/36.9) = 79%

Minimum Detectable Change

- If a reduction of 25% in mean annual TSS concentration is a goal of an implementation project, a weekly sampling schedule could document such a change with statistical confidence, but monthly sampling could not.
- A reduction of 40% or more in TSS concentration would need to occur to be detected by monthly sampling.
- Quarterly sampling for TSS would be ineffective for this project

Slide 26

Link in Slide 22 for additional information on minimum detectable change analysis:

http://www.bae.ncsu.edu/programs/extension/wqg/319monitoring/TechNotes/technote7_MDC.pdf