**Section 378.APPENDIX B Application of the Die-off Equation**

a) Sketch the receiving stream and the progression of higher order streams it flows into, up to and including the major river basin. Major river basins are listed in Appendix C. Also identify on your sketch:

1) Smaller streams which are tributary to the receiving water below the point of discharge.

2) All point source dischargers.

3) All public and food processing water supply intakes.

4) Water body reaches wherein primary contact activities are feasible or known to be engaged.

b) Sources which discharge directly to receiving waters which are obviously suitable for primary contact use and therefore applying for a seasonal exemption only, do not need to assess downstream primary contact potential or use. Sources which are applying for a year-round exemption must carefully assess such potential or use for the entire affected reach of the undisinfected discharge.

c) Subdivide downstream waters into segments where discharge and stream cross-sectional area are relatively uniform. Segments will typically begin at confluences with other streams. Number the segments and identify each on the above sketch. Where available note stream mile numbers established by U.S. Geological Survey (see Appendix C) for the receiving stream.

d) Establish discharge rates for each segment. If no discharge data is available, the equations developed by the Illinois State Water Survey (Appendix C) may be used. For waters protected to 200 fecal coliform per 100 ml, the median discharge (50% recurrence frequency) shall be utilized. For waters protected to 2000 fecal coliform per 100 ml, calculate discharges for the 10%, 30%, 50%, 70%, and 90% recurrence frequencies.

e) Derive average velocities for all necessary recurrence frequencies in each segment. In the absence of field measurements, velocity is best estimated through the use of the Manning equation (Appendix D). For some situations, equations developed by the Illinois State Water Survey (Appendix C) may suffice; however, these equations tend to over-estimate velocity, so it may be beneficial for a discharger to go to a more detailed analysis.

f) Assess the average concentration of fecal coliform directly upstream of the source (Nu) and for all significant tributaries listed in Part A. Data from Agency ambient monitoring stations may be useful in some instances.

g) Assess the concentration of fecal coliforms in the effluent prior to disinfection (No). An average over at least 3 months is preferable, but a minimum of 4 samples in 30 days will be acceptable. A conservative value of 400,000 fecal coliform per 100 ml may be utilized when effluent specific data is not available.

h) Determine the appropriate die-off rate constant (k). Available literature values for k range from 0.01/hour to greater than 1.00/hour. In the absence of stream-specific data, the following values may be used: 0.06/hour for the months May thru October, and 0.03/hour for the months November thru April. Stream assessments are preferred and may be necessary to demonstrate compliance. (See Appendix E).

i) Calculate fecal coliform levels at intervals downstream using the design average flow for the source, for all necessary recurrence frequencies and values of k. Incorporate the contributions of additional downstream sources as necessary. Compare the results to the required levels of protection. (These levels are 200/100 ml for primary contact and 2000/100 ml for water supplies).

j) In cases where the predicted level approximates the required level of protection, the Agency will require additional stream-specific information. Such information may include, but is not limited to:

1) Die-off studies to determine k.

2) Dye tracer studies to determine V.

3) Stream surveying to determine Q.