This accounts for all the assumptions:

- Susceptibles grow logistically and acquire the disease at a rate $\lambda(C)$ that is a type II functional response; this is different than a type II functional response on hosts. Note that $C_0$ is a constant, not $C(0)$.

- Infecteds disappear at constant rate $\mu$

- Cholera in the water system has constant per capita birth $(a)$ and death $(b)$ rates and is produced at rate $d$, which must differ from $\mu$. 

\[ \frac{dS}{dt} = rS \left( 1 - \frac{S}{k} \right) - \frac{\lambda C}{C+C_0} S \]

\[ \frac{dI}{dt} = \frac{\lambda C}{C+C_0} S - \mu I \]

\[ \frac{dC}{dt} = (a-b)I + dI \]