

Calculation of TP Mass Loading Limit Based on Mass-Balance Equation:

$$Q_d C_d + Q_s C_s = Q_r C_r$$

Converting to mass-based equation:

$$M_d = Q_d C_d * 8.34 = (Q_r C_r - Q_s C_s) * 8.34$$

Where:

M_d = mass-based phosphorus limit

Q_d = effluent flow in MGD (52 MGD)

C_d = effluent phosphorus concentration in mg/L

Q_s = 7Q10 flow of Merrimack River upstream of the discharge (1,041.4 cfs = 672.7 MGD)

C_s = median phosphorus concentration in the Merrimack River (0.052 mg/L)

Q_r = downstream 7Q10 flow ($Q_s + Q_d = 724.7$ MGD)

C_r = downstream river phosphorus concentration (Gold Book target = 0.100 mg/L)

8.34 = factor to convert from *MGD * mg/L* to *lb/day*

Solving for M_d :

$$M_d = [(724.7 \text{ MGD})(0.100 \text{ mg/L}) - (672.7 \text{ MGD})(0.052 \text{ mg/L})] * 8.34$$

$$M_d = 312.7 \text{ lb/day}$$