CALCULATION OF STREAM FLOW USING GENERAL OCEANICS MECHANICAL FLOW METER

This is an interesting calculation with a lot of metric/standard conversions. Let's use Sable River at Quarterline Road as our example. Remember, we need to calculate the flow of each stream segment separately and then combine these to get the total stream flow (i.e. There were 11 stream segments for Quarterline Road, ten at 6 Ft. and one at 2 Ft.). Let's look at the first 6' segment:

1. Initial Meter Reading 3620 – Final Reading 3714 = 94 counts in 1 minute.
2. Divide 94 counts per minute by 60 to get 1.57 counts per second.
3. The General Oceanics manual says we need to use the formula:

   $$\text{Flow (Cm/second)} = \frac{\text{Meter counts per second x meter constant 26,873 x 100}}{999{,}999}$$

   $$= \frac{(1.57 \text{ cts./second})(26{,}873)(100)}{999{,}999} = \textbf{4.21 Cm per second flow}$$

4. We need to change this to "Feet per minute" flow

   4.21 Cm per second x 60 seconds per minute = 252.6 Cm per minute / 30.48 Cm per 1 foot

   $$\frac{4.21 \text{ Cm x 60 seconds per minute}}{30.48 \text{ Cm per foot}} = \textbf{8.2876 Feet per minute}$$

5. Our stream segment width was 6' and our depth for this segment was 1.05' (12.6"/12" per ft.)
6. We can now calculate the cubic feet per minute (Ft^3) segment flow by multiplying feet per minute flow (8.2876 Ft/minute x segment width (6') x segment depth (1.05')

   Segment flow = 52.2 (Ft^3/minute)

7. Now we need to do this same calculation for the remaining 10 segments and add them all together to get total stream flow in CFM(Ft^3/minute). NOTE: Remember to use 2' for the segment width when calculating the flow for segment #11. This is why an excel spreadsheet is so useful.
8. Our final stream flow when all segments are calculated is: 12,630 CFM.

9. Your next step will be to calculate the "Pounds Per Day" discharge of a given nutrient, such as "Total Phosphorus".

CALCULATION OF "POUNDS PER DAY NUTRIENT DISCHARGE TO THE LAKE WHEN STREAM FLOW HAS BEEN CALCULATED

This is the second step of the overall "Nutrient Loading" calculation. Once we know the total stream flow, and nutrient concentration found (i.e. from sample analysis), we can calculate the "pounds per day" nutrient loading to the lake. Let's use our Total Phosphorus result of 22 ug/L obtained for the Quarterline Bridge sample.

1. The first thing we need to do is convert micrograms/L (ug/L) to milligrams/L (mg/L) by dividing the result by 1000.

   $$\frac{\text{22 micrograms per Liter}}{\text{1000 ug per mg}} = \textbf{.022 mg per Liter}$$

2. We know from our stream flow calculations that the total flow for the Sable River at Quarterline Road was 12,630 CFM. Let's convert this number to "Liters per Minute" by multiplying this number by the conversion factor of 28.3 Liters per Ft^3.

   = 12,630 Ft^3 per minute x 28.3 Liters per Ft^3 = **357,429 Liters per minute flow**

3. Let's convert this to "Liters per Day" by multiplying the result by 1440 minutes per day.

   357,429 Liters per minute x 1440 minutes per day = **514,697,760 Liters per Day**

4. We know that each Liter of water contains 0.022 mg of Total Phosphorus

   So 514,697,760 Liters per day x 0.022 mg Total Phosphorus per liter = **11,323,351 mg phosphorus discharged per day.**

5. We can convert milligrams Phosphorus (mg P) to grams of phosphorus (g P) by dividing the total 1000.

   $$= \frac{\text{11,323,351 mg Phosphorus discharged per day}}{\text{1000 mg per 1 gram}} = \textbf{11,323.3 grams}$$

6. Now we need to convert grams phosphorus discharged per day to pounds of phosphorus discharged per day by dividing the total by 453.6 grams per pound.

   $$= \frac{\text{11,323.3 grams Phosphorus per Day}}{\text{453.6 grams per pound}} = \boxed{\textbf{24.96 pounds Phosphorus per Day}}$$