## HOW MUCH WATER DO WE NEED?
## Take a moment to consider and estimate volume per person per day

One Person ~ 3 Liters/Day To Maintain Essential Body Fluids (0.8 Gal)

In some arid locations people exist with this as their total consumption

Flushing Toilet ~ 15 Liters, low-flush ~6L, ultra-low-flush ~4L
( ~ 3.5 Gal, 1.6 Gal, 1 Gal)

USA Personal Use ~200-300 Liters/Person/Day
(50-80 Gal/Person/Day or 200-300 Gal/Household/Day (of 4)

Add Industrial, Municipal, Commercial
~4000 LitersPerson/Day ~1000 Gal/Person/Day

Add Energy And Food Production,
~ 5500 Liters/Person/Day ~1500Gal/Person/Day

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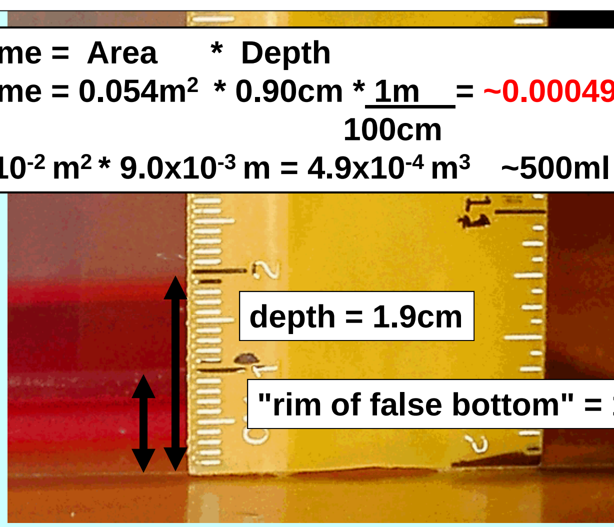
"rain" depth over area

depth = measured - "rim of false bottom"
depth = 1.9cm - 1.0cm = 0.90cm

Volume = Area * Depth

$$\text{Volume} = 0.054\text{m}^2 * 0.90\text{cm} * \frac{1\text{m}}{100\text{cm}} = \sim 0.00049\text{m}^3$$

$5.4\times10^{-2}\ \text{m}^2 * 9.0\times10^{-3}\ \text{m} = 4.9\times10^{-4}\ \text{m}^3$ ~500ml



**to check for homogeneity:**

**compute ratio of values at stations at same times**
**compare - a break in constant ratio indicates a change**
**if only 1 year it is an error**
**otherwise, adjust early data to match later data**
**either multiply or divide early values at the stationary station by the new ratio depending on whether the stationary station is in the denominator or the numerator of the ratio (see example)**

**HOMOGENEITY CORRECTION EXAMPLE:**

| YR | A | B | A:B | B:A | Corrected |
|---|---|---|---|---|---|
| 1 | 11 | 22 | .50 | 2.00 | 5.06 ~5 |
| 2 | 10 | 21 | .48 | 2.08 | 4.83 ~5 |
| 3 | 12 | 23 | .52 | 1.92 | 5.29 ~5 |
| 4 | 6 | 23 | .26 | 3.85 | 6 |
| 5 | 4 | 20 | .20 | 5.00 | 4 |
| 6 | 5 | 21 | .24 | 4.17 | 5 |

**FOR A:B B x 0.23 = CORRECT A VALUE FOR 1,2,3**
**FOR B:A B / 4.3 = CORRECT A VALUE FOR 1,2,3**

**If data are missing, the most likely value is:**

$$P_x = \frac{1}{n}\left[\frac{A_x}{A_1}P_1 + \frac{A_x}{A_2}P_2 + \ldots + \frac{A_x}{A_n}P_n\right]$$

**where:** n = number of stations near station x which has the missing value
$P_x$ = missing value of precipitation @ station of interest "x" for given year
$A_x$ = average annual preciptation at station of interest "x"
$P_\#$ = precipitation at n nearby stations identified by # for given year
$A_\#$ = average annual precipitation at each of n stations identified by #

**TAKE 5 MINUTES**
**homogeneity_missing.xls, sheets = "homogeneity" and "missing"**
**http://inside.mines.edu/~epoeter/_GW/02Budget1/BudgetPrecipEvap.htm**

**25 in**

**Volume of Precipitation on Turkey Creek Basin in a year?**
**Use 20 inches/yr for the average to facilitate moving along in class**

Area of Turkey Creek Basin? = 47.2 $mi^2$

Take a few minutes to estimate the
volume input to the Basin via precipitation (work together)

Area[$L^2$] * Rate[L/T] = Volumetric Rate [$L^3$/T]

First think of it in terms of an average flow rate

$$47.2\ mi^2 * \frac{20\ in}{yr} * \frac{1\ ft}{12in} * \frac{5280ft}{1\ mi} * \frac{5280ft}{1\ mi} \sim \frac{2.19\times10^9\ ft^3}{year} * \frac{1yr}{365d}\ \frac{1day}{86400s} \sim \frac{70\ ft^3}{sec}$$

$$\text{so annual volume} = \frac{2.19\times10^9\ ft^3}{year} * \frac{1\ ac}{43560ft^2} \sim 50{,}000\ AFY$$

Recall 5000 AFY
served ~22,000 homes

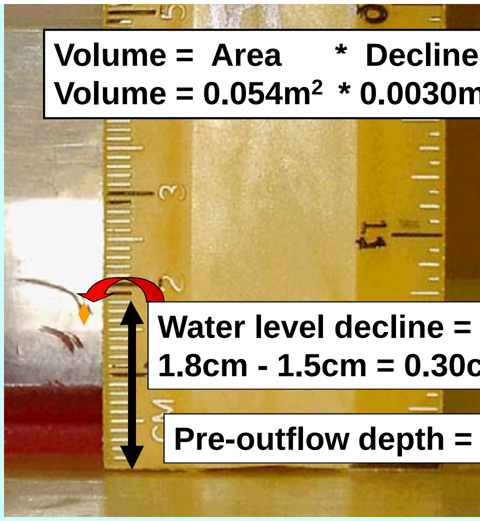
**Take 5 min to get the evaporation rate**

**Mean Temp = 75 F**
**Mean Dew Point Temp = 50 F**
**Solar Radiation = 500 langley's**
**Wind Movement = 200 mi/day**


FIGURE 2.1 Nomograph used to determine the value of daily lake evaporation for shallow lakes if solar radiation, mean daily air temperature, mean daily dew point temperature, and wind movement are known. Source: Roberts & Stall 1967.

**Suppose the budget was for the plastic pan for a 340sec time period?**

**So it is hot hot hot and windy and in that brief time We find a large water level decline over the area**



**Volume = Area * Decline**
**Volume = $0.054 m^2$ * 0.0030m = ~$0.00016 m^3$**

**Water level decline =**
**1.8cm - 1.5cm = 0.30cm = 0.0030m**

**Pre-outflow depth = 1.8cm**

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**Volume of Evapotranspiration in Turkey Creek Basin in a year?**
**Hopefully when you researched the ET rate in TCB you would find the Jefferson County – Mountain Ground Water Resource Study Report**
http://inside.mines.edu/~epoeter/_GW/02Budget1/wri03-4034.pdf **This is a big file & only FYI not required because:**
**Use 18 inches/yr for the average to facilitate moving along in class**

Area of Turkey Creek Basin? = 47.2 $mi^2$

Take a few minutes to
estimate the volume output to evapotranspiration

Area[$L^2$] * Rate[L/T] = Volumetric Rate [$L^3$/T]

First in terms of an average flow rate

$$47.2\, mi^2 * \frac{18\, in}{yr} * \frac{1\, ft}{12 in} * \frac{5280 ft}{1\, mi} * \frac{5280 ft}{1\, mi} \sim \frac{1.97\times10^9\, ft^3}{year} * \frac{1 yr}{365 d}\,\frac{1 day}{86400 s} \sim \frac{63\, ft^3}{sec}$$

$$\text{so annual volume} = \frac{1.97\times10^9\, ft^3}{year} * \frac{1\, ac}{43560 ft^2} \sim 45{,}000\ \text{AFY}$$

**Clearly it is the difference in precipitation and evapotranspiration That matters (20-18 inches) such that the net is 5000AFY**