OPERATOR CERTIFICATION MATH SHEET

♦*Equivalents*♦

1 cubic foot	= 7.48 gallons	1 mg/L = 1ppm
1 cubic yard	= 27 cubic feet	1 MGD = 694 gpm
1 gallon of water	= 8.34 pounds	π (Pi) = 3.1416
1 p.s.i.	= 2.31 feet of water	Radius of circle = diameter ÷ 2
1 horsepower	= 0.746 kilowatts	Circumference of circle = π x diameter
1 acre	= 43,560 square feet	Temp. °Centigrade = (°Fahrenheit - 32°) x 0.55
1 mile	= 5,280 feet	Temp. °Fahrenheit = (°Centigrade x 1.8) + 32°F

♦*Area and Volume Formulas*♦

Rectangles:
Area, sq. ft. = length, ft. x width, ft.
Volume, cu. ft. = length, ft. x width, ft. x height, ft.

Circles/Cylinders:
Area, sq. ft. = π x radius, ft. x radius, ft.
Volume, cu. ft. = π x radius, ft. x radius, ft. x height, ft.

Cone:
Volume, cu. ft. = 1/3 x π x radius, ft. x radius, ft. x height, ft.

♦*General Formulas*♦

Detention Time, hr. = $\frac{\text{volume, gal. X 24 hr./day}}{\text{flow, gal/day}}$

Velocity, ft./sec. = $\frac{\text{flow, cu. ft./sec.}}{\text{area, sq. ft.}}$

Velocity, ft./sec. = $\frac{\text{distance, ft.}}{\text{time, sec.}}$

Water HP = $\frac{\text{gpm x head, ft.}}{3960}$

Pump HP = $\frac{\text{water horsepower}}{\text{pump efficiency}}$

Motor HP = $\frac{\text{pump horsepower}}{\text{motor efficiency}}$

Motor HP = $\frac{\text{water horsepower}}{\text{(pump x motor efficiency)}}$

Flow, cu. ft./sec. = area, sq. ft. x velocity, ft./sec.

Weir Overflow Rate, gpd/ft. = $\frac{\text{flow rate, gpd}}{\text{length of weir, ft.}}$

Surface Loading Rate, gpd/sq.ft. = $\frac{\text{flow rate, gpd}}{\text{area, sq. ft.}}$

Solids Loading, lbs/day/sq.ft. = $\frac{\text{solids applied, lbs/day}}{\text{surface area, sq. ft.}}$

% Stroke Setting = $\frac{\text{required feed, gpd}}{\text{maximum feed, gpd}}$ x 100

% Removal = $\frac{\text{(in – out)}}{\text{in}}$ x 100

Screening Removed = $\frac{\text{screenings, cu. ft.}}{\text{flow, mgd}}$

Day's supply = $\frac{\text{total chemical in inventory, lbs.}}{\text{average use, lbs/day}}$

$ Cost per day = hp x 0.746 x $ rate x hours/day

Solids Applied, lbs./day = flow, mgd x conc., mg/L x 8.34 lbs./gal

♦*Chlorine Formulas*♦

Chemical Feed, lbs./day = flow, mgd x dose, mg/L x 8.34 lbs./gal.

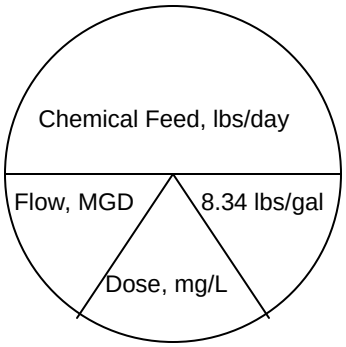
Chlorine Dose, mg/L = $\frac{\text{chemical feed, lbs./day}}{\text{flow, mgd x 8.34 lbs./gal}}$

Chlorine Dose, mg/L = chlorine demand, mg/L + chlorine residual, mg/L

Chlorine Residual, mg/L = chlorine dose, mg/L – chlorine demand, mg/L

Chlorine Demand, mg/L = chlorine dose, mg/L – chlorine residual, mg/L

Pounds of HTH = $\frac{\text{lbs. chlorine needed x 100}}{\text{\% chlorine of HTH}}$



♦*Water Math*♦

Filtration Rate, gpm/sq.ft. = flow, gpm / surface area, sq. ft.

Backwash Rate, gpm/sq.ft. = backwash flow, gpm / surface area, sq. ft.

Backwash % = (backwash water, gal.)(100%) / water filtered, gal.

Wash Water, gpm = area, sq. ft. x rise, ft. x 7.48 / minutes

Reservoir Volume, gal. = volume, ac-ft x 43,560 sq. ft./ac. x 7.48 gal./cu.ft.

Reservoir Volume, ac./ft. = reservoir volume, cu. ft. / 43,560 sq. ft./ac.

Surface Area, ac. = surface area, sq. ft. / 43,560 sq. ft./ac.

Chemical Feed, lbs. = surface area, ac. x dose, lbs./ac.

Mean or Average = sum of values or measurements / number of values or measurements

Median = middle value of a group of data

♦*Wastewater Math*♦

Pond Area, acres = avg. width, ft. x avg. length, ft. / 43,560 sq. ft./acre

Pond, Detention Time, Days = pond volume, ac-ft / flow rate, ac-ft/day

Pond, Population Loading, Number of Persons/Acre = population served, persons / pond area, acres

Pond, Hydraulic Loading Inches Per Day = depth of pond, inches / detention time, days

Pond, Organic Loading lbs. BOD/day/ac. = BOD, mg/L x flow, mgd x 8.34 lbs/gal. / area, ac.

Trickling Filter, Organic Loading Lbs. BOD/day 1,000 cu. ft. = BOD applied, lbs./day / volume of media, 1,000 cu. ft.

Sludge Age (in days) = MLSS, mg/L x tank volume, mg x 8.34 lbs./gal. / SS in primary effluent, mg/L x flow, mgd x 8.34 lbs./gal.

Sludge Volume Index = settleable solids, % x 10,000 / MLSS, mg/L

Grit Removed, cu. ft./MG = volume of grit, cu. ft. / volume of flow, MG

Slope = fall, ft. / length, ft.

Grade, ft./ft. = rise, ft. / run, ft.