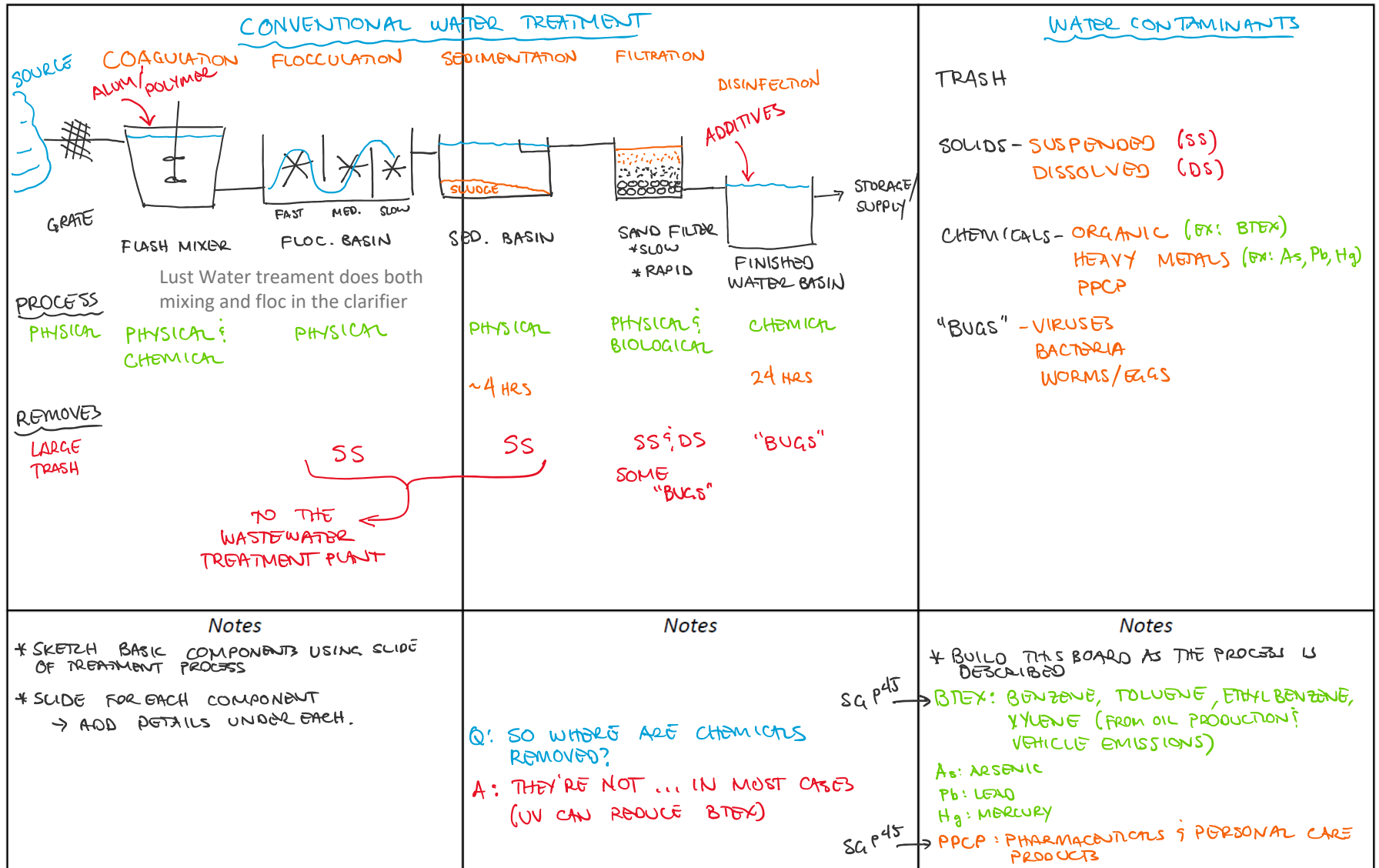


# CE350 LSN 13 Board Notes (Bruhl)

Friday, January 26, 2018  
Updated 2/13/19



WEST POINT

Papeleopen

CONTAMINANTS

BUGS

BACTERIA

VIRUSES

WORMS

SOLIDS

TSS

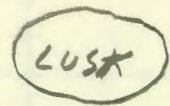
DS

CHEMICALS

BTEX

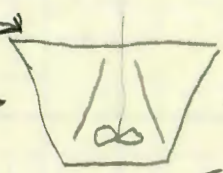
PPCP

METALS

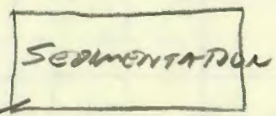


POLYMER

CLARIFIER



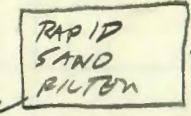
4 HRS



SLUDGE

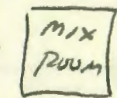
BACKWASH WATER

TIME



SODA ASH  
CHLORINE  
FLUORIDE

TIME



BACTERIA	0	0	0	+	++++
VIRUSES	0	0	0	0	+
WORMS	0	++	0	++	++
TSS	+	++	++++	+++	0
DS	0	+	++	++++	0
BTEX	0	0	0		0
PPCP	0	0	0		0
METALS	0	0	0		0

😊 = GOT 'EM!  
 ☹️ = MISSED...



DEPARTMENT OF CIVIL & MECHANICAL ENGINEERING  
 UNITED STATES MILITARY ACADEMY  
 The Nation's First Department of Engineering

PROBLEM \_\_\_\_\_ INSTRUCTOR \_\_\_\_\_

COURSE \_\_\_\_\_ SECTION \_\_\_\_\_

DATE \_\_\_\_\_ SHEET NO. 2 of \_\_\_\_\_

## ADDITIVES

SODA ASH - RAISES pH; HELPS  
( $\text{Na}_2\text{CO}_3$ ) REDUCE PIPE CORROSION

FLUORIDE - STRENGTHENS TEETH

CHLORINE - DISINFECTS

- PRIMARY - PREVENTS BIOLOGICAL GROWTH IN TREATMENT PLANT
- SECONDARY - FOR STORAGE TANKS & LINES

## TREATMENT TECHNIQUES

### CONVENTIONAL

SETTLE / STAND

FILTER

CHLORINATE

} SOLIDS  
} "BUGS"

### OTHER METHODS

BOIL: KILLS "BUGS"

UV RADIATION: DESTROYS VIRUSES & BTEX

OZONE: KILLS "BUGS"

CARBON: ABSORBS TOXINS

### DESALINATION PLANT

\* BOILS & DISTILLS WATER

\* MAY USE REVERSE OSMOSIS

### REVERSE OSMOSIS

\* PUMPS WATER THROUGH MEMBRANE

\* REMOVES SALTS, PARTICLES, ORGANICS, BACTERIA

ROWPU

### Notes

\* BUILD THIS BOARD AS THEY COME UP IN THE PROCESS

SODA ASH IS "SODIUM CARBONATE"

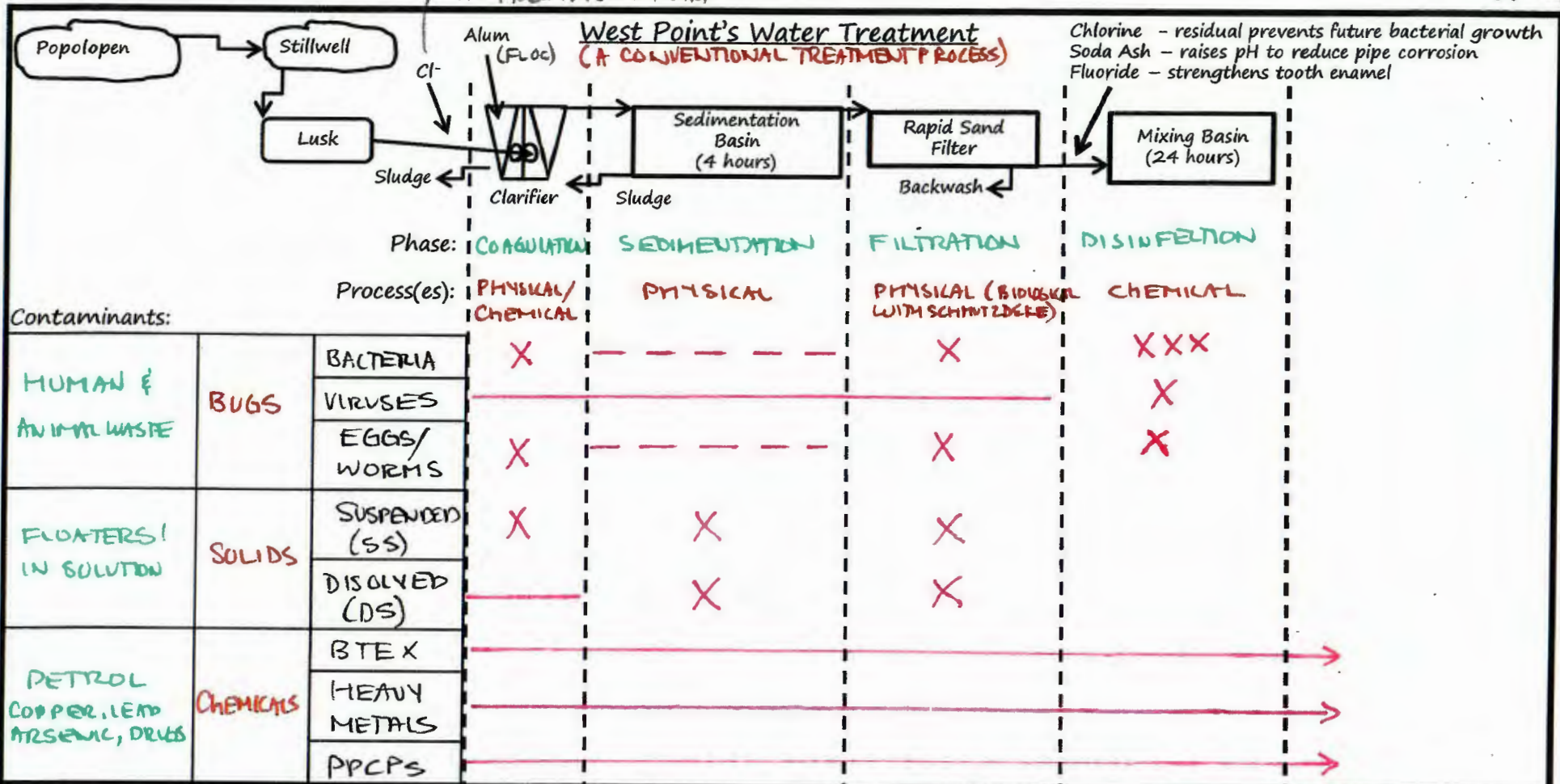
Q: ↑ pH = MORE ACIDIC OR BASIC?

A: BASIC; WE WANT WATER SLIGHTLY ALKALINE

### Notes

\* SUMMARIZE AFTER DESCRIBING COMPLETE PROCESS... THEN ADD OTHER METHODS

### Notes



**Notes:**

- SAFE DRINKING WATER ACT OF 1974
  - 91 REGULATED SUBSTANCES
  - NO UPDATES SINCE 2000
  - ACCEPTED ARSENIC LEVEL EQUATES TO 1 IN 600 RESIDENTS GETTING BLADDER CANCER
  - EQUIVALENT EXPOSURE TO 1604 X-RAYS
- DISSOLVED SOLIDS: BARIUM + CALCIUM  
VOLs + PPCPs ARE ALSO DS
- SUSPENDED SOLIDS: TURBIDITY
- COAGULATION HAS 2 STAGES  
MIX/FLOC AND SETTLE
- UPFLOW CLARIFIER REDUCES RETENTION TIME 1-2 TIMES DUE TO MIXING
- BG CARL DARNALL INVENTED A SYSTEM FOR CHLORINATING DRINKING WATER IN 1910 RESULTING IN MANY LIVES SAVED
- HOW DOES CHLORINE DISINFECT?  
IN WATER IT YIELDS HYDROCHLORIC AND HYPOCHLOROUS ACID WHICH PENETRATES CELL WALLS OF PATHOGENS AND DISRUPTS BIOLOGICAL PROCESSES
- WHAT IS THE DISINFECTION TIME FOR CHLORINE?  
E COLI - 1 MIN  
HEPATITIS A - 16 MIN  
GIARDIA - 45 MIN  
CRYPTOSPORIDIUM - 6-7 DAYS

BTEX = BENZENE, TOLUENE, ETHYLBENZENE, XYLENES => VOCs (TYPICALLY FROM PETROL THAT AFFECT THE CENTRAL NERVOUS SYSTEM)

PPCPs = PHARMACEUTICALS & PERSONAL CARE PRODUCTS