**Unit Process Assigned______________**

# Student Activity #1
## Impacts of Wet Weather Flows on Treatment Plants and Unit Processes

As a group, list below the ways in which high flows and accompanying changes in wastewater characteristics impact the unit process assigned. These should be specific effects of the wet weather flow, not descriptions of what you do differently during wet weather. Additional pages are available if needed.

# Student Activity #2
# <u>Analysis of Plant Data</u>

Mo'town WWTF

Attached is a partial set of one month's plant data for the Mo'town wastewater treatment facility. The basic facility data is as follows:

| | | | |
|---|---|---|---|
| Flow: Design | 0.90 MGD | Preliminary: | Barscreen |
| | | | Detriter |
| Peak Day | 2.0 MGD | Primary: | Circular clarifier |
| Primary Clarifier Volume | 0.113 MG | Secondary: | Activated sludge |
| Secondary Clarifier Volume | 0.225 MG | | Rectangular clar. |
| | | Tertiary: | Sand Filters |
| | | Nutrient Removal: | Nitrification Only |

Your task, as a group, is to analyze the attached data sheet and develop some assumptions and basic actions to be taken based upon the data. To guide the discussion within the group, consider the following questions.

1. What days of this month do you consider to be wet weather flow days?

2. What unit processes seem to be under stress during these times?

3. What process adjustments should be considered?

4. During which of these times do you think that the secondary process is stressed?

5. What other data would you like to have collected by the operators?

6. What month do you think this is?

Be prepared to present your groups opinions and answers to the class.

# Activity #2 - Mo'town WWTF

| | | | | Influent | | | | | | | Barscreen | Quantity | Quantity | Primary Settling | | | | Final Effluent | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | AirT | Rainfall | Flow | Temp. | SettS | SS | BOD | pH | P | TKN | Op | of | of | sludge | sludge | PESS | PEBOD | FESS | FEBOD |
| | | | | | | | | | | | Mode | Screen | Grit | depth | pumped | | | | |
| | F | (inch) | MGD | C | ml/l | mg/l | mg/l | | mg/l | mg/l | | cu.ft. | cu.ft. | feet | gallons | mg/l | mg/l | mg/l | mg/l |
| 1 | 30 | 0 | 0.84 | 13 | 11 | 150 | 160 | 6.8 | 4.3 | 30 | AUTO | <2 | 0 | 2.1 | 1500 | 72 | 64 | 4 | 2 |
| 2 | 32 | 0 | 0.82 | 13 | 12 | 145 | 165 | 6.5 | 4.2 | 32 | AUTO | <2 | 0 | 2.2 | 1520 | 70 | 66 | 3 | 4 |
| 3 | 40 | 0 | 0.85 | 13 | 12 | 135 | 155 | 6.7 | 4.5 | 29 | AUTO | <2 | <2 | 2 | 1500 | 65 | 62 | 5 | 3 |
| 4 | 38 | 0 | 0.9 | 12 | 16 | 145 | 165 | 6.9 | 4.2 | 28 | alar/con | 4 | 2 | 2.3 | 1520 | 70 | 65 | 6 | 5 |
| 5 | 42 | 0.1 | 1.2 | 12 | 12 | 142 | 162 | 6.6 | 4.1 | 26 | alar/con | 2 | 0 | 2.1 | 1500 | 72 | 80 | 4 | 4 |
| 6 | 55 | 0 | 0.89 | 13 | 13 | 138 | 158 | 6.8 | 4.3 | 32 | AUTO | <2 | 0 | 1.9 | 1500 | 66 | 63 | 3 | 3 |
| 7 | 65 | 0 | 0.86 | 14 | 11 | 143 | 163 | 6.7 | 4.4 | 30 | AUTO | <2 | <2 | 2 | 1500 | 69 | 65 | 6 | 4 |
| 8 | 70 | 0 | 0.85 | 13 | 11 | 146 | 164 | 6.7 | 4.3 | 29 | AUTO | <2 | 0 | 2 | 1500 | 70 | 66 | 4 | 5 |
| 9 | 75 | 0 | 0.9 | 14 | 14 | 145 | 156 | 6.7 | 4.1 | 36 | AUTO | <2 | 0 | 2.3 | 1500 | 66 | 70 | 5 | 4 |
| 10 | 50 | 0.8 | 1.76 | 14 | 15 | 80 | 140 | 6.4 | 3.4 | 24 | alar/con | 16 | 20 | 2.8 | 1520 | 95 | 110 | 15 | 25 |
| 11 | 55 | 0.4 | 1.45 | 15 | 13 | 85 | 145 | 6.8 | 3.6 | 26 | alar/con | 4 | 4 | 2.2 | 1600 | 45 | 65 | 6 | 12 |
| 12 | 60 | 0.1 | 1.2 | 14 | 12 | 120 | 155 | 6.9 | 3.9 | 28 | alar/con | 2 | <2 | 1.3 | 1550 | 58 | 65 | 5 | 13 |
| 13 | 65 | 0 | 0.95 | 15 | 10 | 144 | 162 | 6.7 | 4.3 | 30 | AUTO | <2 | 0 | 1.7 | 1400 | 69 | 65 | 4 | 10 |
| 14 | 63 | 0 | 0.84 | 15 | 11 | 142 | 163 | 6.6 | 4.2 | 32 | AUTO | <2 | 0 | 2.2 | 1500 | 68 | 65 | 6 | 8 |
| 15 | 58 | 0 | 0.81 | 14 | 10 | 138 | 158 | 6.9 | 4.5 | 33 | AUTO | <2 | 0 | 1.9 | 1500 | 66 | 63 | 4 | 7 |
| 16 | 65 | 0 | 0.85 | 15 | 11 | 143 | 165 | 6.8 | 4.3 | 31 | AUTO | <2 | <2 | 2 | 1500 | 69 | 66 | 5 | 2 |
| 17 | 66 | 0 | 0.88 | 15 | 13 | 145 | 165 | 6.6 | 4.3 | 29 | AUTO | <2 | 0 | 2.3 | 1500 | 70 | 72 | 4 | 4 |
| 18 | 68 | 0.1 | 1.2 | 16 | 12 | 132 | 150 | 6.7 | 4.1 | 28 | alar/con | <2 | 4 | 2.2 | 1520 | 75 | 70 | 5 | 4 |
| 19 | 70 | 0.2 | 0.98 | 15 | 13 | 137 | 157 | 6.8 | 4.2 | 30 | alar/con | <2 | 2 | 1.8 | 1550 | 70 | 63 | 3 | 3 |
| 20 | 72 | 0 | 0.88 | 16 | 12 | 140 | 163 | 6.7 | 4.3 | 32 | AUTO | <2 | 0 | 2.1 | 1480 | 67 | 65 | 6 | 4 |
| 21 | 75 | 0 | 0.85 | 15 | 11 | 137 | 164 | 6.9 | 4.4 | 29 | AUTO | <2 | 0 | 1.9 | 1500 | 66 | 66 | 4 | 2 |
| 22 | 78 | 0 | 0.98 | 16 | 22 | 140 | 162 | 6.6 | 4.1 | 34 | AUTO | <2 | <2 | 2.5 | 1500 | 75 | 60 | 6 | 5 |
| 23 | 62 | 1.8 | 1.95 | 17 | 14 | 100 | 140 | 6.6 | 2.8 | 22 | alar/con | 10 | 12 | 2.8 | 1560 | 100 | 120 | 15 | 32 |
| 24 | 55 | 0.2 | 1.75 | 18 | 13 | 90 | 105 | 6.8 | 3.2 | 25 | alar/con | 4 | 4 | 2.2 | 1600 | 72 | 62 | 8 | 20 |
| 25 | 58 | 0.1 | 1.25 | 18 | 12 | 95 | 110 | 6.7 | 3.8 | 28 | alar/con | 2 | 2 | 1.7 | 1550 | 65 | 60 | 5 | 17 |
| 26 | 60 | 0 | 0.92 | 17 | 14 | 115 | 155 | 6.9 | 4.1 | 29 | alar/con | <2 | 0 | 1.9 | 1480 | 60 | 62 | 4 | 12 |
| 27 | 62 | 0.1 | 1.2 | 17 | 11 | 130 | 162 | 6.7 | 4 | 30 | alar/con | <2 | 0 | 2.2 | 1500 | 62 | 65 | 5 | 13 |
| 28 | 65 | 0 | 0.88 | 16 | 10 | 140 | 164 | 6.8 | 4.3 | 30 | AUTO | <2 | <2 | 2.1 | 1500 | 67 | 66 | 4 | 8 |
| 29 | 63 | 0 | 0.87 | 17 | 13 | 140 | 163 | 6.7 | 4.4 | 31 | AUTO | <2 | 0 | 1.9 | 1500 | 67 | 65 | 6 | 5 |
| 30 | 65 | 0.1 | 1.1 | 17 | 10 | 143 | 158 | 6.9 | 4.2 | 29 | AUTO | <2 | 0 | 2 | 1500 | 69 | 63 | 3 | 3 |

# Student Activity #3

## Impact of Activated Sludge Mode Changes

Three plant configurations are shown in the diagram on the following page. Each plant has a total aeration tank volume of 2 million gallons and a total clarifier surface area of 20,000 $ft^2$. Mixed liquor suspended solids concentrations, process flow rates, and aeration zone volumes are shown in the attached diagram. For each of the three configurations, answer the following questions:

1. How many pounds of MLSS are there in the aeration tanks?

   Conventional ________

   Step Feed ________

   Contact Stabilization ________

2. What is the clarifier surface overflow rate?

   Conventional ________

   Step Feed ________

   Contact Stabilization ________

3. What is the clarifier solids loading rate?

   Conventional ________

   Step Feed ________

   Contact Stabilization ________

4. What would the clarifier solids loading rate be if the primary effluent flow increased to 20 mgd?

   Conventional ________

   Step Feed ________

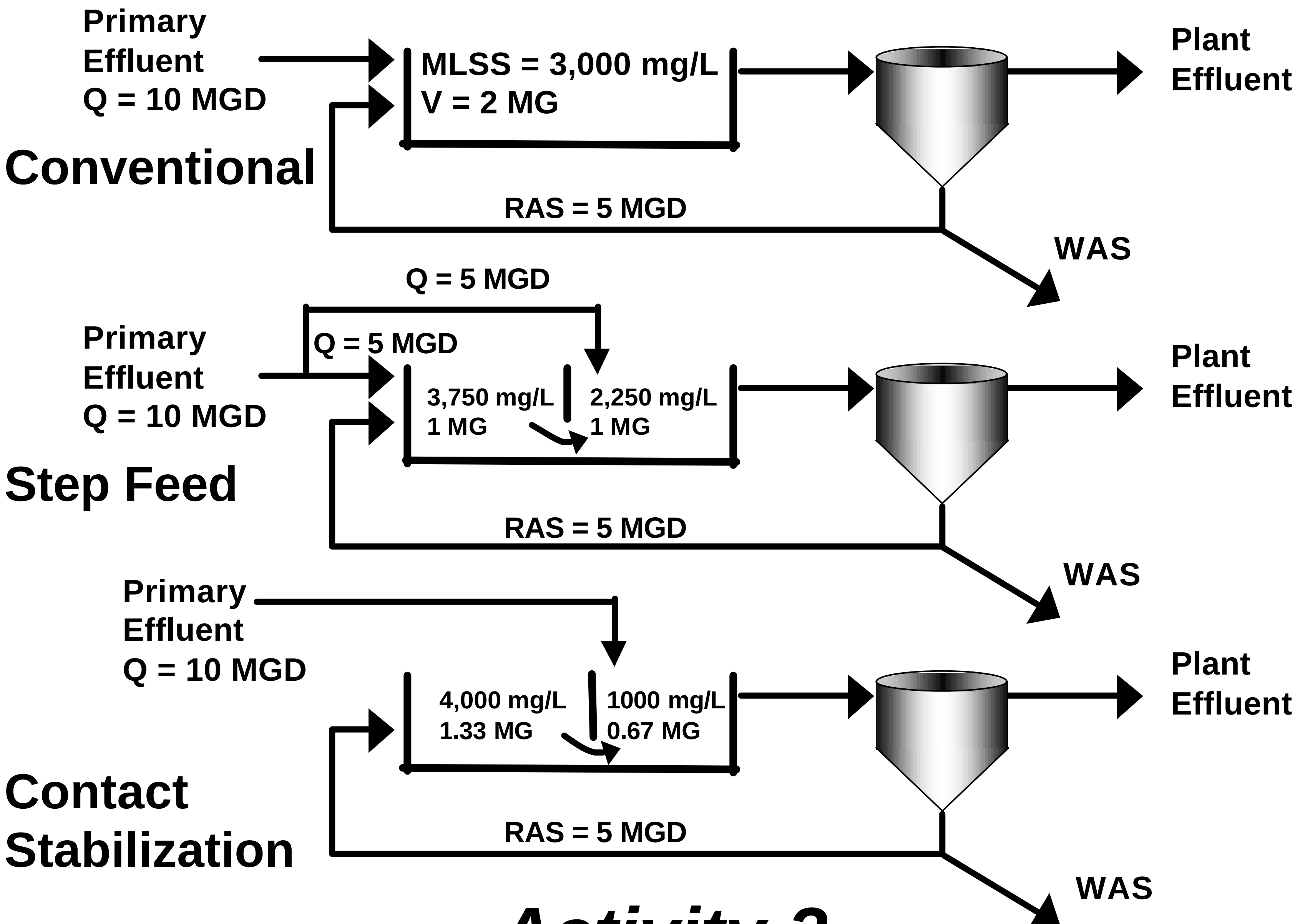
   Contact Stabilization ________

5. At the wet weather flow of 20 mgd, using the allowable solids loading rates on the attached chart, what would be the required SVI in each mode?

   Conventional ________

   Step Feed ________

Contact Stabilization


Primary
Effluent
Q = 10 MGD
MLSS = 3,000 mg/L
V = 2 MG
Plant
Effluent
Conventional
RAS = 5 MGD
WAS
Q = 5 MGD
Primary
Effluent
Q = 10 MGD
Q = 5 MGD
3,750 mg/L
1 MG
2,250 mg/L
1 MG
Plant
Effluent
Step Feed
RAS = 5 MGD
WAS
Primary
Effluent
Q = 10 MGD
4,000 mg/L
1.33 MG
1000 mg/L
0.67 MG
Plant
Effluent
Contact
Stabilization
RAS = 5 MGD
WAS

# *Activity 3*

# Solids Loading Rate
# Circular Clarifier

**Required Input Data**

(1) Clarifier Diameter ($D_c$) ________________ ft

(2) Number of Clarifiers (N) ________________

(3) Flow (Q) *(NOTE - Flow DOES include RAS flow)* ________________ mgd

(4) Mixed Liquor Suspended Solids (MLSS) ________________ mg/l

**Surface Area of One Clarifier**

(5) $A_s = (Pi)(D_c{}^2/4)$

(6) $A_s = (3.14)(\_\_\_\_\_\_^2/4) = \_\_\_\_\_\_ \text{ ft}^2$

Enter from line (1)

**Total Surface Area**

(7) $A_{s\,(TOTAL)} = (N)(A_s)$

(8) $A_{s\,(TOTAL)} = (\_\_\_\_\_\_)(\_\_\_\_\_\_) = \_\_\_\_\_\_ \text{ ft}^2$

Enter from line (2) Enter from line (6)

**Solids Loading**

(9) SL = (Q)(8.34)(MLSS)

(10) SL = (______)(8.34)(______) = ______ lbs / d

Enter from line (3) Enter from line (4)

**Solids Loading Rate**

(11) $SLR = SL / A_{s\,(TOTAL)}$

(12) $SLR = \_\_\_\_\_\_ / \_\_\_\_\_\_ = \_\_\_\_\_\_ \text{ lbs / ft}^2\text{/d}$

Enter from line (10) Enter from line (8)

# Surface Overflow Rate
## Circular Clarifier

**Required Input Data**

(1) Clarifier Diameter ($D_c$) ______________ ft

(2) Number of Clarifiers (N) ______________

(3) Flow (Q) ______________ mgd

*NOTE - Flow does NOT include RAS flow*

**Surface Area of One Clarifier**

(4) $A_s = (Pi)(D_c^2/4)$

(5) $A_s = (3.14)(\_\_\_\_\_\_^2/4) = \_\_\_\_\_\_\ ft^2$

Enter from line (1)

**Total Surface Area**

(6) $A_{s\ (TOTAL)} = (N)(A_s)$

(7) $A_{s\ (TOTAL)} = (\_\_\_\_\_\_)(\_\_\_\_\_\_) = \_\_\_\_\_\_\ ft^2$

Enter from line (2) Enter from line (5)

**Surface Overflow Rate**

(8) $SOR = (Q)(10^6) / A_{s\ (TOTAL)}$

(9) $SOR = (\_\_\_\_\_\_)(10^6) / \_\_\_\_\_\_ = \_\_\_\_\_\_\ gpd / ft^2$

Enter from line (3) Enter from line (7)

Activity 3

| Example Clarifier Solids Loading Guidelines | |
|---|---|
| **SVI mL/g** | **Solids Loading Capacity at Avg. Daily Flow lbs/d/ft$^2$** |
| 75 | 30 |
| 100 | 25 |
| 125 | 22.5 |
| 150 | 20 |
| 175 | 17.5 |
| 200 | 15 |

# Student Activity #4
# <u>Troubleshooting Exercise</u>
Potope WWTP

## General Data

The Potope wastewater treatment facility serves the community of Potope (pop. 7000). The community is residential with only the "normally" associated commercial discharges (gas stations, restaurant, etc.). The plant accepts a limited amount of septage through a separate pretreatment and storage facility. The plant is an oxidation ditch design, with no primary clarifiers preceding secondary treatment. The facility was built in the late 1970's and the solids process was upgraded in the late 1980's. Solids processing consists of aerobic digestion followed by belt filter press dewatering and solids storage for spring land application.

The basic plant design data is:

| | | | |
|---|---|---|---|
| Design Flow: | 0.850 MGD | Preliminary Treatment: | Bar screen<br>Comminutor |
| Peak hourly flow: | 1.8 MGD | Primary Treatment: | None |
| Collection system: | Combined | Secondary Treatment: | Oxidation ditch<br>Circular clarifier |
| Aeration tank volume: (1 used) | 0.750 MG | | |
| Final clarifier volume: (2 used) | 0.250 MG | Tertiary Treatment: | None |
| | | Disinfection: | $Cl_2$ (no dechlorination) |

## Operation Mode

The plant is operated as an extended aeration plant. Normal operation is with one of the two oxidation ditches on line (this has been so since start-up). RAS flow rate is manually adjusted to approximately 75% of influent flow rate. Both secondary clarifiers are on line at all times, but RAS is only drawn from one of them. The solids in the other are collected and wasted to the aerobic digester every other day. The clarifiers are alternated every other day so that any solids not sent to the digester are returned to the aeration tank. This procedure assures high solids concentration in the waste line to the digester.

Effluent quality is always below 5 mg/l for both $BOD_5$ and TSS. The discharge permit limit is 30 mg/L for $BOD_5$ and TSS. During high flow events flows increase very rapidly and at 1.5 MGD an alarm is sent to operators and aeration is stopped (the plant essentially maintains primary treatment with the aeration tank and final clarifiers providing treatment). During these times effluent TSS values are maintained near normal and $BOD_5$ rises slightly, but still remains well within permit requirements. Reaeration takes between twelve and 24 hours to resuspend the contents of the aeration tanks.

## The Problem

During the last two storms the effluent quality has deteriorated significantly. TSS has nearly exceeded permit values and $BOD_5$ has risen significantly. These two recent storms do not appear to be unlike any other storms and there have been no process changes or plant modifications recently.

## Activity #4 (continued)

**Your Task**

Your task is to help the award winning operators from Potope maintain their sterling record of permit compliance. It is now Thursday and there are severe thunderstorms forecast for the weekend. The following questions might help guide you through the problem solving exercise.

1. What is the problem? What caused the TSS and $BOD_5$ to increase during the recent storms?

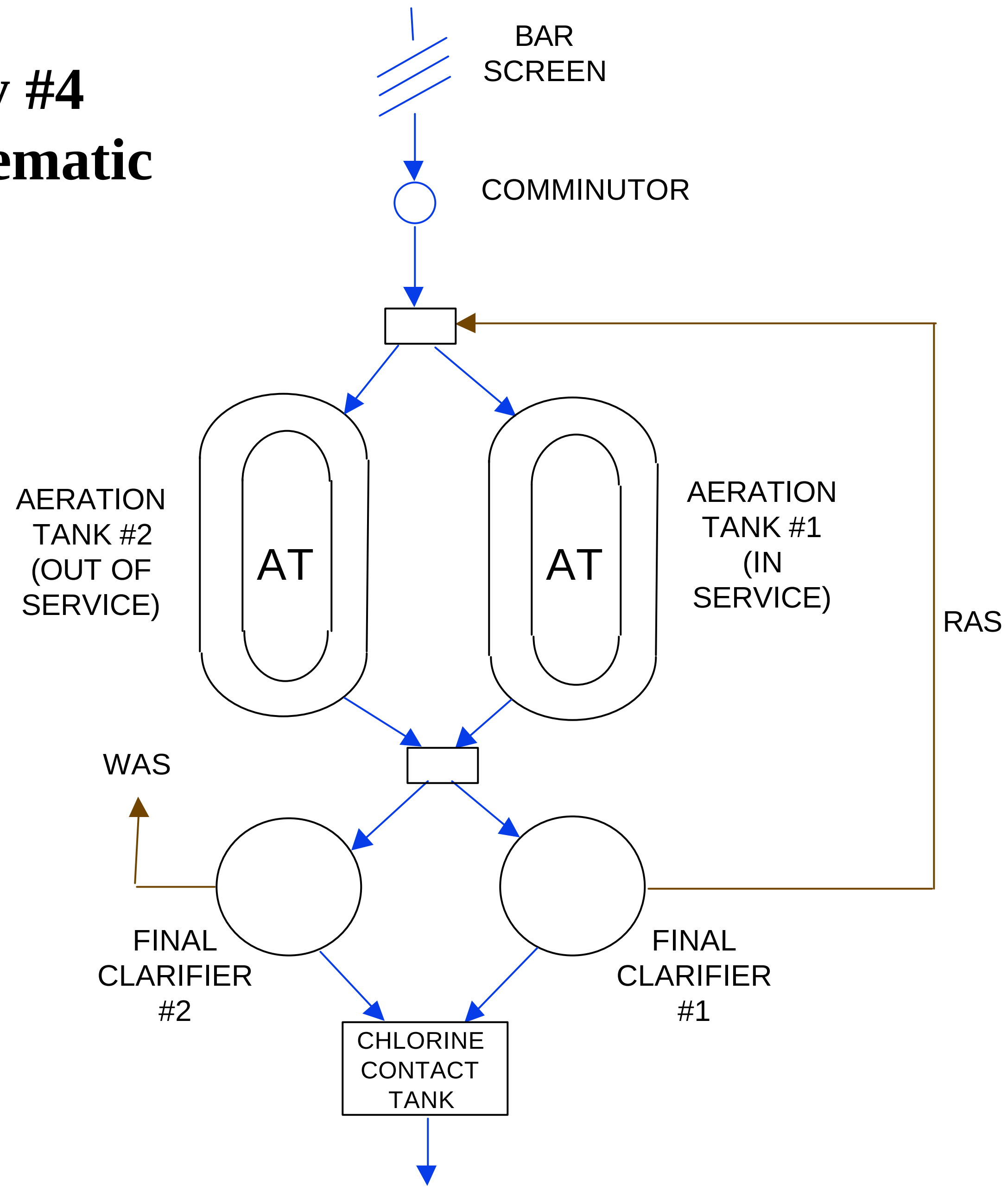
2. What actions could be taken to help reduce the impact this weekend?

3. What are the intermediate solutions to this problem?

4. What additional data needs to be collected?

5. What long-term operational changes do you suggest?

# Activity #4
# Plant Schematic



# Potope WWTP Last Month

| Date | Rainfall | Flow | Influent | | | | Aeration Basin | | Waste | Final Effluent | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Temp | pH | TSS | $BOD_5$ | 30 min sett | MLSS | Sludge | TSS | $BOD_5$ |
| | (inches) | (MGD) | (deg C) | | (mg/L) | (mg/L) | (mL/L) | (mg/L) | (lbs) | (mg/L) | (mg/L) |
| 1 | 0 | 0.79 | 18 | 6.8 | 180 | 220 | 280 | 2700 | 1850 | 3 | 3 |
| 2 | 0 | 0.75 | 19 | 6.5 | 185 | 240 | 290 | 3100 | | 1 | 4 |
| 3 | 0 | 0.78 | 18 | 6.6 | 187 | 230 | 265 | 2650 | 1900 | 2 | 2 |
| 4 | 0 | 0.8 | 20 | 6.7 | 176 | 225 | 270 | 3050 | | 3 | 1 |
| 5 | 0 | 0.77 | 18 | 6.6 | 184 | 234 | 285 | 2610 | 1875 | 4 | 2 |
| 6 | 0 | 0.76 | 19 | 6.8 | 165 | 243 | 295 | 3010 | | 2 | 3 |
| 7 | 0 | 0.78 | 17 | 6.7 | 185 | 235 | 265 | 2590 | 1920 | 1 | 4 |
| 8 | 0.5 | 1.9 | 18 | 6.8 | 105 | 95 | | | | 20 | 35 |
| 9 | 0.3 | 1.6 | 19 | 6.5 | 95 | 110 | | | 1865 | 25 | 40 |
| 10 | 0 | 0.9 | 20 | 6.6 | 165 | 210 | 300 | 2200 | | 3 | 10 |
| 11 | 0 | 0.8 | 17 | 6.7 | 185 | 225 | 320 | 2450 | 1885 | 4 | 5 |
| 12 | 0 | 0.74 | 18 | 6.5 | 145 | 234 | 335 | 3100 | | 5 | 4 |
| 13 | 0.1 | 1.2 | 17 | 6.7 | 120 | 150 | | | 1890 | 3 | 5 |
| 14 | 0 | 0.75 | 19 | 6.5 | 156 | 265 | 345 | 2000 | | 4 | 3 |
| 15 | 0 | 0.72 | 20 | 6.6 | 185 | 253 | 360 | 2440 | 1875 | 5 | 5 |
| 16 | 0.8 | 1.9 | 18 | 6.8 | 120 | 92 | | | | 24 | 40 |
| 17 | 0.3 | 1.7 | 18 | 6.5 | 93 | 85 | | | 1880 | 26 | 45 |
| 18 | 0.1 | 1.5 | 20 | 6.6 | 130 | 98 | 395 | 2100 | | 15 | 20 |
| 19 | 0 | 1 | 18 | 6.8 | 165 | | 400 | 2420 | 1890 | 10 | |
| 20 | 0 | 0.8 | 19 | 6.7 | 184 | | 390 | 2950 | | 12 | |
| 21 | 0 | 0.75 | 18 | 6.5 | 176 | | 410 | 2350 | 1874 | 15 | |
| 22 | 0 | 0.78 | 20 | 6.8 | 165 | | 420 | 2850 | | 14 | |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 26 | | | | | | | | | | | |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 31 | | | | | | | | | | | |

**STUDENT ACTIVITY #5**

WET WEATHER OPERATING STRATEGIES
FOR WASTEWATER TREATMENT FACILITIES

Instructions: Complete the following chart for your facility. In the “application at my plant” column, describe the implications for application of this strategy at your facility. Include necessary purchases and changes in operating procedures. If a strategy will not work, explain why. Also try to develop other strategies not listed below that may be applicable to your plant. You may only mark Not Applicable (NA) for those processes which you do not have in your facility.

| Process | Strategy | Application at My Plant |
|---|---|---|
| General | 1. Assure that unused tankage and equipment are available and ready for use when high flows occur.<br>2. Controlled bypassing of secondary treatment process.<br>3. Develop sampling and testing regimes to identify the flow rate at which process upsets will occur.<br>4. Low cost piping additions which increase plant flexibility.<br>5. Reduce recycle flows (digester supernatant, filtrate, etc.) during wet weather events.<br>6.<br>7. | 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7. |
| | | |

| Process | Strategy | Application at My Plant |
| --- | --- | --- |
| Collection System | 1. Implement regular program for inspecting and cleaning sewers, manholes and catch basins.<br>2. Adjust weir heights/regulator settings at combined sewer overflow points to maximize system storage.<br>3. Throttle plant influent gate to increase storage in collection system.<br>4. Implement regular program to reduce I/I which may include TVing, testing and sealing.<br>5. Remove unnecessary storm sewer connections.<br>6. Install simple regulation devices (vortex-type throttling devices, surface retention, manhole cover inserts) to reduce rate of inflow into system.<br>7.<br>8. | 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8. |

| Process | Strategy | Application at My Plant |
| --- | --- | --- |
| Pump Stations | 1. Modify pump control system to maximize wet well storage.<br>2. Modify pump control system to dampen flow surges to treatment processes.<br>3. Bring stand-by pumps on line.<br>4.<br>5. | 1.<br>2.<br>3.<br>4.<br>5. |
| Screening | 1. Place all screening units in service.<br>2. Increase cleaning frequency (or run mechanical screens continuously)<br>3.<br>4. | 1.<br>2.<br>3.<br>4. |

| Process | Strategy | Application at My Plant |
| --- | --- | --- |
| Grit Removal | 1. Place all grit removal units in service.<br>2. Shut off or reduce air to aerated grit chambers.<br>3. Increase grit removal rate or frequency (e.g. run grit collector continuously).<br>4. Adjust velocity of velocity controlled grit chambers.<br>5. Utilize alternative grit removal systems.<br>6.<br>7. | 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7. |

| Process | Strategy | Application at My Plant |
|---|---|---|
| Primary Settling | 1. Maintain low sludge blanket levels/increase sludge pumping rate or frequency. | 1. |
| | 2. Improve flow splitting to settling tanks. | 2. |
| | 3. Improve tank hydraulics through baffle addition. | 3. |
| | 4. Improve tank hydraulics through weir modifications. | 4. |
| | 5. Chemical addition and flocculent aids to maximize solids removal. | 5. |
| | 6. Increase scum removal rate or frequency. | 6. |
| | 7. Monitor primary sludge concentration more often, especially during early flow. | 7. |
| | 8. | 8. |
| | 9. | 9. |

| Process | Strategy | Application at My Plant |
|---|---|---|
| Activated Sludge | 1. Turn off aeration.<br>2. Turn down aeration.<br>3. Cycle aeration.<br>4. Operate in step feed mode to save biomass in aeration basin.<br>5. Operate in contact stabilization mode to save biomass in aeration basin.<br>6. Reduce return sludge pumping rate.<br>7. Increase return sludge pumping rate.<br>8. Maintain low MLSS (don't use your aeration/clarifier system for storage of excess solids).<br>9. Decrease wasting rates to save biomass. Store biomass in extra tankage until flow decreases.<br>10. Control filamentous growth problems to improve sludge settleability.<br>11.<br>12. | 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.<br>9.<br>10.<br>11.<br>12. |
| | | |

| Process | Strategy | Application at My Plant |
| --- | --- | --- |
| Trickling Filters | 1. Adjust distributor arm speed.<br>2. Reduce or stop filter recycle or recirculation flows.<br>3. Place trickling filters in parallel operation.<br>4.<br>5. | 1.<br>2.<br>3.<br>4.<br>5. |
| Secondary Settling | 1. Maintain low sludge blanket levels.<br>2. Improve flow splitting to settling tanks.<br>3. Improve tank hydraulics through baffle addition.<br>4. Improve tank hydraulics through weir modifications.<br>5. Chemical addition and flocculent aids to maximize solids removal.<br>6. Dye test clarifiers.<br>7.<br>8. | 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8. |
| | | |

| Process | Strategy | Application at My Plant |
|---|---|---|
| Sand Filtration | 1. Place all filter units in service.<br>2. Adjust backwash mode.<br>3. Backwash before storm surge hits.<br>4.<br>5. | 1.<br>2.<br>3.<br>4.<br>5. |
| Disinfection | 1. Increase chlorination rates to handle increased chlorine demand from solids losses from clarifiers.<br>2. Clean solids from contact tank periodically.<br>3. Place all units in service.<br>4. Clean UV equipment prior to storm surge.<br>.<br>. | 1.<br>2.<br>3.<br>4.<br>5.<br>6. |

| Process | Strategy | Application at My Plant |
| --- | --- | --- |
| Solids Processing | 1. Assure maximum available solids storage capacity prior to wet weather season<br>2. Assure all solids processing equipment is in operating condition prior to wet weather conditions<br>3. Consider alternative solids disposal during wet weather events<br>4. Reduce solids volume in digesters prior to wet weather events<br>5.<br>6. | 1.<br>2.<br>3.<br>4.<br>5.<br>6. |

# Student Activity #6
## Development Worksheets for Wet Weather Operating Plan

Select one major unit process area for your plant to use for development of a wet weather operating plan. Using the attached worksheets, develop the pertinent data for the selected process for use in your wet weather operating plan.

## BEFORE WET WEATHER EVENT

**Plant Area: ________________________________________________** **Sheet ID: _____________**

**Unit Process/Equipment: ___________________________________** **Date: ________________**

**A.** We have decided that we need to get ready for a wet weather event.
**What do we do before the flow starts to climb?**

1. What operating adjustments do we make?

2. What do we look at, what do we observe?

3. What do we measure, what do we record?

4. What maintenance do we perform?

5. Anything else?

## DURING WET WEATHER EVENT

**Plant Area:________________________________________________** **Sheet ID: _____________**

**Unit Process/Equipment: ___________________________________** **Date: __________**

**B.** The flow has just started to increase at this unit. **What do we do as the flow climbs, reaches it's peak and begins coming back down?**

1. What operating adjustments do we make?

2. What do we look at, what do we observe?

3. What do we measure, what do we record?

4. What maintenance do we perform?

5. Anything else?

## AFTER WET WEATHER EVENT

**Plant Area: _____________________________________________** **Sheet ID: _____________**

**Unit Process/Equipment: ________________________________** **Date: ________________**

**C.** The flow continues to drop and approaches normal. **What do we do to return this to normal service?**

1. What operating adjustments do we make?

2. What do we look at, what do we observe?

3. What do we measure, what do we record?

4. What maintenance do we perform?

5. Anything else?

# Student Activity #7
## <u>Wet Weather Operating Plan Preparation</u>

Using the information developed in Activity 6, develop a section of your wet weather operating plan.  Fill in the plan information on the attached form.

## SECTION__ - ________________

## ___ Unit Processes and Equipment List

| UNIT PROCESS | EQUIPMENT |
|---|---|
| | |

## ___ Wet Weather O&M Practices

| WHO DOES IT? | | |
|---|---|---|
| SUPERVISORY | IMPLEMENTATION | WHAT DO WE DO? |
| ***Before Wet Weather Event*** | | |
| | | |
| | | |

| WHO DOES IT? | | |
|---|---|---|
| **SUPERVISORY** | **IMPLEMENTATION** | **WHAT DO WE DO?** |
| | | |
| ***During Wet Weather Event*** | | |
| | | |
| | | |
| | | |
| | | |

| WHO DOES IT? | | |
| --- | --- | --- |
| **SUPERVISORY** | **IMPLEMENTATION** | **WHAT DO WE DO?** |
| | | |
| ***After Wet Weather Event*** | | |
| | | |
| | | |
| | | |
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| WHO DOES IT? | | WHAT DO WE DO? |
|---|---|---|
| SUPERVISORY | IMPLEMENTATION | |
| | | |

| WHY DO WE DO THIS? |
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| WHAT TRIGGERS THE CHANGE? |
| |
| WHAT CAN GO WRONG? |
| |

**SECTION __** (Continued):