EXHIBIT BB

High Flow – Wet Weather Management SOP
Springfield Regional Wastewater Treatment Facility
August 2016

Introduction

Why are we concerned about wet weather flows?

- Impacts on Combined Sewer Overflows (CSO's)
- Decreased performance of unit processes
- Long term impacts on process performances
- Impacts on discharge permit requirements

The best tool for dealing with these impacts is a written High Flow – Wet Weather Management plan.

A high flow – wet weather management plan is a way to:

- Develop a strategy for dealing with wet weather events.
- Meet EPA and state regulatory requirements to maximize wet weather flows from combined sewer systems to the treatment facility.
- Identify ways in which you can improve wet weather performance of various plant operations.

In Springfield, high flows to the treatment facility means accepting flow at a rate of 185 million gallons per day through the primary treatment process and a rate of 134 million gallons per day through the secondary treatment process. Higher flow rates – up to 185 million gallons per day – may be accepted through the secondary treatment process if the solids loading rate is such that the state point analysis graph indicates that the secondary clarifies can accept it. These rates mean that we may exceed the design flow of 67 million gallons per day. The goal of the High Flow – Wet Weather Management Plan is to have procedures so as to operate unit processes to treat maximum flows while not appreciably diminishing effluent quality or destabilizing treatment upon return to dry weather operation.

Impacts of High Flow

Collection System

>> Surcharge of the collection system
>> Debris (bottles, bags, grit, leaves) plug lines and / or interfere with regulators
>> Increase infiltration and / or inflow into the collection system

>> Catch basins fill with debris and plug up

>> Increased odor problems

>> Staffing the York Street Pump Station and running the diesel pumps

Preliminary Treatment - Screens

>> Increase screenings to handle and dispose of

>> Blinding of the bars and flow backups

>> More frequent breakdowns

>> Broken shear pins on mechanical devices

>> Large debris caught in bars washed down from the collection system

Dewatering

>> More primary sludge

>> Better performance initially due to primary sludge

>> Poorer performance after storm due to grit and grease

>> Chemical dosage changes more frequently due to inconsistent sludge quality and concentration

Disinfection

>> Increased demand due to solids carry over in effluent

>> Solids accumulation in the chlorine contact tank

>> Reduced contact time

Grit Removal

>> Increased grit to handle and dispose of

>> Grit carries through grit removal system and impacts downstream processes

>> Grit causes pump plugging

>> Grit plugs channels and pipes

>> Grit in primary sludge

Primary Treatment

>> Solids carryover to downstream processes

>> Increase primary sludge due to “first flush”

>> Primary settling tank hydraulic overload

>> Shorter detention times in primary settling tank

>> Bridge problems

>> Scum collectors and pumps plug with debris

>> Primary sludge pumps run more

Pump Stations

>> Increase in pump rates, pumps run longer

>> Flow exceeds pump station capacity and surcharge sewer system

>> Pump station flooding

>> Pump station bypasses

>> Increase in electrical costs / energy use

>> Power failure due to lightning storms

>> Hydraulic overloads cause pump failures

>> Grit / debris accumulate in wet wells

Secondary Treatment – Aeration Basins

>> Loss of biomass / (MLSS) from system

>> Aeration tank detention time reduced

>> Increased solids and BOD loading from primary tanks (first flush)

>> Increased hydraulic loading

Secondary Treatment - Secondary Clarifiers

>> High sludge blanket in secondary clarifiers

>> Solids washout due to high flows

>> Decease in hydraulic detention time in secondary clarifier

>> Difficult to balance flows to multiple clarifiers

>> Flooding of weirs

>> Increase solids loading to secondary clarifiers

Solids Handling - Thickening

>> Increase sludge volume

>> Plugged sludge pumps from grit and debris

>> Excessive grit accumulation in the thickener

>> More grit in sludge, lower volatile suspended solids

>> Thickener efficiency decreases

>> Sludge is more difficult to pump

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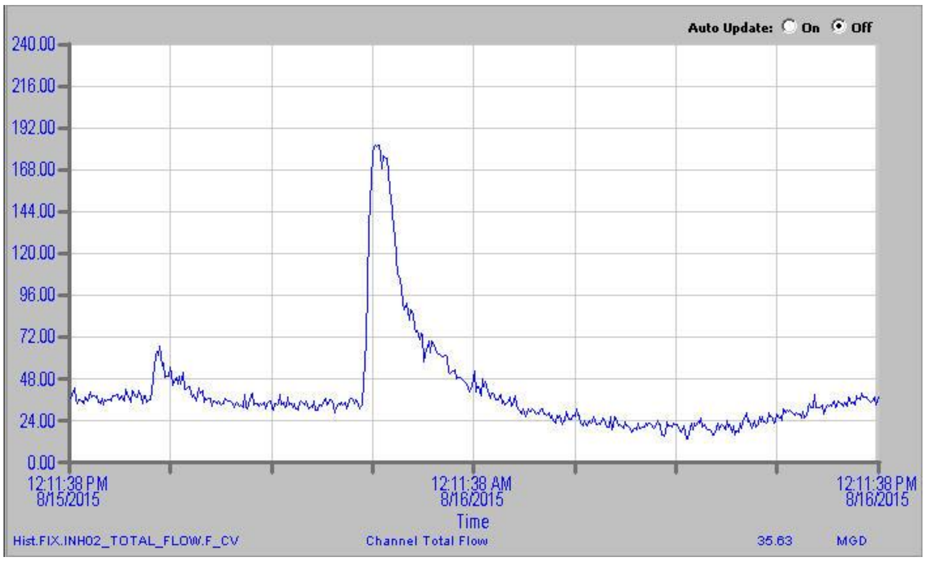
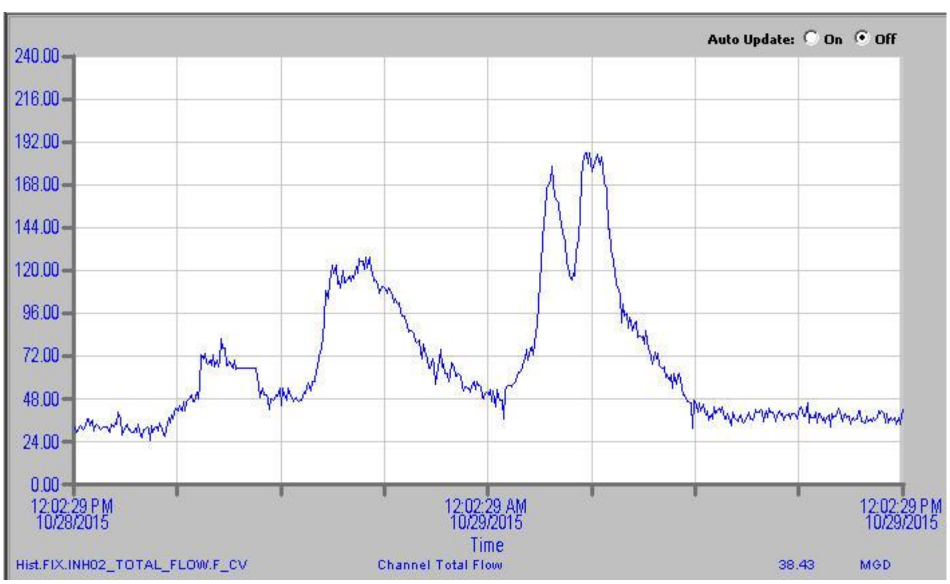
Characterization of High Flows

Average flow to the treatment facility for 2014 was 40.031 mgd. The low flow was 29.51 mgd and the high flow was 94.88mgd. The 15 minute average flow exceeded the rate of 100 mgd on 38 occasions. High flows may initially have increased TSS and BOD as the roads and sewer system receive the "first flush" and then decreased TSS and BOD as rainwater dilutes the sewage. The rate of increase can be quite steep. Flow may increase from a rate of 40 mgd to 180 mgd in as little as 15 minutes. Other rain events produce a much more gradual rise in flow. The graph below shows the flow increase for August 15, 2015.



This wet weather event was a quick thunderstorm moving through the area. In other rain event the rate of increase of flow is much slower and sustained. The graph below shows the flow increase for October 28 and 29, 2015.



Critical Components

York St Pump Station

The York St Pump Station (YSPS) consists of 3 electric automatically controlled wastewater pumps and 2 manually operated flood control pumps. In high flow events (events where the flow into the YSPS will exceed the capacity of the electric pumps and result in wet well levels in excess of 90 inches) one diesel pump will be started and run along with the 3 electric pumps. The YSPS instructions are included at the end of this SOP.

In maximizing flow to the treatment facility the critical components can be broken into two categories. One is the ability to accept the flow and the second is the ability to treat the flow.

Accepting Flow

Influent gates – There are four influent gates. The minimum number needed is 3 in operation
Bar Racks – There are for bar racks. The minimum number needed is 4 in operation.
Rack Room Conveyors – Number 1 conveyor must be in operation. Each classifier in operation must have two conveyors available. The portable conveyor – number 7 – must also be available. Conveyors should be switched to fast before high flow events.
Cyclones and Classifiers – There are 2 classifiers and 4 cyclones. There must be a minimum of two classifiers and 3 cyclones available.
SCADA – Automatic control of the influent gates and bar racks must be available.
Primary Basins – There are four primary basins. A minimum of three must be available.
Secondary Bypass Gate – Must be available.
Aeration Basins – Must be enough gates open to accept flow without the influent channel backing up.
Clarifiers – Must be enough floc gates open so that flow does not back up over the aeration basin weirs.

Treating Flow

Grit and rag containers – containers should be low or empty and ready to accept excess grit and rags
Primary thickeners - two TPS pumps must be available to process excess sludge
Mixed sludge storage tanks – adequate room must be available to accept excess sludge
Secondary bypass gate – Flows above 134 mgd should be bypassed around the secondary treatment system if the clarifiers were to lose solids

Aeration basins – Modify mode of operation from plug feed to contact stabilization to bank solids at the influent end of the aeration basin if necessary

Bridges and flocs – bridges can be left on and flocs are normally off

Chlorination – Additional manual chlorination using number 3 chlorinator in addition to number 4 chlorinator running in automatic may be necessary. The maximum chlorination rate is 3000 lbs/day.

Primary Basins

High flows are defined as flows at a rate of greater than 70 mgd. At 70 mgd the bar racks are programmed to switch from differential level control to hand. Normally two channels are in operation. As the level at the influent structure increases a third and fourth channel will come online. Once four channels are in operation the influent gates will modulate to maintain a flow not in excess of 185 mgd. All flows above 134 mgd may bypass the secondary system by manually opening the secondary bypass. This is only done to prevent blanket washout and is the sole decision of the Senior Operator. Three primary basins are normally receiving full flow. During severe wet weather events the bridges may be re-programmed from SCADA to only scrape the influent end of the basin to keep up with excess grit loads.

Secondary Treatment

The secondary treatment system was designed as a conventional activated sludge system. A typical MLSS concentration for conventional activated sludge is 1500 – 2500 mg/L. The facility tries to run at an aerobic SRT of 19 days. The 19 day SRT is long enough to fully nitrify throughout the year but not overload the clarifiers during high flow periods. In general the clarifier can handle solids loading rates of 35 – 40 lbs/sq ft/day.

The calculation for solids loading on a clarifier in plug flow mode is:

$$((Q(Inf) + Q(RAS)) * MLSS(X)) * 8.34$$

The calculation for return solids loading to the aeration basin is:

$$Q(RAS) * RAS(X) * 8.34$$

When the secondary system is in plug flow mode the MLSS concentration is consistent throughout the aeration basin. The loading on the clarifier changes as the influent flow changes. Below is a chart of a typical daily flow.

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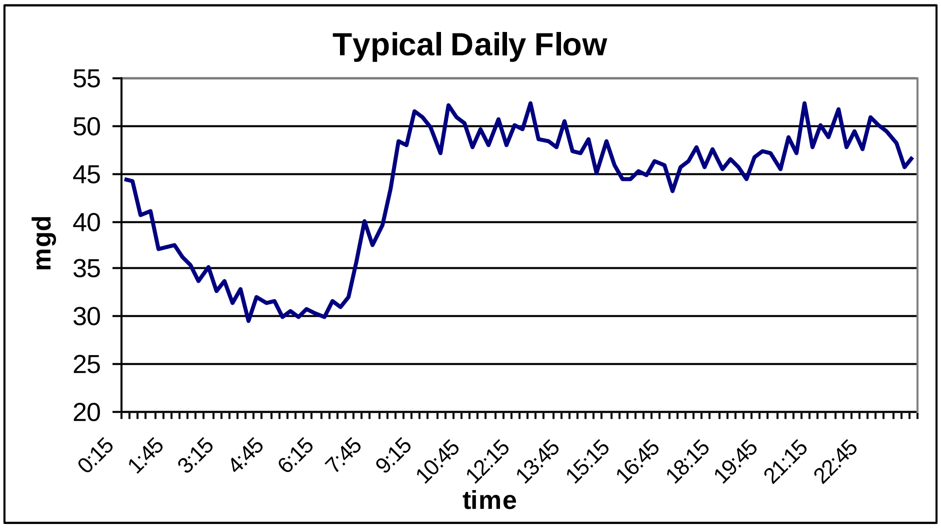


You can see that the flow is at its lowest during third shift and highest during first and second shift. The difference between the lowest flow and the highest flow is almost double so the solids loading on the clarifier can vary greatly throughout the day.

The solids loading on the clarifier is in contrast to the RAS solids loading to the aeration basin. The only difference in the return rate is the very slight difference in the elevation of the clarifier surface. Since this difference is very small, assume that the RAS solids loading to the aeration basin is constant throughout the day.

What you end up with are times of the day where solids loading on the clarifier is greater than at other times of the day. You may see small blankets during the day and less than 1 foot at night. The process control plan is maintain minimum blankets in the clarifiers. Blankets should, on average, never exceed 3 ft. Our SRT19 process control strategy should result in blankets less than 3 feet. In general solids should be in the aeration basin and not in the clarifier. Solids can be transferred from the clarifier to the aeration basin by increasing the RAS return rate prior to storm events or switching to modified step feed or step feed before a rain event.

Below are three flow schematics for operation of the secondary treatment. The first schematic, plug flow, is used for normal to moderate flows. Step feed and modified step feed are used for high flow events. The best way to determine the mode of operation is to use the state point calculator.

A sludge that settles quickly and compacts in the clarifier so that it can be efficiently transferred back to the aeration basin is what makes the whole process work. In Springfield good quality typically means a Sludge Volume Index of 80 to 100. Poor settling and compacting sludge is going to result in a reduced concentration of the RAS and that is going to turn our balances during high flows upside down.

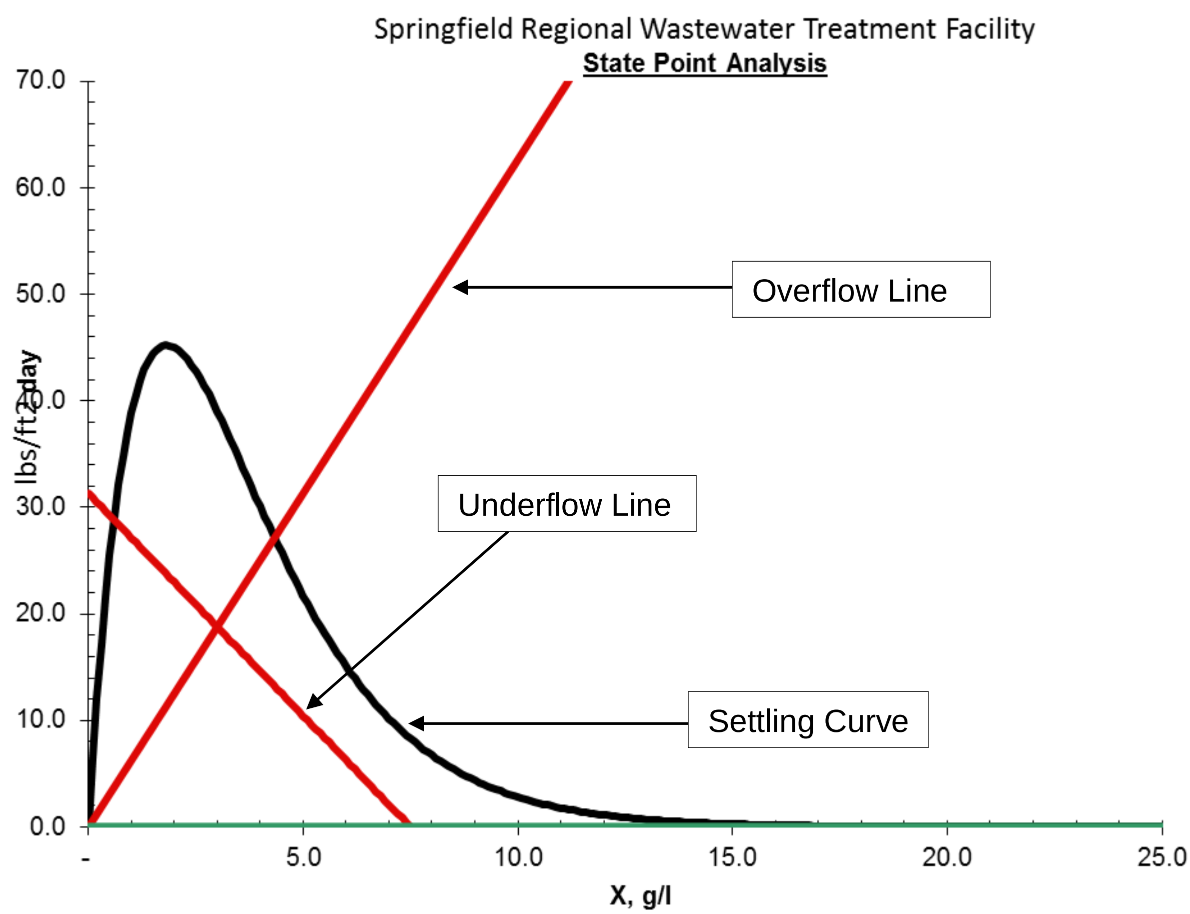
A good tool that takes sludge quality into account is state point analysis. State point analysis is:

- A Graphical representation of clarifier performance.
- Three lines on graph – underflow, overflow, and settling
- Underflow Line – rate of solids leaving clarifier as underflow (RAS)
- Overflow Line – flow through clarifier (Effluent)
- Settling Curve – rate of sludge settling in a clarifier

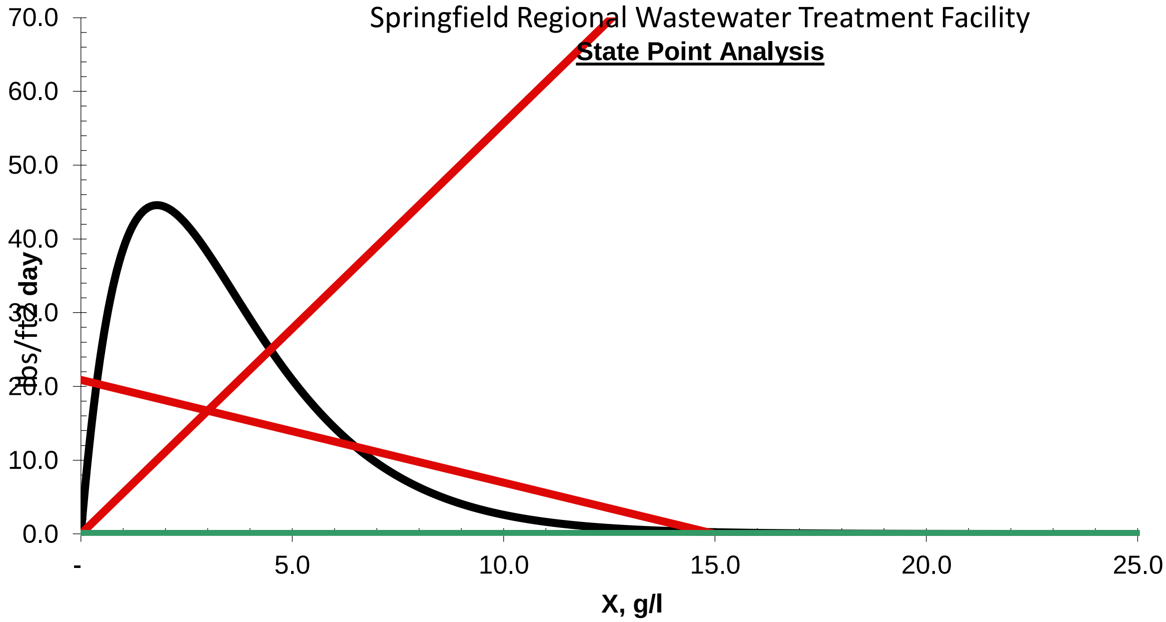
It's very useful for:

- Understanding the movement of solids between the aeration basin and clarifier in the activated sludge process
- For making tactical process control decisions
- Optimizing the activated sludge process
- A great training tool for Operators

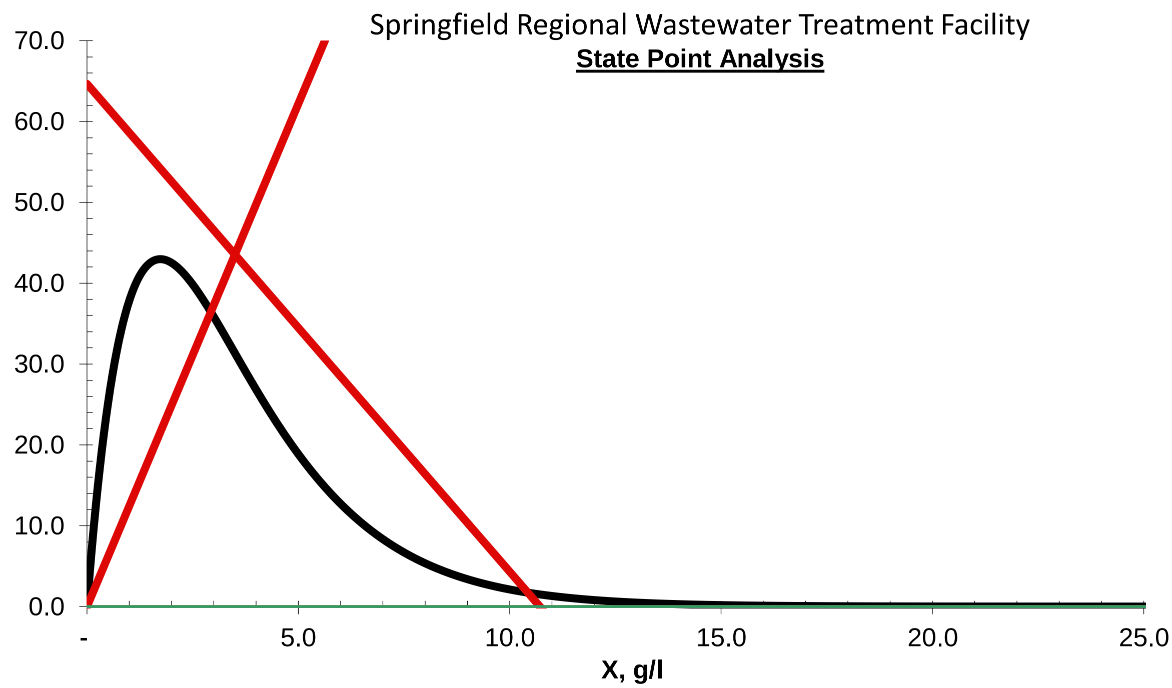
This graph is available for all to use in the "Operations" directory of the "S:\" drive.



The intersection of the two lines – the state point – should always be below the curve. The size of the curve will increase or decrease depending on the sludge quality which you typically see each day as the SVI. The underflow line should also be below the curve. As the underflow line exceeds the curve, this indicates that the blanket will build in the clarifier. The graph above shows a good equilibrium of the movement of solids between the aeration basin and the clarifier.



This graph shows thickening failure. The underflow line is over the curve. Increase your return rate to reach equilibrium!



This graph shows total clarifier failure. You are definitely losing solids at this point.

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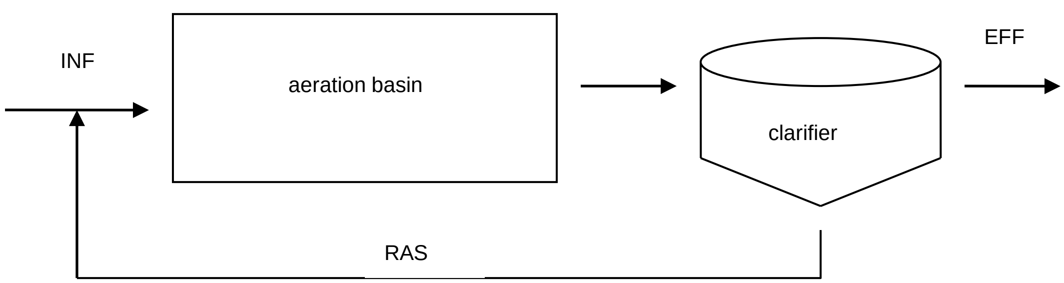
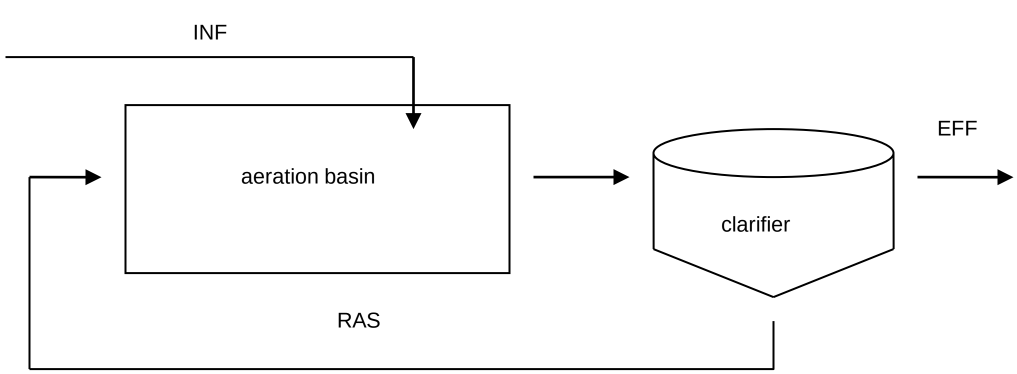
Use the SPA calculator to plug in facility data – flow, SVI, return rate, and clarifiers online to determine a performance expectation before a rain event and to help you plan your actions. In general, with good sludge quality, the clarifier should be able to accept loads of 35-40 lbs per sq ft per day before losing solids.

Flows of up to 134 mgd should be able to go through secondary in the plug flow mode or occasionally the step flow mode if the settling is poor. Flows from 134 to 185 mgd must use the modified step feed mode. This is to assure there are enough aeration influent gates open to accept the flow. **The minimum number of aeration influent gates to accept flows of ~185 mgd is 8. The minimum number of floc gates to accept flow to the clarifiers is 11.** The modified step feed mode will also store some solids at the influent end of the aeration basin.

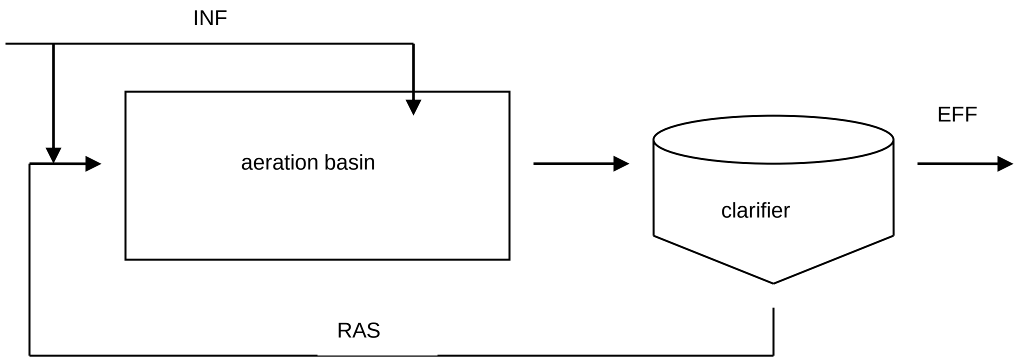
Step feed mode should only be used when the sludge quality is poor, the SRT significantly exceeds 19 days and the state point calculator indicates it is necessary to avoid solids loss. Only flow up to 134 mgd can be accepted though the secondary system in step feed mode. This mode of operation will store the maximum amount of solids at the influent end of the aeration basin and lower loading to the clarifier. When switching from the plug flow mode to step feed mode you reduce solids loading on the clarifier. The concentration of solids in the aeration basin will be high at the influent and low at the effluent end. The difference in concentration will be exaggerated as the flow increases.



Plug Flow Mode



Step Feed Mode



Modified Step Feed Mode

The state point calculator is doing this calculation for you but you should be aware of its importance.

((Q(Inf) + Q(RAS)) *(X)MLSS) **MUST EQUAL** (Q(RAS) * (X)RAS)

You must maintain or exceed this equalibrium. If ((Q(Inf) + Q(RAS)) *(X)MLSS) is greater than (Q(RAS) * (X)RAS) solids will build in the clarifier, blanket will increase and eventually result in losing excessive solids in the effluent.

Let's do some math with typical flows

30 + 27 *2300 * 8.34 = **1,093,300** 27 *4900 *8.34 = **1,103,382**

((Q(Inf) + Q(RAS)) *(X)MLSS) **MUST EQUAL** (Q(RAS) * (X)RAS)

And with high flows

185 + 65 *2050 * 8.34 = **4,274,250** 65 *7,900 *8.34 = **4,282,590**

((Q(Inf) + Q(RAS)) *(X)MLSS) **MUST EQUAL** (Q(RAS) * (X)RAS)

The high flow claculation assumes that there will be some transfer of solids from the aeration basin to the clarifier, thickening the RAS until an equalibrium is met. This is another reason to run with minimum blankets in the clarifier. With low blankets there will be buffer space in the clarifiers to accomidate the increase in blanket levels. It is not uncommon when the secondary system accepts flows of 185 mgd to see the blankets rise to 5-6 feet. The sidewall depth of the secondary clarifier is

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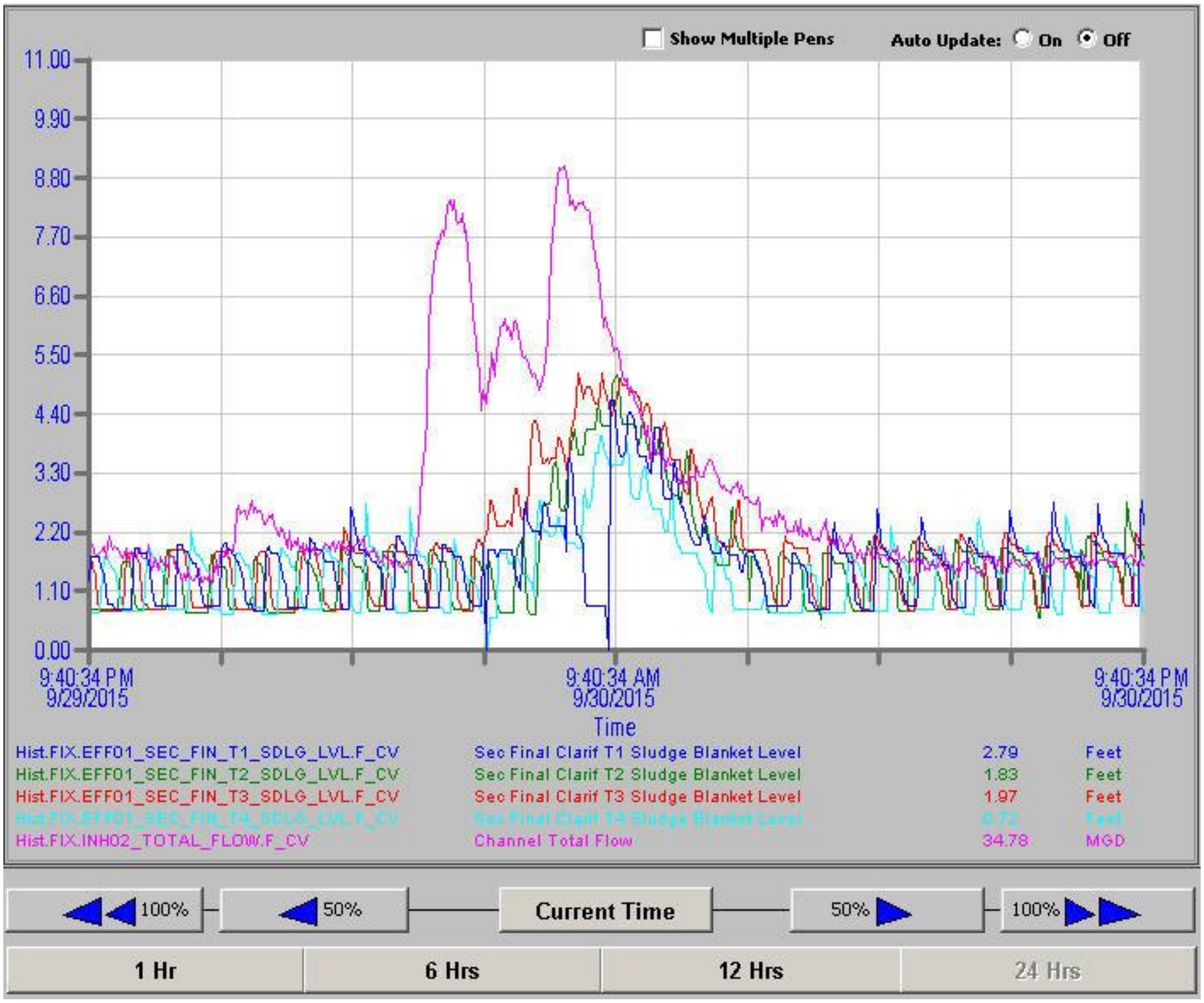
11 feet. Below is a graph of the flow and blanket levels during a wet weather event on September 30, 2015.



During this event the secondary system was in modified step feed and accepted flows as high as 192 mgd.

The Senior Operator must assess the weather and process conditions in selecting the mode of operation that maximizes effluent quality.

It's important to record the times we go into and out of modes of operation and increase RAS rates. We can then look back at our actions and critique our performance and make changes accordingly.

Lastly:

Do not try to out guess the weather. If there is the possibility of heavy rain, switch modes. If it does not rain, no harm is done. If it does rain and no changes are made, it will negatively affect the effluent quality.

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2017 Goal – Eliminate secondary bypasses

With significant rain approaching:

1. **Start #4 RAS screw if it is off**
2. **Increase the return rate to maximum**
3. **Switch to the modified step feed mode – 8 aeration basin influent gates open**
4. **Make sure a minimum of 11 floc gates are open**
5. **Leave secondary bridges running**
6. **Monitor blankets closely**

If blankets average above 7 feet – shut off bridges

If blankets average above 9 feet - open secondary bypass

Please note that the modified step feed mode will accept all flow without having to worry about overflowing the secondary influent channel.

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York Street Flood Pumping Station
Operating Instructions

A The York Street Pump Station is a combination sanitary and flood pumping station.

Three electrically operated pumps work automatically with level controls that monitor the wet well water elevation. The suction and discharge valves are always in the open position.

Two diesel operated pumps work manually. There is no communication or control between the two systems. The diesel pumps assist the three automatic electric pumps in maximizing flow to the treatment facility.

The York St Pump Station (YSPS) will be manned by the on call operator during high flow events prior to the wet well reaching 90 inches. The Senior Operator will look at radar and weather reports in making the determination on staffing.

If the three electrical pumps are running at 100% and the wet well level exceeds 90 inches then one of the diesel pumps will be started. The second diesel pump will be used if the first pump fails.

B Start diesel pump motor no. 2 or 3

Black clutch lever must be disengaged before starting motors. Push the lever south to disengage.

Open the 1”water valve for cooling the engines. The valve is located on the east side of the motor.

Open the ½” fuel gate valve located on the west side of the motor.

Prime the fuel valve until solid resistance is felt on the fuel lever handle. The handle is located on the west side of the engine.

Check the water level in overhead water tank, The tank is located in north east corner of pump room. (tank needs to be full of water) It has a float for automatically refilling the tank.

Check motor oil level. Use dip stick located on the east side of the engine.

Check oil in transfer case gearbox. Use dip stick located on the west side of the gearbox.

Check oil in the right angle gearbox, oil level needs to show in the ¾” pipe elbow located on the west end of the gearbox.

Hold up the orange throttle linkage on the front of the motor while pushing in BLACK starter button.

When motor starts SLOWLY let down the throttle linkage to an idle.
Motor will stay running about 500 rpm.

Check motor oil pressure gage, minimum of 30-40 lbs.

Water temperature will rise as motor warms up. Operating temperature. 170 degrees. Max 200 degrees

C Controlling the bar screen rakes

The rakes are controlled automatically by the level controls that monitor the water elevation in the wet well. They will speed up and down depending on the water level on both sides of the bar screens.

The rakes can also be operated manually. The main control panel switches for the bar screen rakes are located on the east wall in the pump room.

To run the rakes manually open the control panel door and switch both rakes to manual.

The manual controls to operate the rakes are located in the bar screen room on the west wall. The red emergency switch must be pulled out to start the rakes. Push the start button and the rakes will start turning. Push the stop button and the rakes will stop.

D Turn the main water valve on for the distribution cabinet. The valve is located in the back of the water distribution cabinet on the south wall in the pump room.

E Open the ¾"casing water valve for pump no.3. The Valve is located in the pump room basement on the lower level.

F Increase the motor speed to 1000 rpm. Turn the throttle screw next to the black starter button (counter clockwise to increase the rpm.)

G Open the suction valve lever for the pump. The lever is located on the water Distribution cabinet located on the south wall. Check and make sure the valve is open. The valve is located in the basement in front of the pump. The cylinder center shaft should be in the up position.

H Engage the black pump clutch lever slowly to the north.

I Open the discharge valve lever for the pump. The lever is located on the water distribution cabinet located on the south wall. Check and make sure that the valve is open. The valve is located in the basement on the discharge side of the pump. The center cylinder shaft should be in the up position.

J Increase the motor speed to 2000 rpm.

K The pump is now in operation.

L Starting pump no. 2 is the same procedure as pump no. 3
Follow items B,D,E,F,G,H,I,& J

M After the pump is running check the rubbish containers in the back of the bar racks. Empty as necessary.

N Monitor the wet well level with the 3 electric pumps and 1 diesel pump in operation. When the wet well level drops below 70 inches the operator can idle the diesel pump to see if the 3 electric pumps can handle the flow. If the flow rises above 90 inches the diesel pump must be re-engaged. The operator should consult with the Senior Operator concerning weather conditions, flow to the treatment facility, emptying the rag containers and discontinuing the use of the diesel pumps.

O Fill out the diesel log book every half hour when the station is being manned due to a high flow event.

P Call the senior operator when in full operation and when you have completed your shift or when any problem occurs. 413-537-6429 or DC 174*2059*6