BOD Slug Load: Affect on Wastewater Treatment

OTCO Pretreatment Workshop

May 13, 2014

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MONTGOMERY COUNTY

ENVIRONMENTAL SERVICES

Overview

- Effects of increased influent loadings to a WWTP and its effects on :
  - Biosolids Production
  - Aeration demands – Hourly aeration needs
  - Digestion demands – Longer to met 503 regs
  - Compliance – Ammonia issues during high loadings
  - Costs – Passing back to discharger
  - Long Term Facility Planning

My Goals of Presentation

- Give real numbers, problems, solutions from a Ohio WWTP Facilities
- Put a direct and total cost of increased cBOD influent on WWTP
- How to predict future financial needs of increased loadings?
- Design needs to treat cBOD slug loads
- Not insult anyone who designed the equipment that I might bad mouth

Western Regional WRF

Montgomery County Water Reclamation (since 2008)

- Flow- Avg. 14.94 MGD Median 13.81 MGD
  - 12.25 MGD Summer 15.59 MGD Winter 20.0 MG Design
- TSS Loadings – Avg. 22,559 lbs Median 19,939 lbs
  - 22,141 lbs summer 22,960 lbs winter 55,000 lbs Design
- Ammonia Loadings – 1800 lbs per day
- cBOD Loadings – Avg. 24,628 lbs Median 23,583 lbs
  - 24,651 summer 24,605 lbs winter 38,400 lbs Design
- We have lots of concrete, what technology is in the concrete is old, inefficient, and creates constant headaches…

$1,200,000 will get you this

Solids Holding Building

Jet Aeration Digester Empty

After cleaning out 200 tons of grit/sludge

Jet Aeration Digester Full

Gravity Thickener

Six 700 HP Blowers

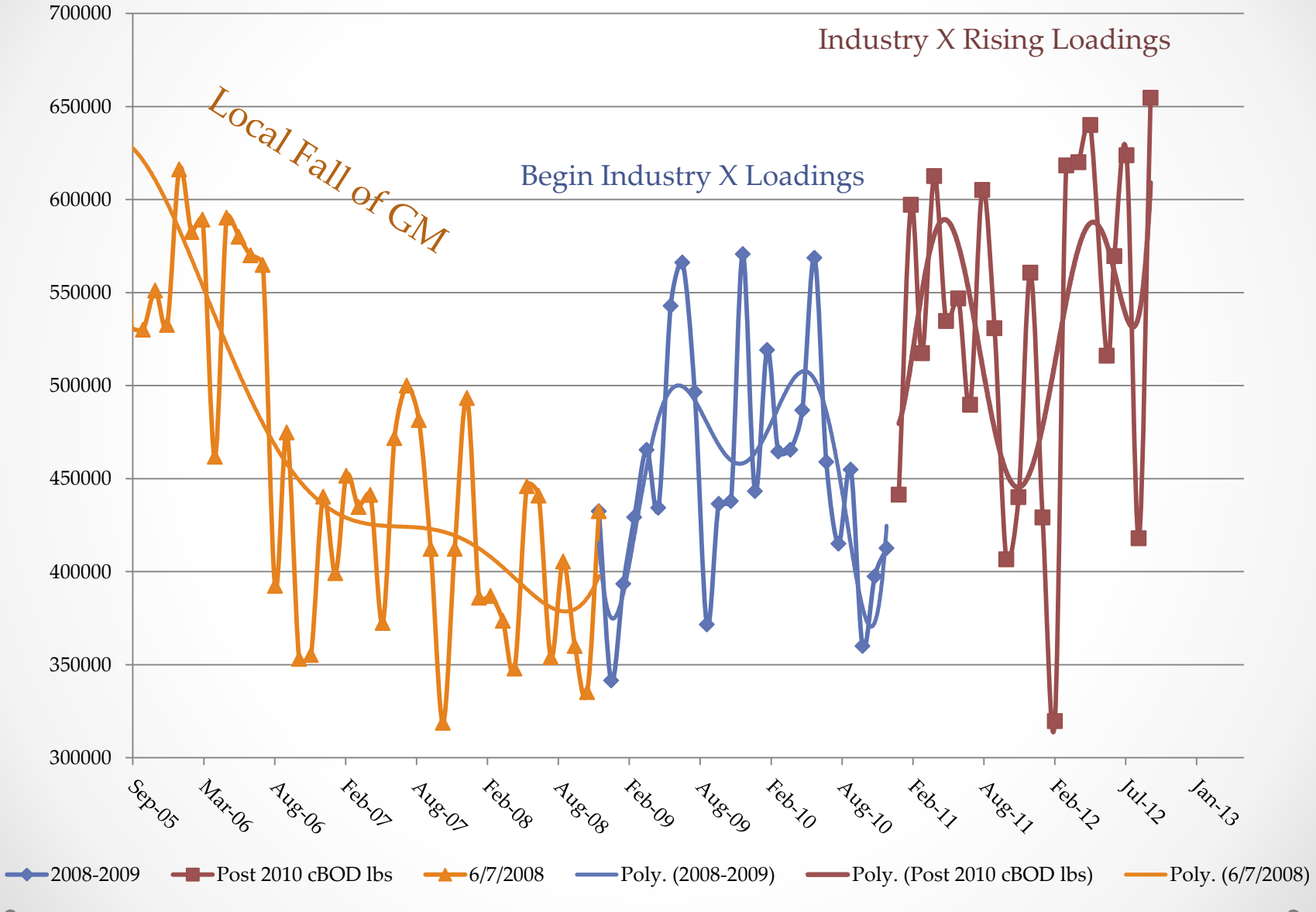
Huffman Multistage

Belt Filter Presses

So what's the problem…..

- By Plant Design data there should not be a problem
  - Still having ammonia spike through plant
  - Increased amount of digester sludge to dewater
  - Cannot stay caught up on processing biosolids
  - Increased dewatering costs
  - Had to put third 700 HP blower on to meet aeration demands
  - Increased electric bill
  - Constant worrying about the system
  - Excess foaming in aeration and aerobic digesters
  - Heavy solids to clarification during high flow events

- ***Needed to find out what was going on***


Industry X Rising Loadings
Local Fall of GM
Begin Industry X Loadings
700000
650000
600000
550000
500000
450000
400000
350000
300000
Sep-05
Mar-06
Aug-06
Feb-07
Aug-07
Feb-08
Aug-08
Feb-09
Aug-09
Feb-10
Aug-10
Feb-11
Aug-11
Feb-12
Jul-12
Jan-13
2008-2009
Post 2010 cBOD lbs
6/7/2008
Poly. (2008-2009)
Poly. (Post 2010 cBOD lbs)
Poly. (6/7/2008)

Let's Look @ Industrial Discharger X

- Knew largest industrial discharger was likely source but how to quantify & understand their effect on Plant
  - Began to break down influent loadings by lift station
  - Large Pre-Treatment LS was 94% flow and small Opossum Creek LS was 6% flow (line with Industrial Discharger X)
  - Needing to start looking at separate loadings per LS and the timing of the flow from LS through the aeration basin at Plant.

  - ***Now we are getting somewhere.***

Influent Loadings Comparison 2008-2013

Pre-Treatment LS

2008-2013

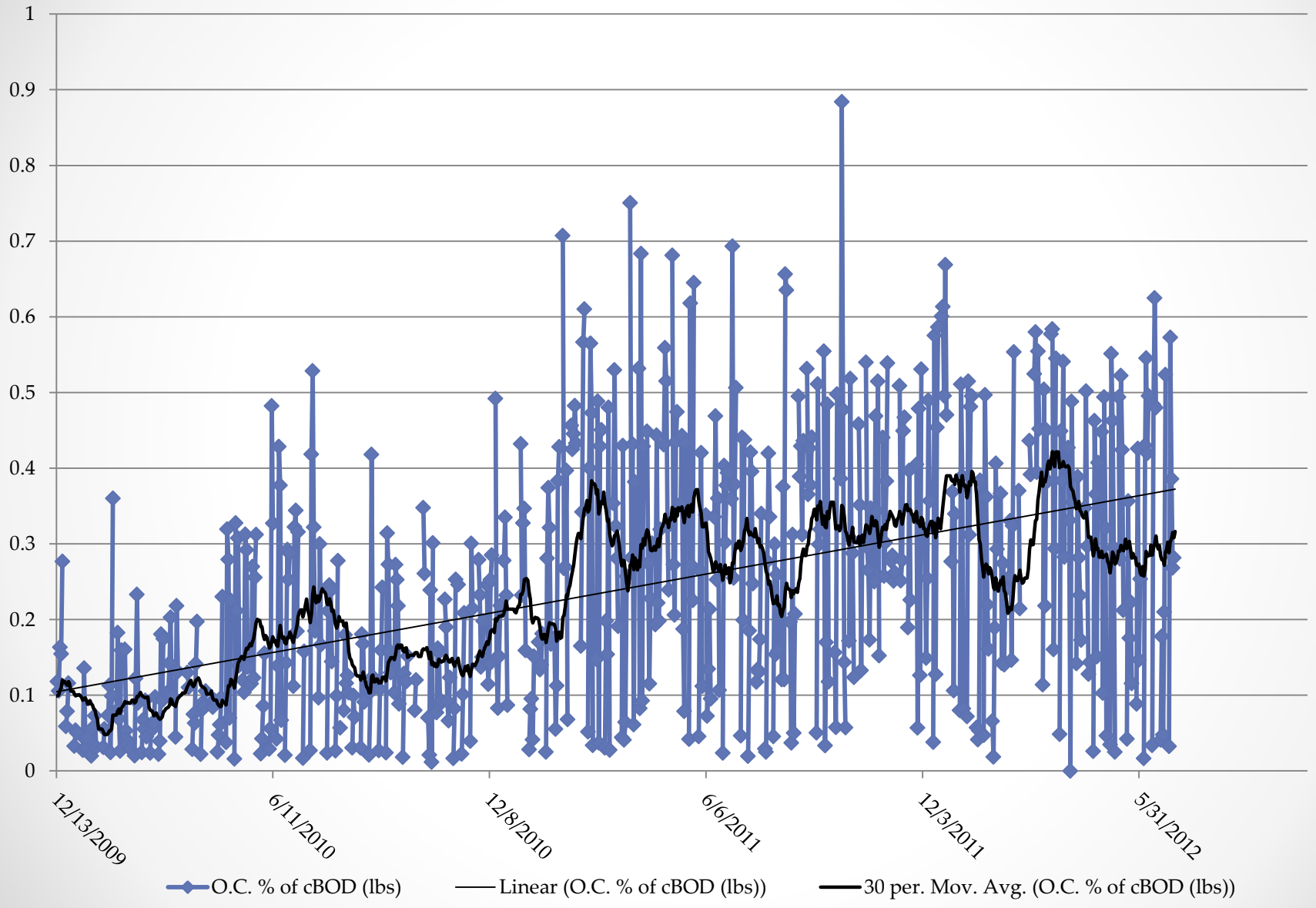
- 94% of Flow
- 89% of TSS
- 94% of ammonia
- ***75% of cBOD***

Opossum Creek LS

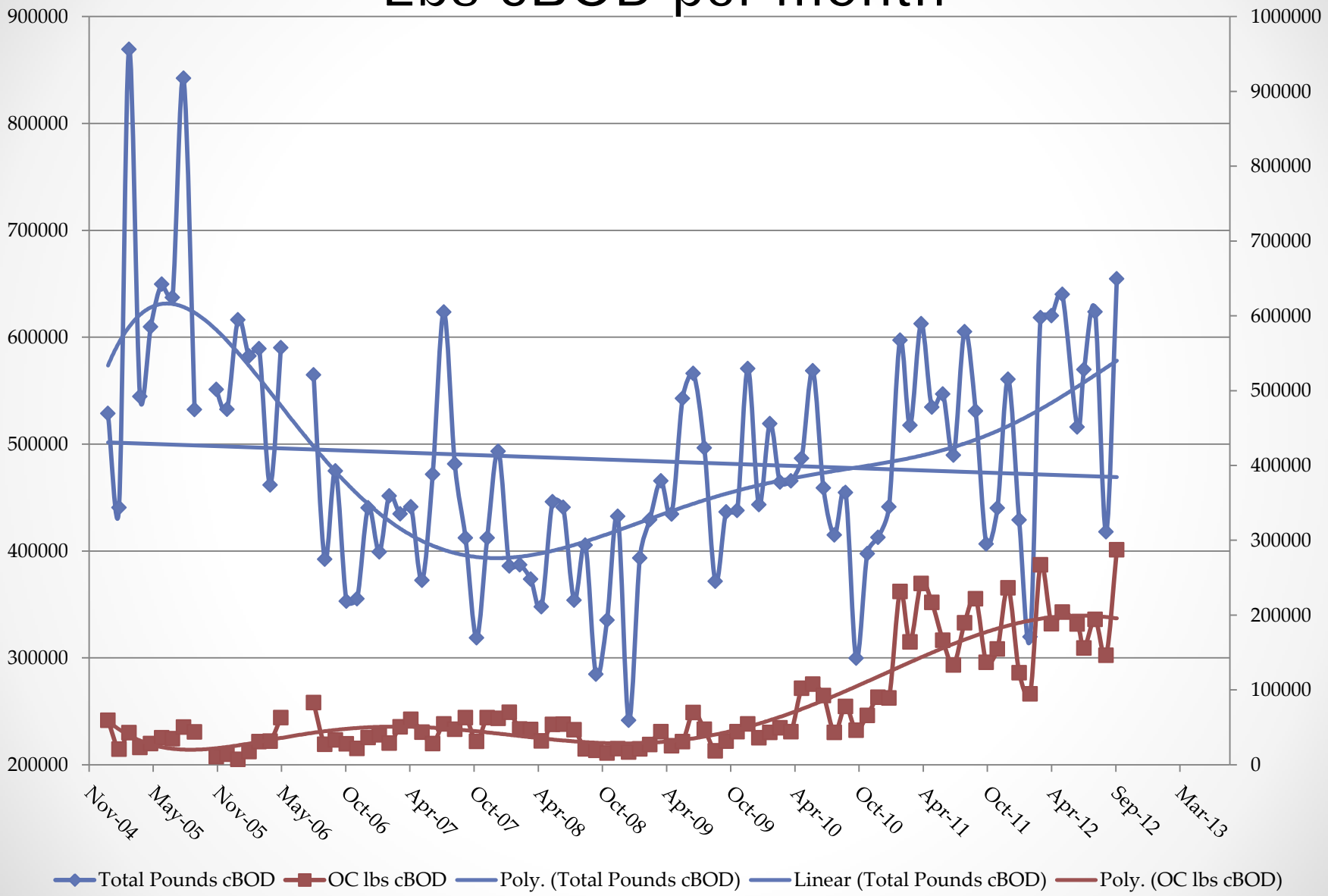
2008-2013

- 6% of Flow
- 11% of TSS
- 6 % of ammonia
- ***Reached 25% of cBOD***
- 2008 – 8.19% cBOD
- 2009 – 10.1% cBOD
- 2010- 13.9% cBOD
- 2011- 25.1% cBOD
- 2012- 21.2% cBOD
- 2103- 13.6% cBOD

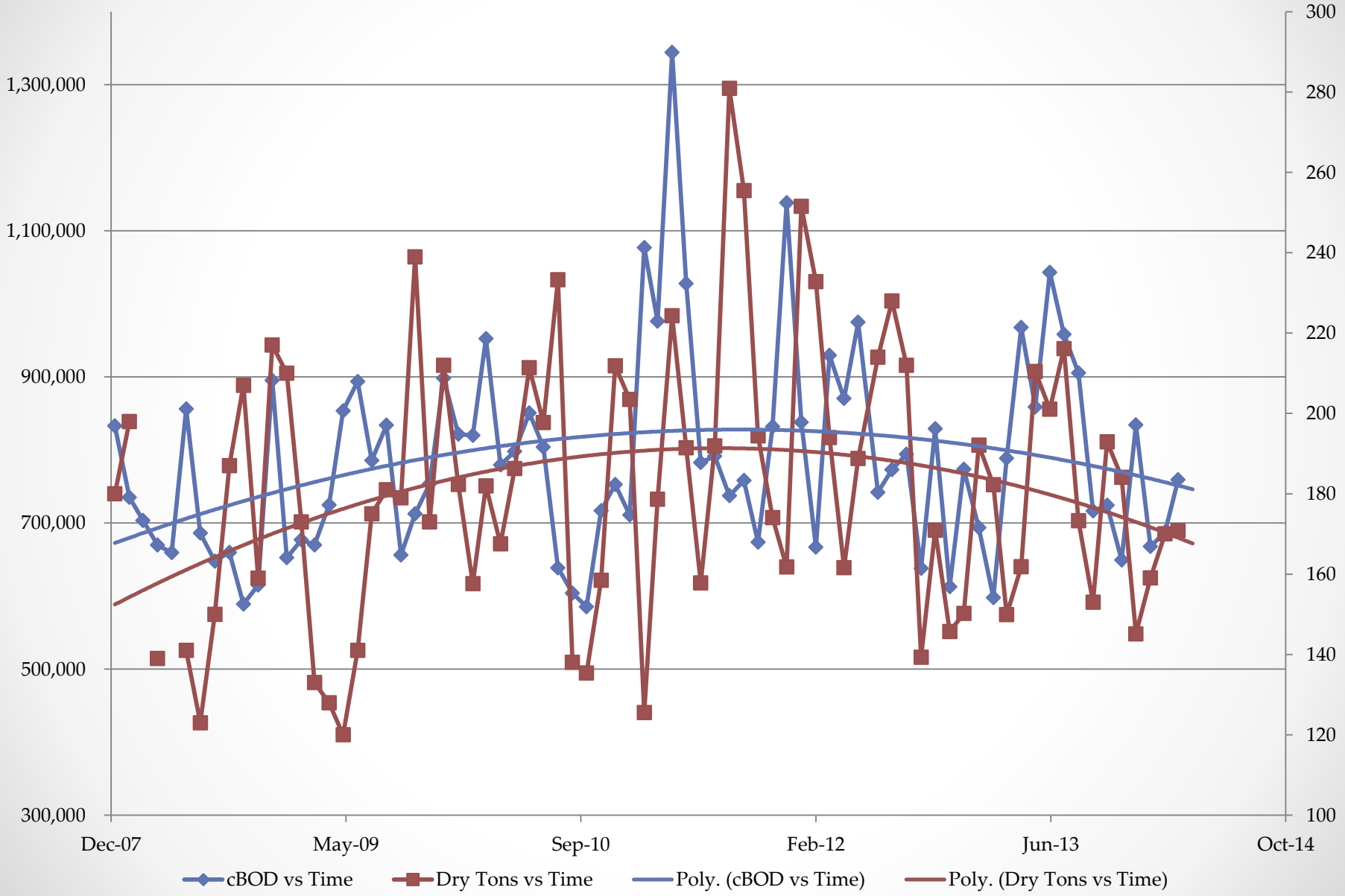
O.C. % of WR Total INF cBOD (lbs) (2009-2012)



Lbs cBOD per month

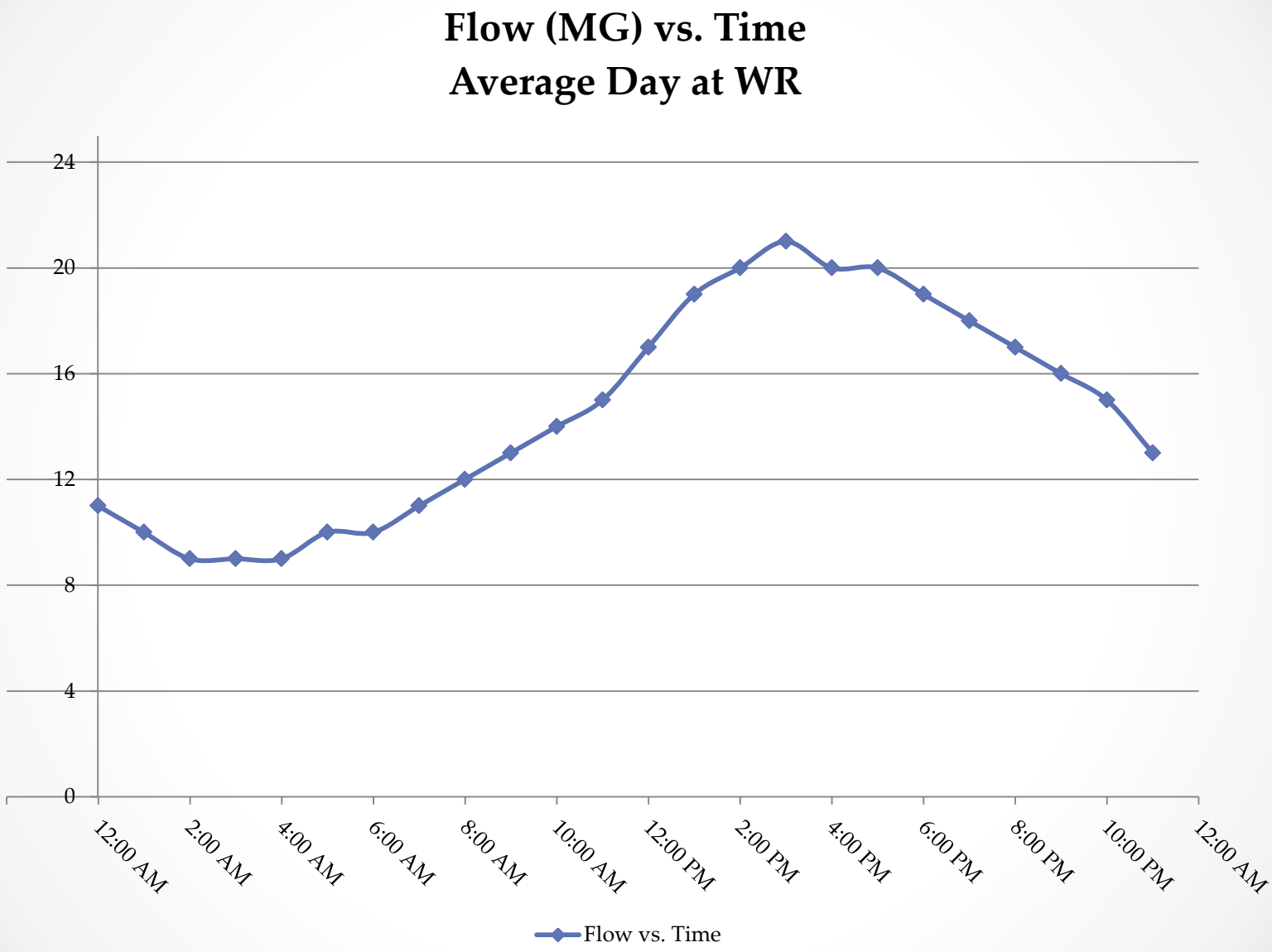


cBOD vs. Biosolids Dry Ton

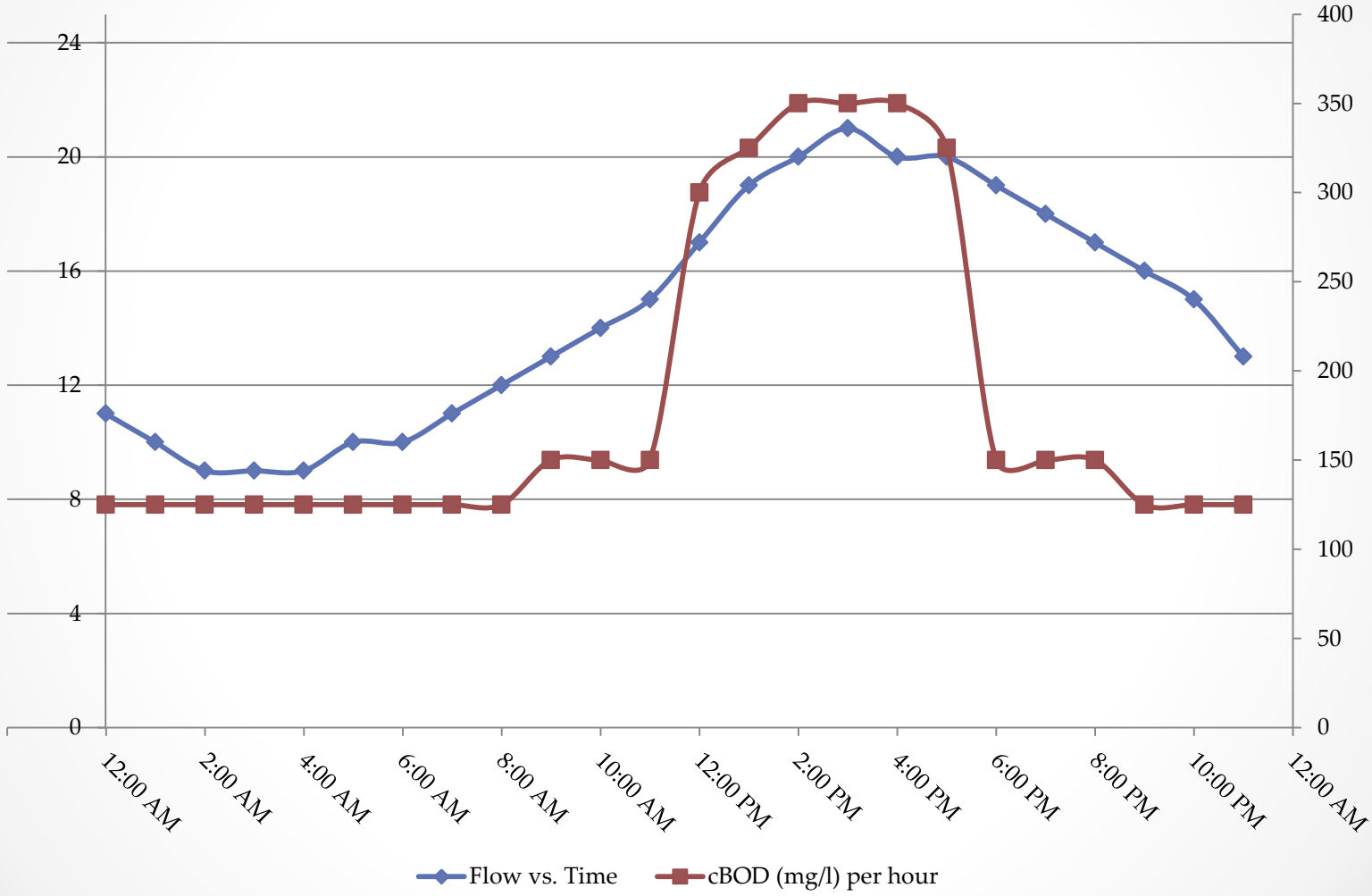


So what does this mean?

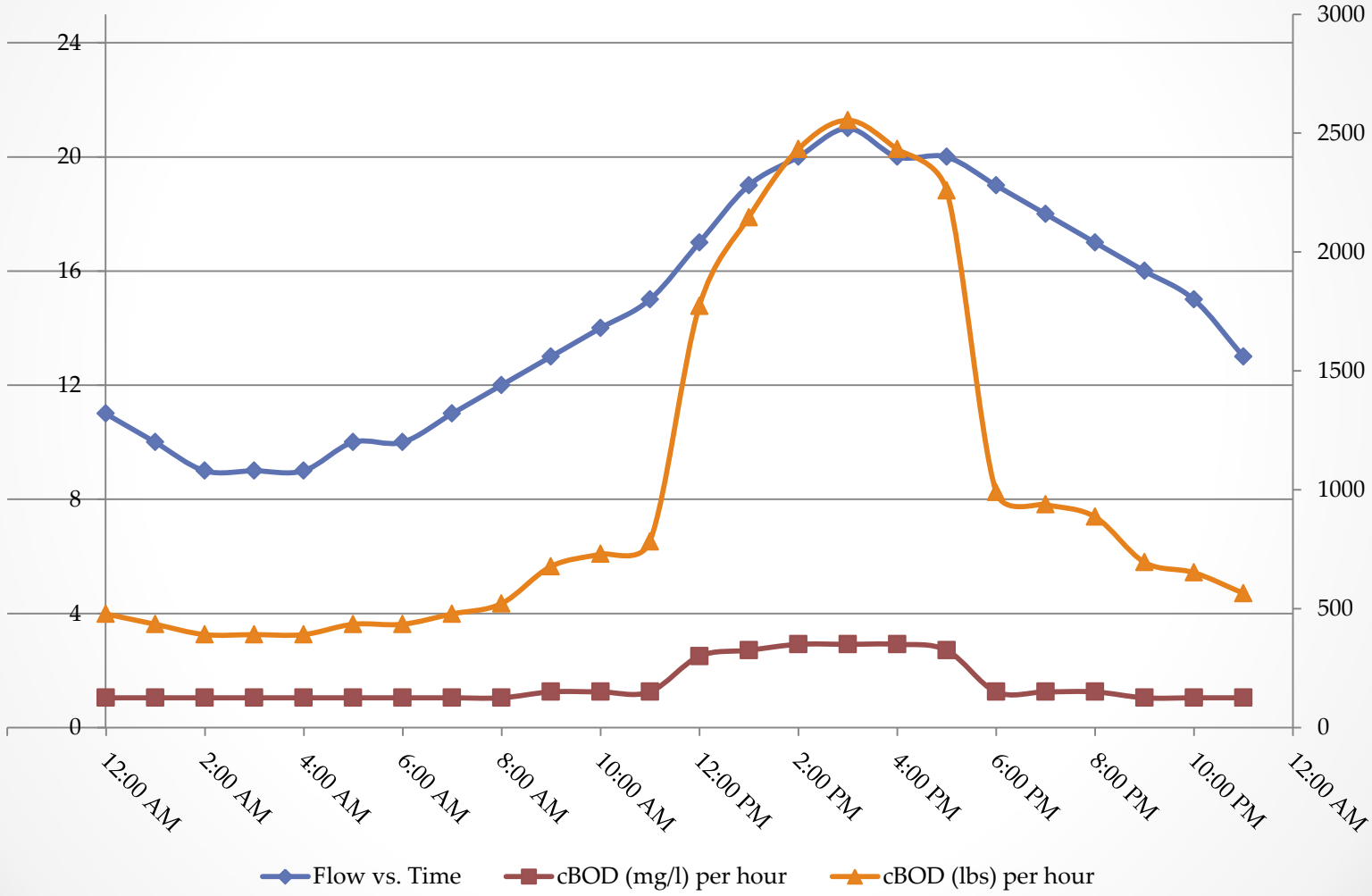
- Means that the Influent Loadings at WR
  - Stayed the same through time (2005-2012)
  - Steadily lost GM+ other industrial loadings (economy), but this was cancelled out with increase in Industry X.
- Why this is bad for the plant and biosolids production?
  - Lost all of the revenue from GM + other industry
  - Gained a new much more potent industrial discharge that was about 10x stronger and was discharged in 4-6 hour slugs
  - And most likely not billing Industry X enough to cover costs
  - GM loading was 24/7 and even through the day
  - New loading hits in 4-6 hour slugs


Flow (MG) vs. Time
Average Day at WR
24
20
16
12
8
4
0
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM
Flow vs. Time

Flow (MG) & cBOD (mg/l) vs. Time
Average Day at WR



Flow (MG) & cBOD (mg/l) & cBOD (lbs) vs. Time
Average Day at WR



		Design		Actual			
	Typical Flow/ hour (MG)	cBOD mg/l	lbs/hour	cBOD (mg/l)	lbs/hour	lbs/hr/tank (6 tanks online)	lb/d/1000 cu ft design 80
12:00 AM	11	200	765	125	478	80	39
1:00 AM	10	200	695	125	434	72	35
2:00 AM	9	200	626	125	391	65	32
3:00 AM	9	200	626	125	391	65	32
4:00 AM	9	200	626	125	391	65	32
5:00 AM	10	200	695	125	434	72	35
6:00 AM	10	200	695	125	434	72	35
7:00 AM	11	200	765	125	478	80	39
8:00 AM	12	200	834	125	521	87	42
9:00 AM	13	200	904	150	678	113	55
10:00 AM	14	200	973	150	730	122	59
11:00 AM	15	200	1043	150	782	130	64
12:00 PM	17	200	1182	300	1772	295	144
1:00 PM	19	200	1321	325	2146	358	175
2:00 PM	20	200	1390	350	2433	405	198
3:00 PM	21	200	1460	350	2554	426	208
4:00 PM	20	200	1390	350	2433	405	198
5:00 PM	20	200	1390	325	2259	376	184
6:00 PM	19	200	1321	150	990	165	81
7:00 PM	18	200	1251	150	938	156	76
8:00 PM	17	200	1182	150	886	148	72
9:00 PM	16	200	1112	125	695	116	57
10:00 PM	15	200	1043	125	652	109	53
11:00 PM	13	200	904	125	565	94	46
MGD	14.50		**24186**		**24464**		
			6000 CW				

cBOD rules

- 33.6% of plant flow going through the aeration basin during this high cBOD spike
- Minimal treatment for ammonia during these periods
- cBOD loving bacteria out compete the ammonia loving bacteria
- Shock load of cBOD has wipe out nitrifiers 1-2 per summer over last few years
  - Lost nitrifiers and had only 25% ammonia removal
  - Take about 3 weeks to recover
- Great cBOD removal, even with high slugs coming in
  - Plant effluent cBOD < 3.0 mg/l
  - Ammonia can fluctuate from < 0.25 mg/l to 5.0 mg/l

Industry X Discharge

2005-2008

- Discharged 40,000 gpd
- @ 5,500 cBOD
- 1,835 lbs cBOD per day
- Sent in a 4 hour slug
- Five days per week
- Occasionally get 10,000 lbs cBOD per day

2009-2012

- Discharge 100,000 gpd
- @ 11,000 cBOD
- 9,174 lbs cBOD per day
- Sent in 4 hour slug
- Five days per week
- Seen many days with 20,000 + lbs cBOD per day

Changes to Biosolids Production

- How much money does the extra cBOD cost?
  - Electric
  - Processing
  - Disposal
- How much more effort involved in meeting 503 regs?
  - Extra time and effort to meet SOUR test
  - Can current dewatering process keep up with loadings
  - Excess foaming during these periods
- Future considerations
  - Will we need to upgrade dewatering or add run times or combination
  - Future waste streams
    - Does this hinder our efforts for new customers
    - What if Industry X gets more business and send us more loadings?

Increased Costs ***BIOSOLIDS*** and more

- Biosolids Production Increase
- Ammonia Treatment Troubles
- Electrical Usage and demand Increases
  - Aeration Increase
- Maintenance Increase
- Increased Onsite Storage Costs
  - Storage building in conjunction with field storage issue
- Upgrade Dewatering Equipment Cost
  - Maxing out throughput of current dewatering devices
  - What will it take to dewater with predicted future loadings?

Biosolids Increased Cost
Western Regional Dry Tons Production
(Synagro cost for dewatering and disposal) (Land Apply or Landfill)

Year	Dry Tons	% increase over pre- 2009 level	dry ton increase over pre- 2009 avg. (per year)	$$ increase from pre-2009 avg.	$$ Increased Running Total
2012	*2350*	24.2%	458	$ 151,272	$ 453,882
2011	2350	24.2%	458	$ 151,173	$ 302,610
2010	2151	13.7%	259	$ 85,536	$ 151,437
2009	2091	10.6%	200	$ 65,901	
2000-2008 average	**1892**	**Baseline**			
2008	1834				
2007	1962				
2006	1814				
2005	2032				
2004	1905				
2003	1868				
2002	1841				
2001	1921				
2000	1847				

Extra Electrical Usage

Two 700 HP Blowers

- Both at 75 amps
- 4160 Volts
- 624,000 kwh per month
- Current $0.069 per kwh
- $43,056 per month aeration costs

Three 700 HP Blowers

- Three Blowers at 70 amps
- 4160 Volts
- 873,600 kwh per month
- Current $0.069 per kwh
- $60,278 per month aeration costs
- **$17,222 Extra per month**
- **$206,664 Extra per year**
- **28.6% increase**

Industry X Combined Cost Estimates 2012

- Extra Electrical Costs– $206,664
- Baseline Electrical Costs $102,000
- Extra Biosolids costs- $151,272
- Baseline Biosolids costs- $70,000
- Extra trips to landfill costs– $67,200
- Labor/Maint/Sampling/POM- $100,000
- TOTAL- $ 697,136
- Base Sewer Fee + Surcharge Fee= $729,870

Industry X Combined Cost Estimate 2011

- Extra Electrical Costs– $206,664
- Baseline Electrical Costs $102,000
- Extra Biosolids costs- $151,272
- Baseline Biosolids costs- $70,000
- Extra trips to landfill costs– $67,200
- Labor/Maint/Sampling/POM- $100,000
- TOTAL- $ 697,136
- Base Sewer Fee + Surcharge Fee= $474,631

Industry X Combined Cost Estimates 2010

- Extra Electrical Costs– $50,000
- Baseline Electrical Costs $102,000
- Extra Biosolids costs- $85,856
- Baseline Biosolids costs- $70,000
- Extra trips to landfill costs– $35,200
- Labor/Maint/Sampling/POM- $50,000
- TOTAL- $ 393,056
- Base Sewer Fee + Surcharge Fee= $220,895

Industry X Combined Cost Estimates 2009

- Extra Electrical Costs– $0
- Baseline Electrical Costs $102,000
- Extra Biosolids costs- $0
- Baseline Biosolids costs- $70,000
- Extra trips to landfill costs– 0
- Labor/Maint/Sampling/POM- $50,000
- TOTAL- $ 222,000
- Base Sewer Fee + Surcharge Fee= $118,128

Industry X Combined Cost Estimates 2008

- Extra Electrical Costs– $0
- Baseline Electrical Costs $102,000
- Extra Biosolids costs- $0
- Baseline Biosolids costs- $70,000
- Extra trips to landfill costs– 0
- Labor/Maint/Sampling/POM- $50,000
- TOTAL- $ 222,000
- Base Sewer Fee + Surcharge Fee= $85,647

Summary of Costs

Money Out

- 2008- $222,000
- 2009- $222,000
- 2010- $393,056
- 2011 – $697,136
- 2012 – $697,136
- TOTAL- $2,231,328

Money In (Rate + Surcharge)

- 2008- $85,647
- 2009 - $118,128
- 2010 - $220,895
- 2011 - $474,631
- 2012 - $729,870
- TOTAL- $1,629,171

Long Term Capital Changes

- Change over all aeration basins and aerobic digesters from Jet Aeration to Fine Bubble Diffusers
  - This will increase oxygen efficiency transfer rate
  - Minimize 3rd Blower need, maybe even run 2 blowers at times of year
  - Capital costs to design and install new aeration devices
  - Create better control to operate blower inlet valve
  - Dissolved Oxygen control of aeration needs
  - Be able to adapt aeration need to our huge cBOD swings

Surcharge Structure

- Had not been address in a long time, standard inflation adjustment
- Surcharge study- raised rates to cover all (WWTP costs/lbs influent cBOD)
- Implemented over 3 years
- Industry X changed cBOD numbers went down and have stayed down
- Less spikes coming in
- This summer will be the big test to see if their changes will keep working


Compliance
Dewatering Options
Electrical Costs
Increase Aeration Demands
BOD Loadings
A LOT TO THINK ABOUT
Increased Capital Costs
503 Regulations
Land Apply Costs
Gravity Thickener Process
Dewatering
Dry Tons vs. Wet Tons
Extra Maintenance Costs
Contract Operations
Landfill Costs
Proper Surcharges
Replacing old equipment
Influent Loadings
UNDERSTANDING HAS ONLY JUST BEGUN

Questions or Corrections

- Now

  or

- Later

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