Blue Frog ™ System Case Study: **Winery**

Blackstone Winery is in Gonzales, CA and is owned by Constellation Wines, the largest vintner in the world.

Waste is accumulated on the plant site, neutralized and injected with air and then pumped 2.5miles to two treatment lagoons, P-1 and P-2. Effluent is pivot-sprayed over 45 acres per month, 7acres per day at any single pumping.

Prior system did not meet limits, smelled and accumulated sludge.

There is a strong North-to-South prevailing wind that moves floating sludge from the inlet to the outlet.

Sludge digested at night has occluded gas and floats to the surface; when sunlight heats the floating sludge, the gas is released and the sludge sinks by mid morning. This creates vertical mixing which was overcome by additional GF clarifiers in P2.

[A sketch of the Blackstone pond is sent separately as a PDF file.]

Objectives

1. Reduce energy consumption by 50%
2. Meet current regulations
    a. 300lb BOD/acre*day; 100lb/sum-acres irrigated*30day average; DO $\geq$ 1.0 in the top 12 inches; pH 6-8
3. Eliminate malodor complaints.

Results

1. Energy reduced 50%
2. BOD is well below limits when daily irrigation hours are managed (3.5hr/day max during crush).
    a. Crush peak BOD is 50% of historical peak BOD
3. Surface DO ranges from .4 to 3.0 depending on location.
4. There is no odor from these ponds.
5. The residual sludge is about 6inches.

Issues and Observations

1. Winery waste is very difficult to manage because
    a. It is a high strength waste

b. It has a high instantaneous COD (e.g. red wine color, alcohol-to-acetic-acid and antioxidants)

c. The pH is low (4.5); anaerobes stop growing at ~pH = 6.2

d. Sugars are so rapidly oxidized that surface DO is hard to maintain @ DO>1.0.

2. The instantaneous COD was oxidized by injecting compressed air into the 2.5mile/2hour transit to the ponds.

3. The surface DO limit was not achieved after the initial installation with 36" suctions on each GF. Installation of J-tubes met the requirements in P-1 and most of P-2.

   a. The J-tube pulls from the top 15" of the water column, effectively doubling the DO concentration in the top 12inches with no change in horsepower.

   b. We are testing a low hp aerator, Yellow Frog (YF) that gives a surface DO of .4 without an impellor. The impellor is being fabricated now.

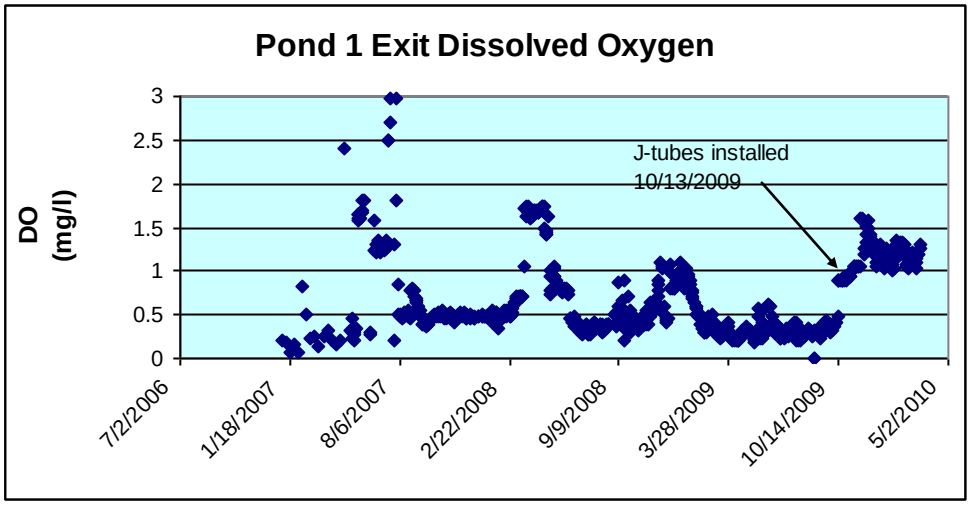
      i. The design concept is to produce small bubbles within the YF chassis and to separate them (to minimize coalescing) with 7MGD flow from the impellor.

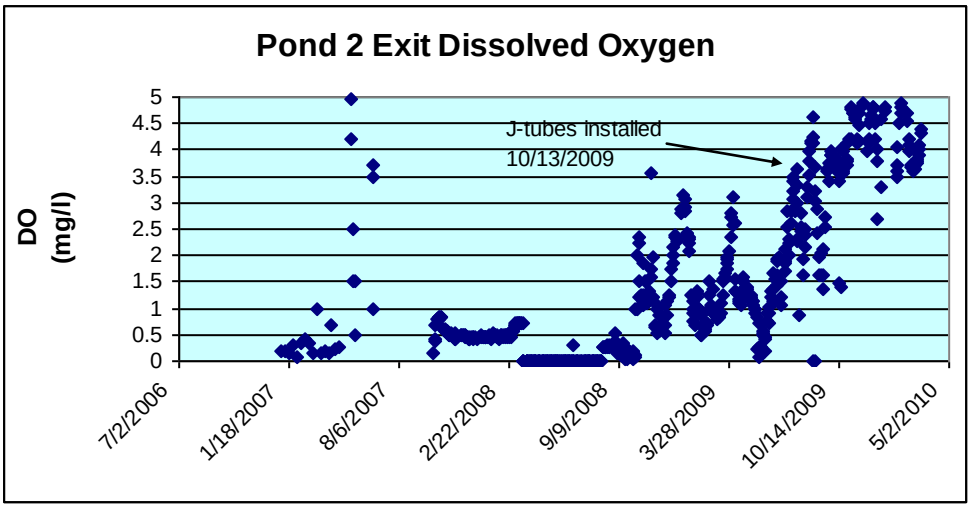
      ii. The DO =.4 is achieved just by density difference as the mixing driving force without an impellor.

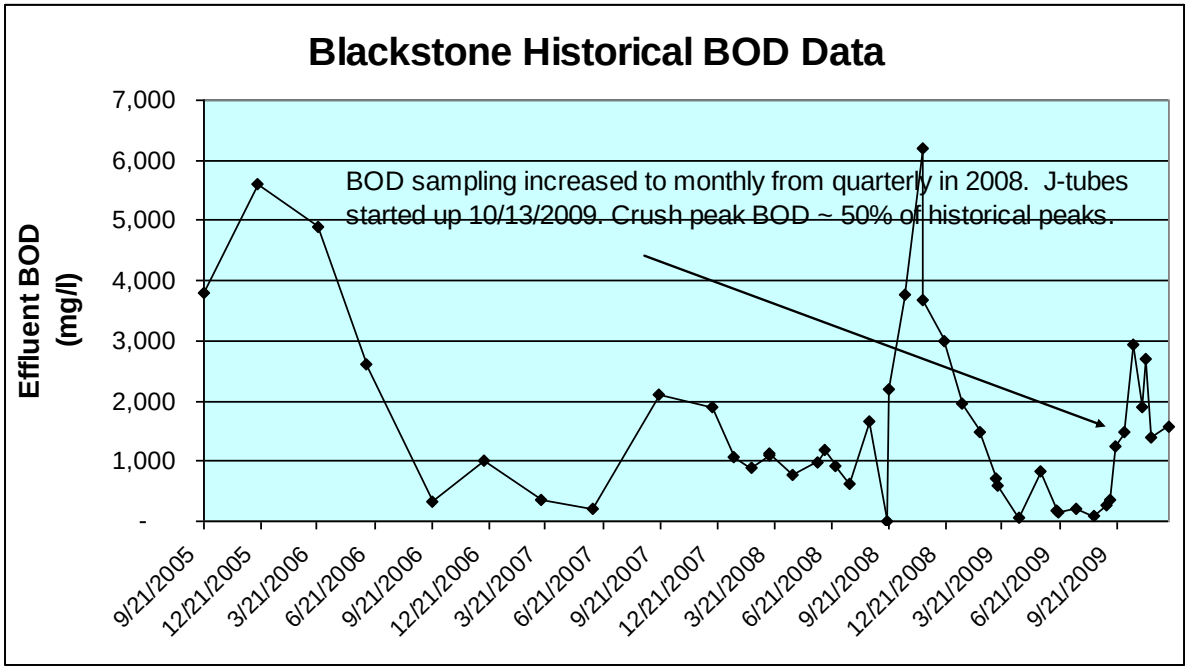
4. BOD performance was excellent. Compliance with daily limits is achieved by watering 3.5hour max /24hour day.

BOD SOIL IRRIGATION LOADING					
	Total		MONTH/YEAR: OCTOBER, 2009		
Total Irrigated	Irrigated	30-Day Average			
Gallons	Acres	BOD#/Acre/Day			
3,066,000	35	36.5		2.7hour/day needed	
3days out of 31, the daily BOD loading exceeded the Permit					

5. With the J-tubes and a 5-fold increase in DO sampling, the crush DO in P1 >1. The crush DO outside the exit GF/CSTR averages .61mg/l. The crush discharge DO >2.

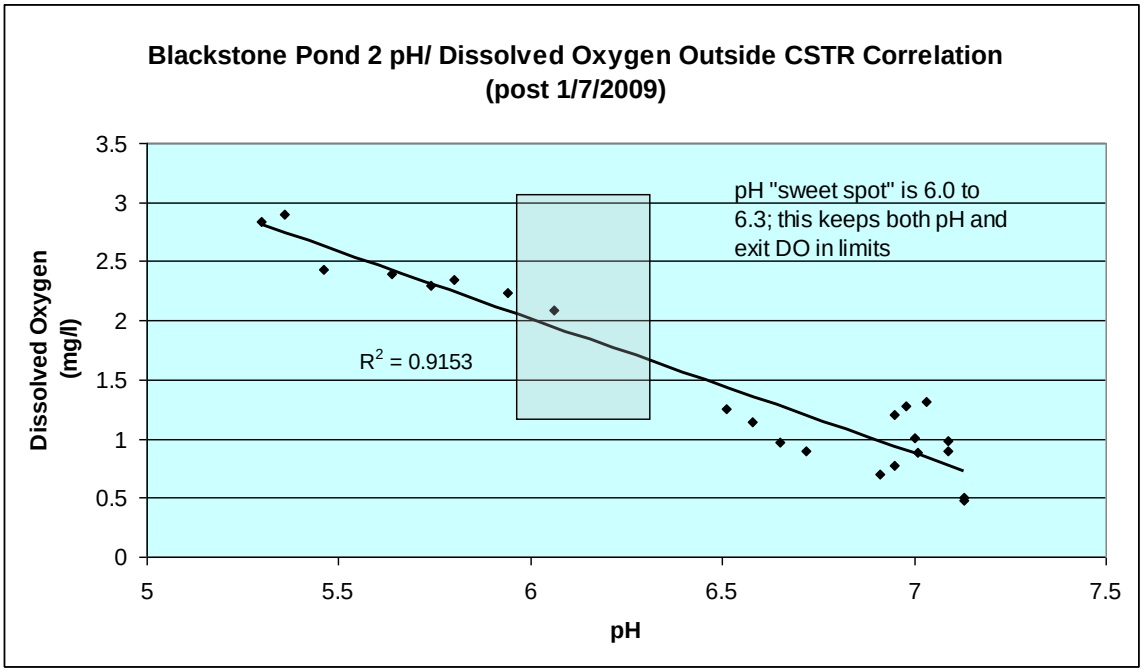

Pond 1 Exit Dissolved Oxygen
DO (mg/l)
3
2.5
2
1.5
1
0.5
0
J-tubes installed
10/13/2009
7/2/2006
1/18/2007
8/6/2007
2/22/2008
9/9/2008
3/28/2009
10/14/2009
5/2/2010

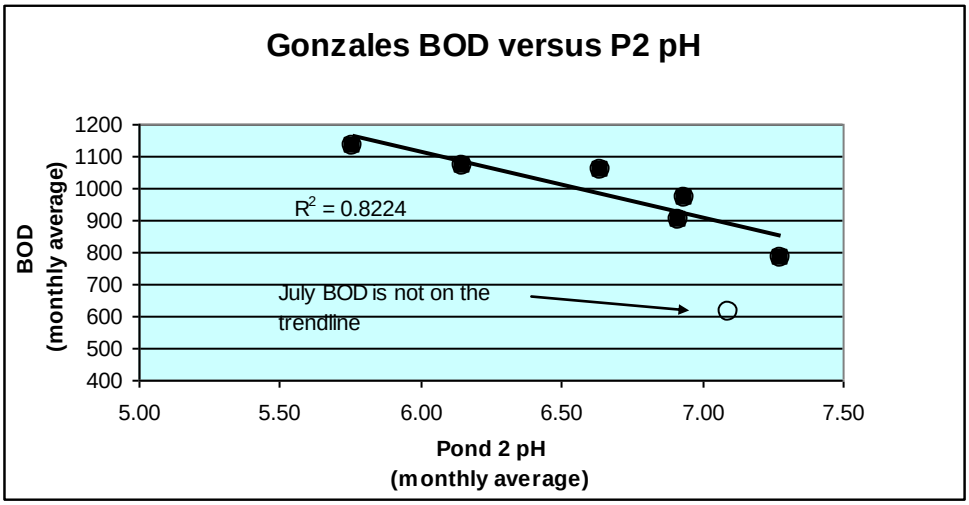

Pond 2 Exit Dissolved Oxygen
DO (mg/l)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
J-tubes installed
10/13/2009
7/2/2006
1/18/2007
8/6/2007
2/22/2008
9/9/2008
3/28/2009
10/14/2009
5/2/2010

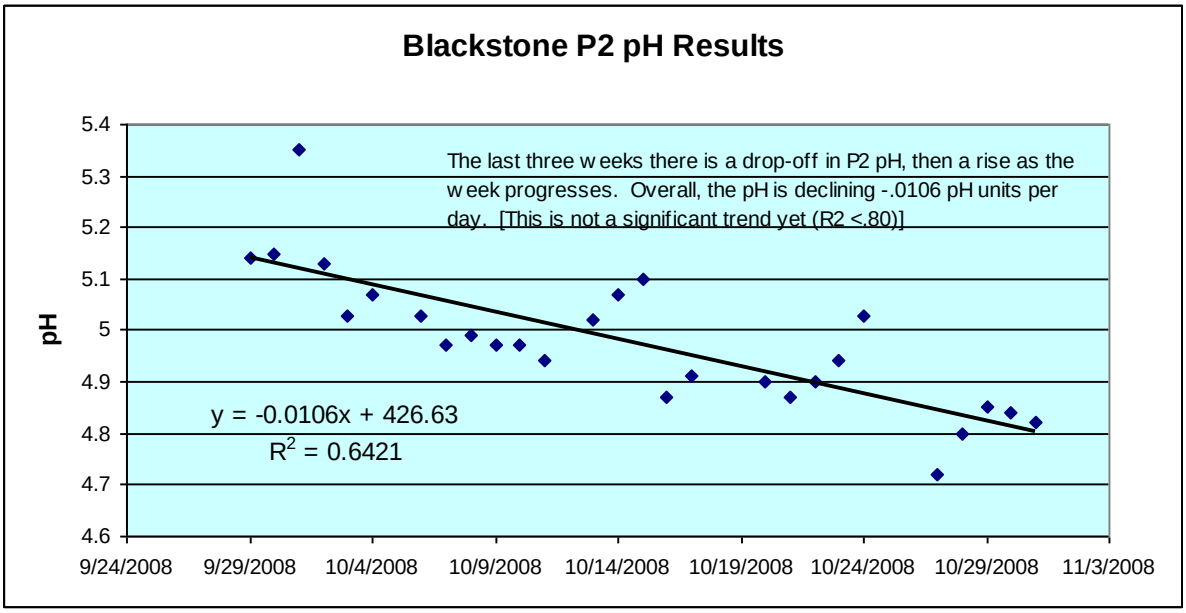


6. The performance of the system is a strong function of water pH. At pH <6, performance drops way off.

	BOD Reduction		
	BOD	BOD	
	On-Site	Pond 2	Pond 2 pH
Ave. 2009 only	3,226	483	6.8
% Reduce:		85%	
Ave. Crush 09	3,730	1,535	5.8
% Reduce:		59%	







Discussion

1. Blackstone pH falls during crush (Sept through Nov) below the permitted level.
    a. pH drops outside of permitted levels. Blackstone reports soil pH (which is in limits).
    b. A low pH reduces BOD efficiency. This perversely increases surface DO as the bacterial oxygen consumption rate declines.
    c. It takes about 6 weeks for the acid consuming bacterial population to grow back to normal.
2. Blackstone is a development site for BFS.
    a. The J and double J tube were developed to address the surface DO issue.

b. The YF development is field tested here.

c. We intend to convert all the free standing GFs to YFs with impellors once we are confident of the results.

    i. This will reduce the overall energy consumption by 75%.