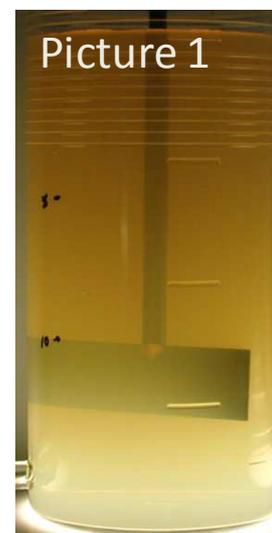


Date: 1/12/09
To: StormKlear
From: J. Scott
Data found in: LNB 181-79

Subject: Test report on floccing and clearing a well water sample.

Purpose: Test to determine the flocculation performance of StormKlear Liquifloc at different delivered chitosan concentrations on the experimental sample. The water sample is from a 660 foot deep well from Lower Lake California, and was sent in by Cliff Rediger.

Background: Picture 1 to the right shows what a freshly agitated test sample looks like. The sample has a turbidity of about 208 NTU. The pH of the sample was about 7.04. The amount of iron in an undigested sample of the water was 2.04 ppm.



Procedure: Perform floccing and settling studies as described below.

Results: Method 1: Small scale floccing test of well mixed sample. Add 20 ml of the well mixed test sample to each of the test vials. Then add the appropriate amount of StormKlear Liquifloc to each vial and shake to mix well. Allow to stand over time to determine flocculent performance. Note: as StormKlear Liquifloc is only 1% chitosan (more concentrated chitosan solutions can be made) one must calculate the amount of StormKlear Liquifloc to add so that the correct amount of chitosan in ppm is added to each of the test samples.

The turbidity of a well mixed starting sample was about 200 NTU. StormKlear was added to each of the vials 1 through 10 in the concentration as listed in Table 1 (no StormKlear was added to the first sample "0" the control). Also seen in Table 1 is the turbidity of the samples, measured while in the test vials after 15 minutes of settling. The floccing results over time are shown in Pictures 2- 3 below. From the Pictures below it can be seen that with 15 minutes of settling time the clarity has improved. Turbidity was reduced at sample 4 with a turbidity of approximately 42 NTU after 15 minutes of settling time. The amount of iron in an undigested sample of the supernatant of the treated water was reduced from 2.04 ppm to about 0.5 ppm.

Table 1

Sample Vial Number	Control	1	2	3	4	5	6	7	8	9	10
StormKlear LiquiFloc Concentration (ppm)	0	100	200	300	400	500	600	700	800	900	1000
Chitosan Concentration (ppm)	0	1	2	3	4	5	6	7	8	9	10
Turbidity at ~15 minutes (NTU)	205	176	145	82	42	52	34	49	49	38	36

Picture 2: Elapsed time = 5 minute



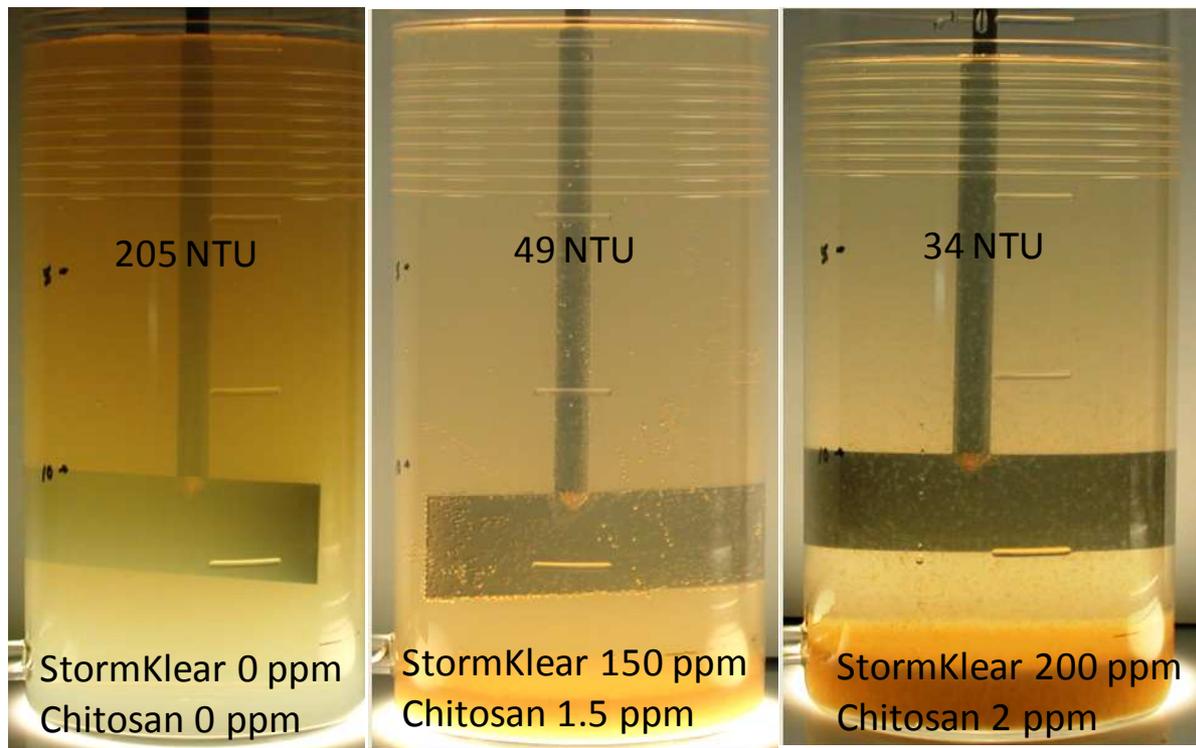
Picture 3: Elapsed time = 15 minutes



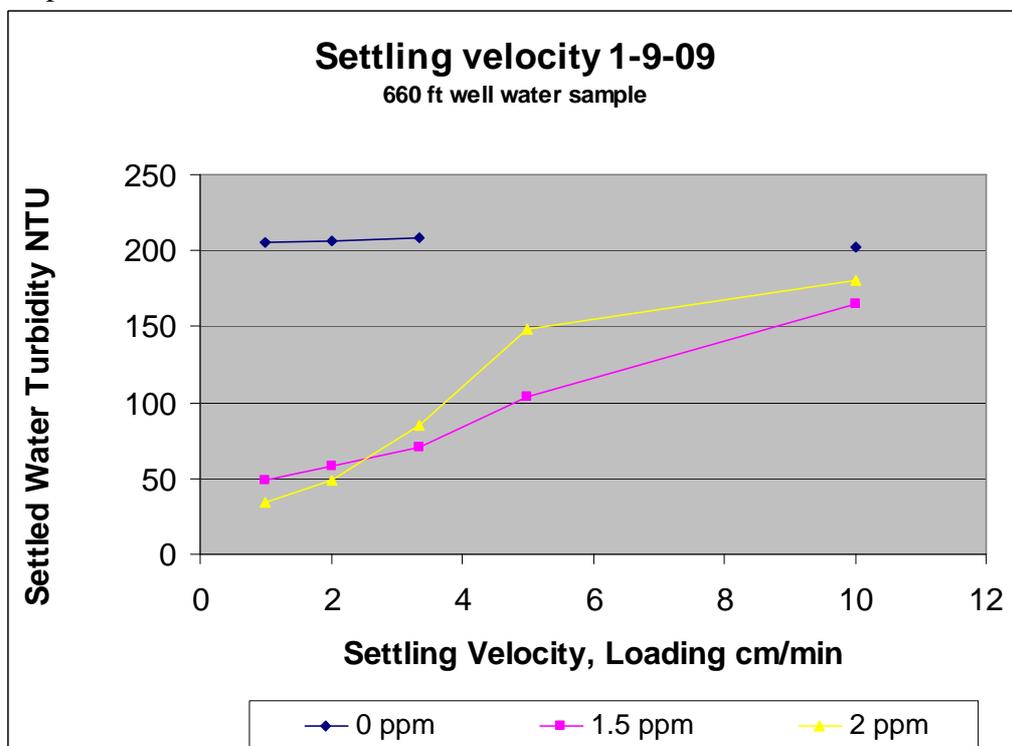
Method 2: Settling testing using a larger amount of sample. Well mixed test samples, 1 liter in size, were placed into tall beakers and mixed using a Phipps & Bird stirrer and standard jar test method. The appropriate amount of StormKlear Liquifloc was added to each beaker and mixed for 10 seconds at 300 rpm, an additional 2 minutes at 100 rpm, 3 more minutes at 60 rpm and then a final 15 minutes at 20 rpm and then stopped. The test samples were allowed to stand over time to determine settling performance. Small aliquots were taken 10 cm below the top of the solution at certain time points and the turbidity was measured and plotted versus settling velocity (see Graph 1 and Table 2 below). Picture 4 A-C, below, was taken about 15 minutes after the stirring was stopped.

Picture 4 A-C shows the improved clarity of the sample using as low as 150 ppm of StormKlear (1.5 ppm chitosan) versus the non-treated sample.

Picture 4 A-C:



Graph 1:



From Graph 1 and Table 2 effective floccing and clearing performance can be obtained with a StormKlear concentration of 150 ppm (1.5 ppm Chitosan).

Table 2:

StormKlear:	0 ppm	150 ppm	200 ppm	Settling	Mixing Procedure	
Chitosan:	0 ppm	1.5 ppm	2 ppm	Velocity	RPM	Time
TIME (min)	NTU	NTU	NTU	cm/min		
1	202	165	181	10	300	10 sec
2		104	148	5	100	2 min
3	208	71	85	3.3	60	3 min
5	206	58	49	2	20	15 min
10	205	49	34	1		

Discussion: From the results collected in method 2 (1 liter samples) using a little as 150 ppm of StormKlear (1.5 ppm chitosan) to treat the whole sample can get a reduction in turbidity from the hundreds to about 30-40 NTU. Note: Method 1 with small (20 ml) sample amounts shows that using the same 150 ppm of StormKlear will only reduce the turbidity of the whole sample to about 150 NTU (about 4x greater ending turbidity than when using large, 1 liter samples). From this data it may be shown that using larger amounts of sample in excess of 1 liter, along with slow mixing, may improve performance of the floccing thus lessening the amount of StormKlear needed. The slow mixing, along with the large quantity of test solution, allows the floc to build up and become large settleable particles. The best dosing and mixing method must be uniquely determined for each equipment setup.

In any case, by using filtration it may be possible to reduce the amount of StormKlear needed to clear the water to less than 150 ppm and get turbidity to much less than 30-40 NTU.

Also, the iron concentration in the cleared supernatant of the treated water was reduced about 75% from 2.04 ppm to less than 0.5 ppm.