Award Recommendation for Bid # SA001804
Polymer – Southerly Wastewater Treatment Plant – Opened 11/3/05

Bids were opened for Southerly Wastewater Treatment Plant Polymer on 11/3/05. Each vendor/supplier was permitted to submit one emulsion polymer and one Mannich polymer. A submittal of both products was not required. The intent of this bid was to compare the cost effectiveness of the two product types in dewatering Southerly's biosolids and recommend the lowest and best bid of all products submitted. Product submittal tabulation is provided in Table 1.

Polymers are used at Southerly to enhance the dewatering or drying of biosolids prior to incineration. The more efficient the polymer, the less will be required (polymer dosage) per dry ton of biosolids dewatered. Additionally, a better, more efficient polymer will produce a dryer biosolids cake which will require less natural gas for combustion in the incineration of the biosolids. As described in the specification, the emulsion polymers were subjected to full-scale field trial. The data from this testing was tabulated and combined with the bid prices. The lowest and best bid was determined as the lowest overall disposal cost, where the disposal cost is a sum of the polymer cost + natural gas cost per dry ton of biosolids disposed. Tables 2 through 4 summarize the data from the plant trials. The lowest and best bid was determined to be Tidewater's TWC-8624 as shown in Table 5.

Three Mannich polymers were submitted for bid as shown in Table 1. These three products were compared in side-by-side bench testing to determine the best product for Southerly's dewatering application. While bench testing is more qualitative than actual field trials, relative dosages for each product can easily be determined. The results of that testing are shown in Table 6. The optimum test run of each product is highlighted. Because Polydyne 7950NR was shown to have the best performance relative to the other to Mannich products and because the bid price submitted for this product was the lowest, Polydyne 7950NR was determined to be the lowest and best bid of the three Mannich products.

Next, a comparison was made of the best emulsion (Tidewater TWC-8624) and best Mannich (Polydyne 7950NR) products. The results of this comparison are shown in Table 7. The results show a savings of nearly $120,000 per year by using a Mannich polymer.

It is our recommendation that Polydyne 7950NR is the lowest and best bid polymer product for the following reasons:

1. Polydyne 7950NR showed the best overall performance of the three Mannich polymers in bench testing.
2. Polydyne 7950NR was the lowest bid Mannich polymer at $0.084/lb delivered.
3. Polydyne 7950NR is the product that is currently being used at Southerly and its satisfactory performance over the past three years has been well documented.

4. Polydyne 7950NR has documented plant performance to show current dosage rates at 227 lbs/ton. As illustrated in Table 7, Southerly's cost savings using the Mannich polymer Polydyne 7950NR over the best performing emulsion polymer would approach $120,000 per year.

Table 1.

Price Tabulation - Bid #SA001804
Polymer / Southerly Wastewater - Opened 11/3/05

EMULSION		Item #1		Item #2		Item #3		
		4/1/06 thru 3/31/07		4/1/07 thru 3/31/08		4/1/08 thru 3/31/09		
Bidder	Quantity	Each	Extended	Each	Extended	Each	Extended	Total
Polydyne (NE-1077)	1,800,000	$ 0.900	$ 1,620,000.00	$ 0.945	$ 1,701,000.00	$ 0.992	$ 1,785,600.00	$ 5,106,600.00
Stockhausen (Praestol K148L)	1,800,000	$ 1.020	$ 1,836,000.00	$ 1.020	$ 1,836,000.00	$ 1.020	$ 1,836,000.00	$ 5,508,000.00
Tidewater (TWC-8624)	1,800,000	$ 1.075	$ 1,935,000.00	$ 1.120	$ 2,016,000.00	$ 1.180	$ 2,124,000.00	$ 6,075,000.00
MANNICH		Item #4		Item #5		Item #6		
		4/1/06 thru 3/31/07		4/1/07 thru 3/31/08		4/1/08 thru 3/31/09		
Bidder	Quantity	Each	Extended	Each	Extended	Each	Extended	Total
Delta (Delta-Floc 522)	11,000,000	$ 0.087	$ 957,000.00	$ 0.089	$ 979,000.00	$ 0.092	$ 1,012,000.00	$ 2,948,000.00
Polydyne (7950NR)	11,000,000	$ 0.084	$ 924,000.00	$ 0.088	$ 968,000.00	$ 0.092	$ 1,012,000.00	$ 2,904,000.00
Tidewater (TWC-1172)	11,000,000	$ 0.170	$ 1,870,000.00	$ 0.190	$ 2,090,000.00	$ 0.210	$ 2,310,000.00	$ 6,270,000.00

Table 2.

2005 Southerly WWTP Polymer Trials

Date: 12/5/2005
Polymer: Polydyne Clarifloc NE-1077
Neat %TS: 41.0
Cost/lb: $ 0.900

Natural Gas Cost: $ 8.00

Time	Feed GPM	Torque, %	Poly, GPM	Feed %TS	Cake %TS	Centrate %TS	Polymer Feed Sol. %TS	Capture %	Polymer Dosage Lbs/dt	Polymer Cost/dt	Nat. Gas Cost/dt	Disposal Cost/dt
12/5/2005												
11:00	150	60	18.0	4.46	25.4	0.25	0.50%	95.3	28.0	$ 25.18	$ 6.92	$ 32.11
11:30	150	63	18.0	4.60	25.3	0.25	0.50%	95.5	27.1	$ 24.42	$ 7.02	$ 31.43
12:00	151	63	17.0	4.34	26.5	0.18	0.50%	96.5	27.0	$ 24.28	$ 5.89	$ 30.17
12:30	151	63	16.0	4.20	26.5	0.27	0.50%	94.5	26.2	$ 23.61	$ 5.89	$ 29.50
13:00	152	63	15.0	4.08	25.6	0.26	0.50%	94.6	25.2	$ 22.64	$ 6.73	$ 29.37
13:30	149	66	15.0	4.28	25.1	0.29	0.50%	94.3	24.5	$ 22.02	$ 7.21	$ 29.22
14:00	149	69	15.0	4.12	25.2	0.31	0.50%	93.6	25.4	$ 22.87	$ 7.11	$ 29.98
14:30	151	69	16.0	3.97	26.1	0.24	0.50%	94.8	27.8	$ 24.98	$ 6.26	$ 31.25
12/6/2005												
9:00	150	63	16.0	4.26	26.9	0.24	0.50%	95.2	26.0	$ 23.44	$ 5.51	$ 28.95
9:30	151	66	16.0	4.26	26.7	0.19	0.50%	96.2	25.9	$ 23.28	$ 5.70	$ 28.98
10:00	149	69	16.0	4.34	26.4	0.23	0.50%	95.5	25.7	$ 23.16	$ 5.98	$ 29.14
10:30	149	69	17.0	4.67	27.0	0.18	0.50%	96.8	25.4	$ 22.87	$ 5.42	$ 28.28
11:00	149	73	17.0	4.03	27.1	0.20	0.50%	95.7	29.4	$ 26.50	$ 5.32	$ 31.82
11:30	149	76	17.0	4.22	26.7	0.27	0.50%	94.6	28.1	$ 25.31	$ 5.70	$ 31.01
12:00	150	79	17.0	4.78	26.9	0.27	0.50%	95.3	24.7	$ 22.19	$ 5.51	$ 27.70
12:30	150	82	17.0	4.43	26.8	0.18	0.50%	96.6	26.6	$ 23.95	$ 5.60	$ 29.55
								Average:	**26.4**	**$ 23.79**	**$ 6.11**	**$ 29.90**

Percent Capture =100*(Cake,%TS*(Feed, %TS - Centrate, %TS))/((Feed, %TS*(Cake, %TS - Centrate, %TS))

Dosage, lbs neat/dt =((Poly, GPM*Poly Sol,%*8.34*1.04))*2000/(Feed, GPM*8.34*Feed,%TS*0.01)

Polymer Cost/dt =Poly Dosage, lbs/dt*Poly Cost/lb

Natural Gas Cost/dry ton cake incinerated = Lookup from gas usage table

Total Disposal Cost = Polymer Cost + Natural Gas Cost

Table 3.

2005 Southerly WWTP Polymer Trials

Date: 11/15/2005
Polymer: Degussa Praestol K148L
Neat %TS: 46
Cost/lb: $ 1.02

Natural Gas Cost: $ 8.00

Time	Feed GPM	Torque, %	Poly, GPM	Feed %TS	Cake %TS	Centrate %TS	Polymer Feed Sol. %TS	Capture %	Polymer Dosage Lbs/dt	Polymer Cost/dt	Nat. Gas Cost/dt	Disposal Cost/dt
11/16/2005												
9:10	150	56	19.0	4.39	31.2	0.24	0.75%	95.3	45.0	$ 45.91	$ 2.69	$ 48.60
10:30	155	60	18.5	4.76	28.9	0.23	0.75%	95.9	39.1	$ 39.90	$ 3.63	$ 43.53
11:05	155	60	17.5	4.85	28.5	0.24	0.75%	95.9	36.3	$ 37.04	$ 4.00	$ 41.05
12:26	156	60	17.0	5.01	28.2	0.19	0.75%	96.9	33.9	$ 34.61	$ 4.29	$ 38.90
1:05	156	60	16.0	4.96	27.8	0.19	0.75%	96.8	32.3	$ 32.90	$ 4.66	$ 37.57
1:35	157	60	15.0	5.15	27.7	0.22	0.75%	96.5	28.9	$ 29.52	$ 4.76	$ 34.28
11/17/2005												
8:25	140	68	15.0	3.33	28.9	0.21	0.75%	94.5	50.2	$ 51.20	$ 3.63	$ 54.82
9:00	153	68	14.0	3.30	27.7	0.22	0.75%	94.0	43.3	$ 44.12	$ 4.76	$ 48.88
9:30	155	68	13.0	3.55	26.9	0.14	0.75%	96.7	36.9	$ 37.59	$ 5.51	$ 43.10
10:00	156	68	12.0	3.64	25.0	0.28	0.75%	93.3	33.0	$ 33.63	$ 7.30	$ 40.93
11:00	158	68	11.0	3.38	26.3	0.25	0.75%	93.5	32.1	$ 32.78	$ 6.08	$ 38.85
11:35	155	66	10.0	Bad Run Lost Centrate								
2:15	155	70	12.0	4.10	26.0	0.29	0.75%	94.0	29.5	$ 30.05	$ 6.36	$ 36.40
2:40	154	70	11.0	4.11	25.4	0.23	0.75%	95.2	27.1	$ 27.65	$ 6.92	$ 34.58
3:25	154	65	12.0	4.28	24.6	0.20	0.75%	96.2	28.4	$ 28.97	#N/A	#N/A
3:55	154	73	12.0	4.50	27.4	0.27	0.75%	95.0	27.0	$ 27.55	$ 5.04	$ 32.59
								Average:	**35.3**	**$ 36.03**	**$ 4.97**	**$ 41.00**

Percent Capture =100*(Cake,%TS*(Feed, %TS - Centrate, %TS))/((Feed, %TS*(Cake, %TS - Centrate, %TS))

Dosage, lbs neat/dt =((Poly, GPM*Poly Sol,%*8.34*1.04))*2000/(Feed, GPM*8.34*Feed,%TS*0.01)

Polymer Cost/dt =Poly Dosage, lbs/dt*Poly Cost/lb

Natural Gas Cost/dry ton cake incinerated = Lookup from gas usage table

Total Disposal Cost = Polymer Cost + Natural Gas Cost

Table 4.

2005 Southerly WWTP Polymer Trials

Date: 11/28/2005
Polymer: Tidewater
Neat %TS: 43.0
Cost/lb: $ 1.075

Natural Gas Cost: $ 8.00

Time	Feed GPM	Torque, %	Poly, GPM	Feed %TS	Cake %TS	Centrate %TS	Polymer Feed Sol. %TS	Capture %	Polymer Dosage Lbs/dt	Polymer Cost/dt	Nat. Gas Cost/dt	Disposal Cost/dt
11/28/2005												
12:30	145	57	17.0	4.79	22.6	0.66	0.50%	88.8	25.5	$ 27.36	#N/A	#N/A
13:00	146	58	18.0	4.80	24.5	0.26	0.50%	95.6	26.7	$ 28.72	#N/A	#N/A
13:30	146	59	18.0	4.81	25.6	0.29	0.50%	95.0	26.7	$ 28.66	$ 6.73	$ 35.39
14:00	146	59	17.0	4.81	24.9	0.31	0.50%	94.7	25.2	$ 27.06	#N/A	#N/A
14:30	148	62	16.0	4.84	24.7	0.29	0.50%	95.1	23.2	$ 24.97	#N/A	#N/A
15:00	148	58	15.0	4.96	23.6	0.33	0.50%	94.7	21.3	$ 22.84	#N/A	#N/A
15:30	147	58	15.0	4.90	23.4	0.35	0.50%	94.3	21.7	$ 23.28	#N/A	#N/A
11/29/2005												
9:30	144	60	16.5	5.20	28.1	0.23	0.50%	96.4	22.9	$ 24.64	$ 4.38	$ 29.02
10:00	148	62	15.5	5.06	27.1	0.28	0.50%	95.5	21.5	$ 23.14	$ 5.32	$ 28.46
10:30	148	62	15.0	5.12	27.9	0.29	0.50%	95.3	20.6	$ 22.13	$ 4.57	$ 26.70
11:00	150	65	15.0	5.33	29.4	0.25	0.50%	96.1	19.5	$ 20.98	$ 3.16	$ 24.13
11:30	148	67	14.5	5.02	29.5	0.20	0.50%	96.7	20.3	$ 21.82	$ 3.06	$ 24.88
12:00	148	69	15.0	4.70	30.1	0.26	0.50%	95.3	22.4	$ 24.11	$ 2.69	$ 26.79
12:30	149	72	15.0	4.65	32.0	0.19	0.50%	96.5	22.5	$ 24.20	$ 2.69	$ 26.89
13:00	149	70	14.0	4.51	32.2	0.18	0.50%	96.5	21.7	$ 23.29	$ 2.69	$ 25.98
13:30	149	77	13.0	4.57	31.3	0.19	0.50%	96.4	19.9	$ 21.34	$ 2.69	$ 24.03
								Average:	**21.8**	**$ 23.42**	**$ 3.70**	**$ 27.11**

Percent Capture =100*(Cake,%TS*(Feed, %TS - Centrate, %TS))/((Feed, %TS*(Cake, %TS - Centrate, %TS)) **Avg Cost**

Dosage, lbs neat/dt =((Poly, GPM*Poly Sol,%*8.34*1.04))*2000/(Feed, GPM*8.34*Feed,%TS*0.01)

Polymer Cost/dt =Poly Dosage, lbs/dt*Poly Cost/lb

Natural Gas Cost/dry ton cake incinerated = Lookup from gas usage table

Total Disposal Cost = Polymer Cost + Natural Gas Cost

Table 5.
Emulsion Field Test Summary

Bidder	Polymer Dosage Lbs/dt	Polymer Cost/dt	Nat. Gas Cost/dt	Disposal Cost/dt
Tidewater (TWC-8624)	21.8	$ 23.42	$ 3.70	$ 27.11
Polydyne (NE-1077)	26.4	$ 23.79	$ 6.11	$ 29.90
Stockhausen (Praestol K148L)	35.3	$ 36.03	$ 4.97	$ 41.00

Table 6.

2005 Southerly WWTP Polymer Trials
Mannich Bench Testing

Sludge Vol. MLs	Poly Dose MLs	Feed %TS	Poly Sol. %	Polymer Dosage Lbs/dt		Test Observations: Polydyne ($0.084/lb) 7950NR	Delta ($0.087/lb) Delta-Floc 522	Tidewater ($0.17/lb) TWC-1172
200	8.0	4.50	5.00%	92.4	10 Inversion-Gentle Mix	Poor Flocculation	No Floc observed	Poor Flocculation
					10 Inversion-Violent Mix	Floc Destroyed	No Floc observed	Floc Destroyed
200	10.0	4.50	5.00%	115.6	10 Inversion-Gentle Mix	Good Flocculation	Poor Flocculation	Good Flocculation
					10 Inversion-Violent Mix	Good Flocculation	Floc Destroyed	Still Flocculated, but floc smaller
200	12.0	4.50	5.00%	138.7	10 Inversion-Gentle Mix	Good Flocculation	Satisfactory Flocculation	Good Flocculation
					10 Inversion-Violent Mix	Good Flocculation - Best water/floc separation	Floc broken/very fine	Good Flocculation - Next best water/floc separation
200	14.0	4.50	5.00%	161.8	10 Inversion-Gentle Mix	V. Good Flocculation (May be overdosed)	Good Flocculation, but fine floc	V. Good Flocculation
					10 Inversion-Violent Mix	V. Good Flocculation-Next best water/floc separation	Floc broken/very fine, little water/floc separation	V. Good Flocculation-Best water/floc separation
200	16.0	4.50	5.00%	184.9	10 Inversion-Gentle Mix	Good Flocculation (May be overdosed)	V. Good Flocculation	V. Good Flocculation
					10 Inversion-Violent Mix	Good Flocculation-Less water/floc separation	Floc broken/very fine, little water/floc separation	V. Good Flocculation-Less water/floc separation

Table 7.

Estimated Relative Annual Mannich polymer Costs
As Calculated from Optimum Bench Test Dosages

			4/1/06 thru 3/31/07		4/1/07 thru 3/31/08		4/1/08 thru 3/31/09		
Bidder	**Biosolids Dewatered, tons/yr**	**Optimum Bench Dosage, lbs/dt**	**Bid Price/lb**	**Estimated Cost per year**	**Bid Price/lb**	**Estimated Cost per year**	**Bid Price/lb**	**Estimated Cost per year**	**Total**
Delta (Delta-Floc 522)	27,375	185	$ 0.087	$ 440,600.63	$ 0.089	$ 450,729.38	$ 0.092	$ 465,922.50	$ 1,357,252.50
Polydyne (7950NR)	27,375	139	$ 0.084	$ 319,630.50	$ 0.088	$ 334,851.00	$ 0.092	$ 350,071.50	$ 1,004,553.00
Tidewater (TWC-1172)	27,375	162	$ 0.170	$ 753,907.50	$ 0.190	$ 842,602.50	$ 0.210	$ 931,297.50	$ 2,527,807.50

Please note that above annual costs are laboratory estmates only and do not reflect what actual costs for the product will be. In practice, actual plant polymer usage is always higher than laboratory generated dosage data. The laboratory data are relative to each product and their scale-up to plant usage.

Table 8.

Mannich vs. Emulsion Cost Comparrison

Year	Biosolids Dewatered, dt/d	Biosolids Dewatered, dt/y	Mannich Polymer Avg Dosage, lbs/dt	Mannich Polymer Cost/lb	Mannich Polymer Cost/dt	Mannich Polymer Cost/y	Emulsion Polymer Avg Dosage, lbs/dt	Emulsion Polymer Cost/lb	Emulsion Polymer Cost/dt	Emulsion Polymer Cost/y	Emulsion Differential, Cost/y
2006	75	27,375	227	$0.084	$ 19.068	$ 521,986.500	21.78	$1.075	$ 23.414	$ 640,944.563	118,958.06
2007	75	27,375	227	$0.088	$ 19.976	$ 546,843.000	21.78	$1.120	$ 24.394	$ 667,774.800	120,931.80
2008	75	27,375	227	$0.092	$ 20.884	$ 571,699.500	21.78	$1.180	$ 25.700	$ 703,548.450	131,848.95