10

Sediment Quantity in the San Luis Drain

October 1, 2001 – December 31, 2002

Joseph C. McGahan[1]

Grassland Bypass Project

1 Drainage Coordinator, Grassland Area Farmers. Summers Engineering, Inc. PO Box 1122, Hanford, California 93232 (559) 582-9237, California

Grassland Area Farmers

The purpose of this aspect of the Grassland Bypass Monitoring Program (Monitoring Program) is to determine the changes in quantity and movement of sediment in the San Luis Drain (SLD). This is accomplished by actual measurement of the bed sediment and using total suspended solids measurements at the inlet and outlet of the SLD.

Sediment Quantity Monitoring Procedure

Section 11.4 of the Compliance Monitoring Program Phase II (USBR et al., 2001) describes the procedure to measure the quantity of sediment in the SLD. The Monitoring Program calls for the measurement of sediment in four reaches of the SLD (Reaches 1, 10, 14, and 17). The locations of the sediment measurement points duplicated those of the March of 1987 survey performed by Summers Engineering. San Luis & Delta-Mendota Water Authority Personnel performed the sediment survey in November of 2002. The sediment bed was cross-sectioned at regular intervals in all 19 reaches of the SLD, with depth-to-sediment measurements taken at both banks and in the middle of the channel. These three measurements were used to calculate an average volume of sediment per foot of channel, which was then used to estimate the total volume of sediment in the SLD from Check 19 to the outlet at Mud Slough (North).

Table 1 summarizes the results. The results are also shown graphically in Figure 1. The results indicate that there is a net increase of 22,700 cubic yards from November 2001 to November 2002, compared to a net increase of 25,700 cubic yards from July 1999 to August 2000 and 21,400 cubic yards from August 2000 to November 2001. An estimated total of 97,900 cubic yards of sediment has accumulated in the SLD since 1997.

Survey measurements indicated that individual reaches of the SLD gained a maximum of 3,800 cubic yards (Pool 14), and lost a maximum of 160 cubic yards (Pool 16) as compared to the 2001 sediment survey. The average depth of sediment throughout the SLD was 2.6 feet, with a maximum depth of 6.7 feet measured in Pool 15 (see Figure 2).

In general, sediment accumulation is occurring in the first 5 reaches (Pools 18 to 14), as the suspended solids drop out of the water column upon entering the SLD. The water velocity within the SLD is kept below 1 foot per second to prevent the suspension of material from the sediment bed. The slower velocity also increases the rate at which suspended solids drop out of the water column.

Total Suspended Solids Measurements

The Monitoring Program calls for total suspended solids (TSS) measurements as part of the water quality monitoring. These measurements were to be taken just downstream of the inlet to the SLD (Site A) and just upstream of the outlet (Site B). Measurements were taken on a weekly basis at these sites. The monthly averages are shown for WY 1997 through December 2002 in Table 2. Overall, the 2002 data (including the last three months of 2001) show that TSS concentrations at Site A are higher than at Site B by a factor of 2.5, averaged over the entire 15 month period. One commitment of the GBP was to minimize flows so as to not cause sediment movement or suspension of sediments from the bottom of the SLD. The data suggest that the

suspended sediments are settling in the SLD and that there is no net movement or suspension of sediments.

References

U.S. Bureau of Reclamation et al. 2001. Compliance Monitoring Program for Use and Operation of the Grassland Bypass Project, Phase II, March 2002. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

U.S. Bureau of Reclamation et al. 1996. Compliance Monitoring Program for Use and Operation of the Grassland Bypass Project, September 1996. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

Table 1. 2002 San Luis Drain Sediment Survey
Survey Summary and Comparison

			March 1987		June-Sept. 1997		July 1998		July 1999		August 2000		November 2001		November 2002	
Pool	Checks	Distance	Volume	Vol / mile	Volume	Vol / mile	Volume	Vol / mile	Volume	Vol / mile	Volume	Vol / mile	Volume	Vol / mile	Volume	Vol / mile
		(miles)	(cu yd)	(cu yd/mi)	(cu yd)	(cu yd/mi)	(cu yd)	(cu yd/mi)	(cu yd)	(cu yd/mi)	(cu yd)	(cu yd/mi)	(cu yd)	(cu yd/mi)	(cu yd)	(cu yd/mi)
End	End to 1	2.64	3,176	1,203	1,697	643	2,795	1,059	3,602	1,364	4,451	1,686	5,611	2,125	6,338	2,401
1*	1 to 2	1.82	2,567	1,410	1,840	1,011	3,375	1,854	4,514	2,480	5,306	2,915	5,487	3,015	7,661	4,209
2	2 to 3	0.28	1,059	3,781	531	1,896	955	3,411	872	3,114	836	2,986	1,748	6,242	2,496	8,914
3	3 to 4	2.57	4,909	1,910	3,350	1,304	4,839	1,883	3,244	1,262	5,582	2,172	6,404	2,492	9,349	3,638
4	4 to 5	1.80	4,440	2,467	6,521	3,623	9,049	5,027	6,760	3,756	8,968	4,982	9,836	5,465	11,496	6,387
5	5 to 6	2.06	4,242	2,059	4,370	2,121	4,596	2,231	4,139	2,009	5,679	2,757	6,481	3,146	7,765	3,770
6	6 to 7	0.83	2,160	2,602	2,584	3,113	2,432	2,930	1,762	2,123	2,416	2,910	2,321	2,797	3,530	4,253
7	7 to 8	0.45	3,935	8,744	3,278	7,285	3,135	6,967	3,099	6,887	3,068	6,817	2,842	6,315	2,990	6,644
8	8 to 9	0.47	907	1,931	816	1,736	778	1,655	627	1,334	1,420	3,022	1,600	3,404	1,775	3,776
9	9 to 10	3.20	6,963	2,176	6,390	1,997	8,571	2,678	4,632	1,448	8,797	2,749	9,364	2,926	10,420	3,256
10*	10 to 11	1.46	2,647	1,813	2,708	1,855	2,781	1,905	3,101	2,124	3,669	2,513	3,835	2,626	4,975	3,408
11	11 to 12	2.50	4,835	1,934	4,947	1,979	7,620	3,048	6,499	2,600	10,194	4,078	10,900	4,360	13,692	5,477
12	12 to 13	0.46	784	1,705	909	1,977	1,504	3,270	629	1,367	2,274	4,942	1,966	4,273	2,324	5,052
13	13 to 14	0.91	2,038	2,240	1,771	1,946	2,657	2,920	2,709	2,977	3,835	4,215	4,378	4,811	5,884	6,466
14*	14 to 15	1.34	2,304	1,719	3,803	2,838	5,427	4,050	12,030	8,978	11,466	8,557	14,917	11,132	18,720	13,970
15	15 to 16	0.96	1,822	1,898	2,700	2,813	6,456	6,725	11,699	12,186	15,420	16,062	18,661	19,438	19,214	20,015
16	16 to 17	1.68	5,863	3,490	7,605	4,527	10,482	6,239	12,895	7,676	14,691	8,745	21,132	12,578	20,971	12,483
17*	17 to 18	0.68	1,885	2,772	3,006	4,420	2,435	3,581	3,205	4,713	3,477	5,113	4,900	7,206	5,318	7,821
18	18 to 19	0.97	1,558	1,607	1,768	1,822	2,519	2,597	2,603	2,684	2,819	2,906	3,427	3,533	3,571	3,681
Totals		27.08	58,094		60,594		82,406		88,621		114,368		135,809		158,489	
Averages				2,145		2,238		3,370		3,741		4,744		5,678		6,612

Data source: Summers Engineering Inc.

Note: * Required by Grassland Bypass Monitoring Program

Table 2. Total Suspended Solids (Monthly Average) October 1996 - December 2001

Date	Site A TSS mg/L	Site B TSS mg/L
Oct. 96	92	38
Nov. 96	59	8
Dec. 96	77	19
Jan. 97	135	23
Feb. 97	57	31
Mar. 97	94	33
Apr. 97	111	38
May 97	101	56
Jun. 97	107	27
Jul. 97	136	21
Aug. 97	140	22
Sept. 97	111	22
WY 1997 Average	102	28
Oct. 97	51	24
Nov. 97	86	19
Dec. 97	45	36
Jan. 98	61	24
Feb. 98	243	143
Mar. 98	290	114
Apr. 98	200	69
May 98	270	86
Jun. 98	123	42
Jul. 98	171	49
Aug. 98	94	44
Sept. 98	37	33
WY 1998 Average	139	57
Oct. 98	43	61
Nov. 98	28	40
Dec. 98	19	30
Jan. 99	54	19
Feb. 99	149	50
Mar. 99	57	33
Apr. 99	43	38
May 99	97	60
Jun. 99	160	68
Jul. 99	145	65
Aug. 99	166	61
Sept. 99	69	71
WY 1999 Average	86	49

Date	Site A TSS mg/L	Site B TSS mg/L
Oct. 99	73	57
Nov. 99	62	43
Dec. 99	26	51
Jan. 00	67	64
Feb. 00	250	71
Mar. 00	148	57
Apr. 00	134	69
May 00	165	45
Jun. 00	136	63
Jul. 00	99	53
Aug. 00	120	58
Sept. 00	59	57
WY 2000 Average	111	57
Oct. 00	63	51
Nov. 00	36	44
Dec. 00	46	46
Jan. 01	49	40
Feb. 01	108	33
Mar. 01	84	41
Apr. 01	67	41
May 01	188	46
Jun. 01	184	42
Jul. 01	142	41
Aug. 01	116	41
Sept. 01	65	pending
WY 2001 Average	96	42
Oct. 01	164	39
Nov. 01	75	37
Dec. 01	32	42
Jan. 02	43	38
Feb. 02	108	36
Mar. 02	110	42
Apr. 02	58	30
May 02	193	51
Jun. 02	267	55
Jul. 02	138	51
Aug. 02	117	48
Sept. 02	96	36
WY 2002 Average	117	42
Oct. 02	73	49
Nov. 02	44	45
Dec. 02	60	39
Fifteen Month Average	105	42

Figure 1 - San Luis Drain Sediment Survey Comparison

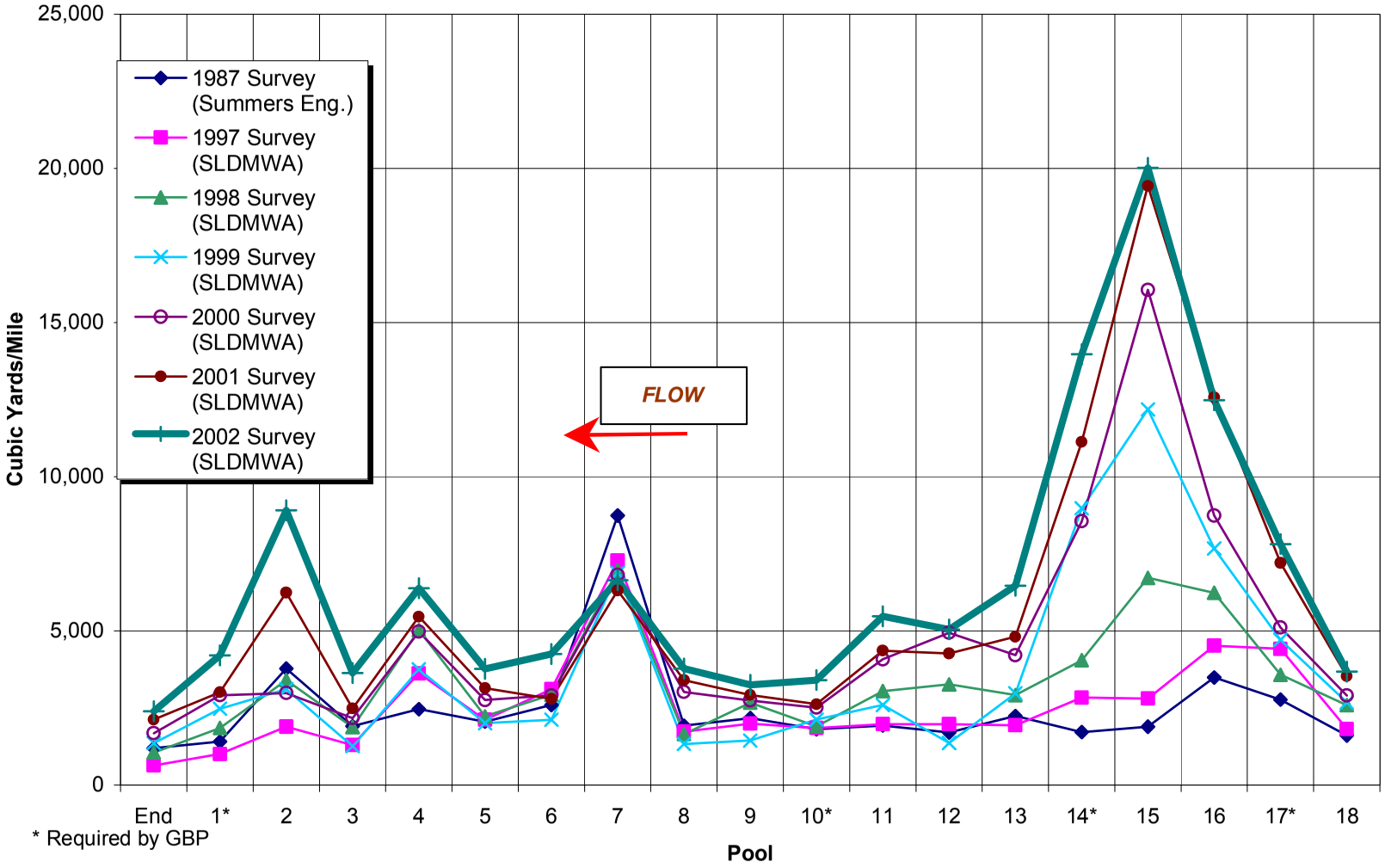
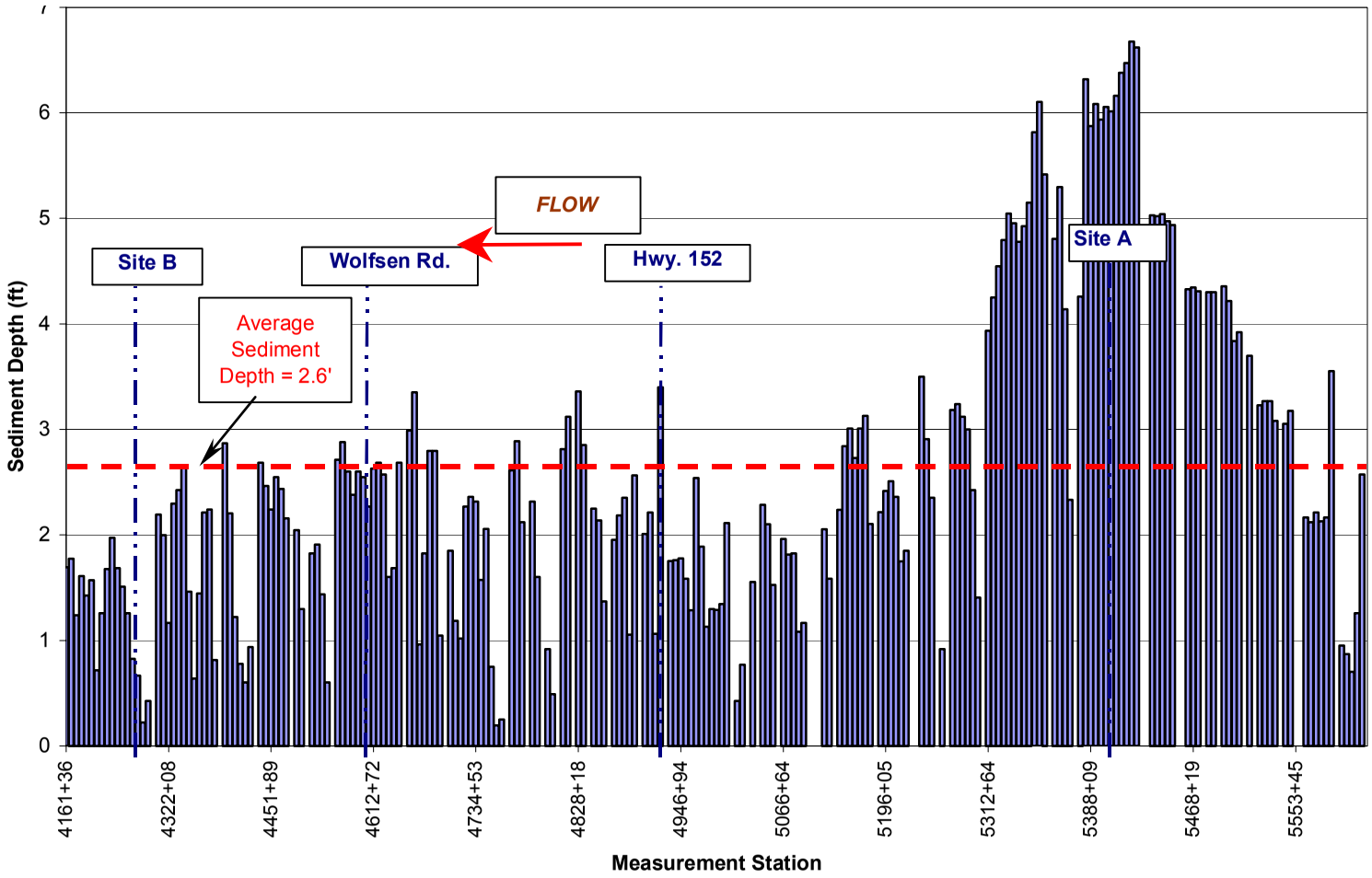
Figure 2: San Luis Drain November 2002 Sediment Depth