

APPENDIX F – DAILY LOADS

F1.0 OVERVIEW

A percent reduction based on average yearly loading was used as the primary approach for expressing the sediment TMDLs within this document because there is uncertainty associated with loads derived from the source assessment, and using the estimated sediment loads alone creates a rigid perception that the loads are absolutely conclusive. However, in this appendix the TMDL is expressed using daily loads to satisfy an additional EPA required TMDL element. Daily loads should not be considered absolute limits for a given day and may be refined in the future as part of the adaptive management process. The TMDLs may not be feasible at all locations within the watershed but if the allocations are followed, sediment loads are expected to be reduced to a degree that the sediment targets are met and beneficial uses are no longer impaired. It is not expected that daily loads will drive implementation activities.

F2.0 APPROACH

In order to determine a daily load, the means of daily mean values for suspended sediment discharge in tons per day were reviewed from a USGS gage station on the Clark Fork River. The USGS station on the Clark Fork River at Deer Lodge (12324200) was selected to represent the daily variability in sediment loading in the Flint Creek TPA due to its relative proximity to the Flint Creek watershed, and therefore similar climate; its reasonably similar land uses; fairly similar drainage area (Upper Clark Fork watershed to Deer Lodge (excluding the area draining to Warm Springs Ponds) = 618 sq miles, Flint Creek TPA = 500 sq miles) and the fact that it actually had a period of record for annual total suspended sediment, whereas most USGS stations in the region do not have daily sediment data. Although there is some variability in size between the Upper Clark Fork watershed and the Flint Creek TPA, the true size of the streams is of less concern in this case because it is the relationship between sediment load (a function of sediment concentration and flow) and the day of the year that is the primary focus for this analysis. It is assumed that the hydrologic properties and rate of loading on a given day are similar enough to the Flint Creek TPA to discern relative percentages and distribution of an annual load to each day in the calendar year.

The mean of daily mean values for suspended sediment discharge, in tons per day, was calculated based on approximately 26 years of record (October 1, 1984 – September 30, 2010) (**Table F-1**). The mean annual suspended sediment load for USGS gage 12324200, based on a summation of the mean of daily mean values is 9,368 tons per year. Although the suspended sediment load represents a portion of the total load from the source assessment, it provides an approximation of the relationship between sediment and flow in the Upper Clark Fork, which can in turn be used to mirror conditions in the Flint Creek watershed. Using the mean of daily mean sediment loads, a daily percentage relative to the mean annual suspended sediment load was calculated for each day (**Table F-2**). **Figure F-1** visually represents the average daily percentage of the total yearly sediment load for each day of the calendar year.

To conserve resources, this appendix only provides the base data from the USGS stream gage, and the daily percentages of the total annual load. For specific streams, all daily TMDLs may be derived by using

the daily percentages in **Table F-2** and the TMDLs expressed as an average annual load, which are discussed in **Section 5.6**. For instance, the total allowable annual sediment load for Smart Creek is 691 tons. To determine the TMDL for January 1, this value is multiplied by 1.12% which provides a daily load for January 1st for Smart Creek of 7.7 tons. The daily loads are a composite of the allocations, but as allocations are not feasible on a daily basis, they are not contained within this appendix. If desired, daily allocations may be obtained by applying allocations provided in **Section 5.6** to the daily load.

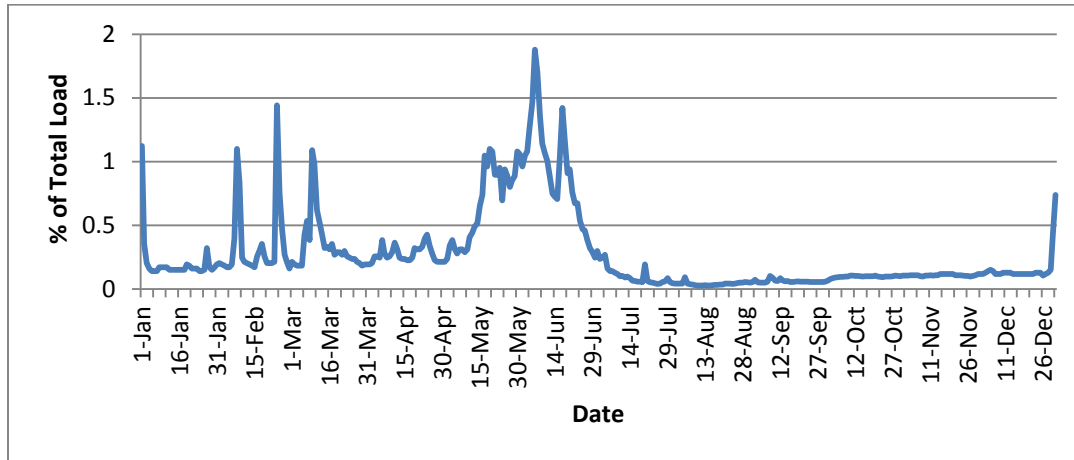


Figure F-1. Average daily percentage of the total yearly sediment load

The percent of total daily sediment loading information from the USGS gage station on the Clark Fork River at Deer Lodge in **Figure F-1** illustrates the fluctuating nature of sediment loads, driven by climate and precipitation, in many western Montana streams. In general, it appears that elevated sediment loading is most closely linked to spring runoff, with occasional sporadic elevated loads, probably as the result of individual runoff events, mostly in winter and early spring, potentially as a result of wet spring snows with rapid melting or rain-on-snow events.

Table F-1. Average Suspended Sediment Discharge, (Calculation Period 1984-10-01 -> 2010-09-30)

Day of month	Mean of daily mean values for each day of record in tons/day											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	105	19	20	18	20	90	28	3.9	5.1	6	9.7	11
2	33	18	18	19	22	98	22	4	6.7	7.1	9.8	11
3	19	17	17	24	32	101	23	3.9	4.9	7.8	10	12
4	15	16	17	24	36	120	25	3.8	4.5	8.4	10	13
5	13	16	17	23	29	137	15	8.5	4.6	8.7	10	14
6	13	18	40	36	26	176	13	3.8	4.6	8.9	10	13
7	13	37	50	26	29	159	13	3.4	5.4	8.9	9.4	11
8	16	103	36	23	29	127	12	3.1	9.6	9.2	9.2	11
9	16	78	102	24	27	107	11	2.8	8.1	9.1	9.7	11
10	16	23	92	27	29	100	9.4	2.4	6.1	9.7	9.9	12
11	16	20	58	34	38	94	9.6	2.4	5.9	9.8	10	12
12	14	19	49	29	41	82	8.3	2.6	7.9	9.6	9.9	12
13	14	18	40	23	46	70	9	2.7	6.3	9.6	10	12
14	14	17	30	22	48	68	7.8	2.6	5.6	9.4	10	11
15	14	16	31	22	61	66	6.1	2.5	5.7	9.2	11	11
16	14	24	29	21	69	97	5.9	2.8	5	9.4	11	11
17	14	28	33	21	98	133	5.4	3	5	9.3	11	11
18	14	33	25	23	90	108	5.3	3	5.4	9.3	11	11
19	18	24	27	30	103	85	5.1	3.2	5.5	9.3	11	11
20	17	19	27	29	101	88	18	3.3	5.4	9.8	11	11
21	15	19	25	29	84	71	5.9	3.9	5.4	9.2	10	11
22	15	19	28	31	84	63	4.8	4	5.3	8.9	10	11
23	15	20	24	37	89	63	4.5	3.9	5.4	8.7	10	12
24	13	135	23	40	65	50	4.1	3.7	5.2	9	9.9	12
25	13	71	22	32	88	44	3.6	3.8	5.2	9.2	9.6	12
26	14	44	22	26	83	43	4	4.3	5.2	9.1	9.5	9.8
27	30	25	20	21	75	36	5.2	4.7	5	9.4	9.2	11
28	16	20	19	20	80	30	5.5	4.5	5.1	9.7	9.5	12
29	14	15	17	20	83	27	8	5	5.1	9.6	10	14
30	16		18	20	101	23	5.2	4.9	5.3	9.4	11	41
31	18		18		99		4.1	4.5		9.7		69

Table F-2. Suspended Sediment Discharge, Percentage of tons per day based on the annual load

Day of month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.12	0.20	0.21	0.19	0.21	0.96	0.30	0.04	0.05	0.06	0.10	0.12
2	0.35	0.19	0.19	0.20	0.23	1.05	0.23	0.04	0.07	0.08	0.10	0.12
3	0.20	0.18	0.18	0.26	0.34	1.08	0.25	0.04	0.05	0.08	0.11	0.13
4	0.16	0.17	0.18	0.26	0.38	1.28	0.27	0.04	0.05	0.09	0.11	0.14
5	0.14	0.17	0.18	0.25	0.31	1.46	0.16	0.09	0.05	0.09	0.11	0.15
6	0.14	0.19	0.43	0.38	0.28	1.88	0.14	0.04	0.05	0.10	0.11	0.14
7	0.14	0.39	0.53	0.28	0.31	1.70	0.14	0.04	0.06	0.10	0.10	0.12
8	0.17	1.10	0.38	0.25	0.31	1.36	0.13	0.03	0.10	0.10	0.10	0.12
9	0.17	0.83	1.09	0.26	0.29	1.14	0.12	0.03	0.09	0.10	0.10	0.12
10	0.17	0.25	0.98	0.29	0.31	1.07	0.10	0.03	0.07	0.10	0.11	0.13
11	0.17	0.21	0.62	0.36	0.41	1.00	0.10	0.03	0.06	0.10	0.11	0.13
12	0.15	0.20	0.52	0.31	0.44	0.88	0.09	0.03	0.08	0.10	0.11	0.13
13	0.15	0.19	0.43	0.25	0.49	0.75	0.10	0.03	0.07	0.10	0.11	0.13
14	0.15	0.18	0.32	0.23	0.51	0.73	0.08	0.03	0.06	0.10	0.11	0.12
15	0.15	0.17	0.33	0.23	0.65	0.70	0.07	0.03	0.06	0.10	0.12	0.12
16	0.15	0.26	0.31	0.22	0.74	1.04	0.06	0.03	0.05	0.10	0.12	0.12
17	0.15	0.30	0.35	0.22	1.05	1.42	0.06	0.03	0.05	0.10	0.12	0.12
18	0.15	0.35	0.27	0.25	0.96	1.15	0.06	0.03	0.06	0.10	0.12	0.12
19	0.19	0.26	0.29	0.32	1.10	0.91	0.05	0.03	0.06	0.10	0.12	0.12
20	0.18	0.20	0.29	0.31	1.08	0.94	0.19	0.04	0.06	0.10	0.12	0.12
21	0.16	0.20	0.27	0.31	0.90	0.76	0.06	0.04	0.06	0.10	0.11	0.12
22	0.16	0.20	0.30	0.33	0.90	0.67	0.05	0.04	0.06	0.10	0.11	0.12
23	0.16	0.21	0.26	0.39	0.95	0.67	0.05	0.04	0.06	0.09	0.11	0.13
24	0.14	1.44	0.25	0.43	0.69	0.53	0.04	0.04	0.06	0.10	0.11	0.13
25	0.14	0.76	0.23	0.34	0.94	0.47	0.04	0.04	0.06	0.10	0.10	0.13
26	0.15	0.47	0.23	0.28	0.89	0.46	0.04	0.05	0.06	0.10	0.10	0.10
27	0.32	0.27	0.21	0.22	0.80	0.38	0.06	0.05	0.05	0.10	0.10	0.12
28	0.17	0.21	0.20	0.21	0.85	0.32	0.06	0.05	0.05	0.10	0.10	0.13
29	0.15	0.16	0.18	0.21	0.89	0.29	0.09	0.05	0.05	0.10	0.11	0.15
30	0.17		0.19	0.21	1.08	0.25	0.06	0.05	0.06	0.10	0.12	0.44
31	0.19		0.19		1.06		0.04	0.05		0.10		0.74