

APPENDIX D - SEDIMENT TOTAL MAXIMUM DAILY LOADS

D1.0 SEDIMENT

D1.1 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 the 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 absolutely conclusive and may be refined in the future as part of the adaptive management process. It is not expected that daily loads will drive implementation activities.

D1.2 APPROACH

The preferred approach for calculating daily sediment loads is to use a nearby water quality gage with a long-term dataset for flow and suspended sediment. Within the Flathead-Stillwater TPA, there is one USGS gage station with an extensive discharge dataset for a stream segment with a TMDL in this document. Since sediment loading in the Flathead-Stillwater TPA is associated with nonpoint sources and stormwater related point sources, the hydrograph is assumed to be a reasonable surrogate for sediment loading to streams (i.e. peak contributions during periods of runoff and high flow). Therefore, mean daily discharge values from seven years of record (2006-2013) at the gage on the Stillwater River at Lawrence Park, Kalispell, MT (#12365700) were used to provide the bases for calculating daily sediment values for TMDLs in the Flathead-Stillwater TPA.

Using the mean of daily mean discharge values from the gage, a daily percentage relative to the mean annual discharge was calculated for each day (**Table D-1**). For each TMDL, the daily load can be calculated by multiplying the daily percentages in **Table D-1** by the total average annual load associated with the TMDL percent reductions in **Section 6.6.3** of the main document (**Table D-3** in this appendix). For instance, the total allowable annual sediment load for the Stillwater River is 15,117.9 tons. To determine the TMDL for January 1, 15,117.9 tons is multiplied by 0.06% which provides a daily load for the Stillwater River on January 1st of 9.1 tons. To conserve resources, this appendix contains the daily loads for the Stillwater River as an example (**Table D-2** and **Figure D-1**). Daily loads for all other TMDLs can be calculated by multiplying the percentages in **Table D-1** by the values in **Table D-3**. 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 6.6.3** of the main document to the daily load.

Table D-1. USGS Stream Gage 12365700 (Stillwater River at Lawrence Park, Kalispell, MT) - Percent of mean annual discharge based on mean daily discharge values for each date of record (calculation period 2006-10-01 → 2013-09-30)

Day of month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.06%	0.06%	0.06%	0.20%	0.72%	0.92%	0.62%	0.19%	0.10%	0.08%	0.09%	0.08%
2	0.06%	0.06%	0.06%	0.22%	0.71%	0.90%	0.59%	0.18%	0.10%	0.08%	0.09%	0.08%
3	0.06%	0.06%	0.07%	0.24%	0.70%	0.89%	0.58%	0.18%	0.09%	0.08%	0.10%	0.08%
4	0.06%	0.06%	0.07%	0.27%	0.68%	0.89%	0.56%	0.18%	0.09%	0.08%	0.10%	0.08%
5	0.07%	0.06%	0.07%	0.29%	0.69%	0.89%	0.54%	0.18%	0.09%	0.08%	0.09%	0.08%
6	0.07%	0.06%	0.07%	0.31%	0.69%	0.89%	0.51%	0.17%	0.09%	0.08%	0.09%	0.08%
7	0.07%	0.06%	0.07%	0.33%	0.72%	0.89%	0.49%	0.17%	0.09%	0.08%	0.09%	0.09%
8	0.06%	0.06%	0.07%	0.34%	0.74%	0.89%	0.46%	0.16%	0.09%	0.08%	0.09%	0.08%
9	0.06%	0.06%	0.07%	0.35%	0.77%	0.90%	0.44%	0.16%	0.09%	0.09%	0.09%	0.09%
10	0.06%	0.06%	0.08%	0.35%	0.80%	0.92%	0.42%	0.15%	0.09%	0.09%	0.09%	0.08%
11	0.06%	0.06%	0.08%	0.36%	0.82%	0.94%	0.40%	0.15%	0.09%	0.08%	0.09%	0.08%
12	0.06%	0.06%	0.09%	0.37%	0.84%	0.94%	0.38%	0.14%	0.09%	0.08%	0.09%	0.08%
13	0.06%	0.06%	0.09%	0.38%	0.86%	0.92%	0.36%	0.14%	0.09%	0.08%	0.09%	0.08%
14	0.06%	0.06%	0.10%	0.41%	0.90%	0.88%	0.35%	0.14%	0.09%	0.08%	0.09%	0.08%
15	0.06%	0.06%	0.10%	0.43%	0.95%	0.84%	0.35%	0.14%	0.08%	0.08%	0.09%	0.08%
16	0.06%	0.06%	0.10%	0.45%	0.99%	0.82%	0.34%	0.14%	0.08%	0.08%	0.09%	0.07%
17	0.06%	0.06%	0.11%	0.45%	1.04%	0.80%	0.33%	0.13%	0.08%	0.08%	0.09%	0.07%
18	0.06%	0.06%	0.12%	0.46%	1.10%	0.79%	0.32%	0.13%	0.08%	0.09%	0.09%	0.07%
19	0.06%	0.06%	0.12%	0.46%	1.15%	0.78%	0.31%	0.13%	0.08%	0.08%	0.09%	0.07%
20	0.06%	0.05%	0.12%	0.47%	1.16%	0.80%	0.30%	0.12%	0.09%	0.08%	0.09%	0.07%
21	0.06%	0.05%	0.13%	0.48%	1.18%	0.82%	0.29%	0.12%	0.09%	0.08%	0.08%	0.07%
22	0.06%	0.06%	0.14%	0.50%	1.19%	0.82%	0.27%	0.12%	0.09%	0.08%	0.09%	0.07%
23	0.06%	0.06%	0.14%	0.53%	1.18%	0.81%	0.27%	0.11%	0.09%	0.09%	0.08%	0.07%
24	0.06%	0.06%	0.15%	0.56%	1.15%	0.80%	0.26%	0.11%	0.09%	0.09%	0.08%	0.07%
25	0.06%	0.05%	0.15%	0.59%	1.12%	0.78%	0.25%	0.11%	0.09%	0.09%	0.08%	0.07%
26	0.06%	0.05%	0.16%	0.63%	1.09%	0.76%	0.24%	0.10%	0.09%	0.09%	0.08%	0.07%
27	0.06%	0.06%	0.17%	0.67%	1.04%	0.74%	0.23%	0.10%	0.09%	0.09%	0.08%	0.07%
28	0.06%	0.06%	0.18%	0.70%	1.01%	0.71%	0.22%	0.10%	0.09%	0.09%	0.08%	0.07%
29	0.06%		0.19%	0.71%	0.99%	0.68%	0.21%	0.10%	0.09%	0.09%	0.08%	0.07%
30	0.06%		0.19%	0.73%	0.97%	0.64%	0.20%	0.10%	0.09%	0.09%	0.08%	0.07%
31	0.06%		0.19%		0.94%		0.20%	0.10%		0.09%		0.06%

Table D-2. Daily TMDL for the Stillwater River in tons

Day of month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	9.3	8.7	9.6	31.4	112.4	143.0	95.6	29.7	15.1	12.3	14.5	13.0
2	9.2	9.0	9.9	34.3	110.8	140.6	91.9	28.6	14.9	12.2	14.7	13.1
3	9.1	8.7	10.2	37.8	108.1	138.3	89.8	28.4	14.7	12.4	14.8	12.9
4	9.3	9.3	10.6	41.8	106.2	138.3	86.7	28.1	14.4	12.4	14.8	12.6
5	10.4	9.6	11.5	45.0	106.6	138.3	83.3	27.3	14.3	12.5	14.7	12.6
6	10.2	9.8	11.1	48.3	107.8	138.3	79.2	26.6	14.3	12.8	14.7	12.5
7	10.3	9.6	11.3	51.0	111.2	138.3	75.4	26.0	14.3	13.0	14.5	13.2
8	10.0	9.1	11.2	52.3	115.3	138.3	72.0	25.1	14.3	13.1	14.5	13.1
9	10.0	8.7	11.1	54.4	119.3	139.4	68.5	24.1	14.2	13.2	14.5	13.2
10	9.8	8.6	12.4	54.9	124.1	143.0	65.5	23.4	14.3	13.2	14.4	13.0
11	9.3	8.7	13.1	55.7	127.6	146.5	62.4	23.0	14.2	13.1	14.3	12.6
12	9.0	9.2	14.3	56.8	130.0	146.5	59.1	22.3	13.9	13.0	14.3	12.8
13	9.3	9.1	14.4	59.7	133.5	143.0	56.2	21.7	13.6	13.0	14.5	12.8
14	9.3	9.3	14.8	63.1	139.4	137.1	54.4	21.6	13.5	13.0	14.7	12.4
15	9.6	9.3	15.2	67.2	147.7	131.2	53.8	21.5	13.0	12.9	14.7	11.8
16	9.6	9.0	15.8	69.2	153.6	127.6	52.9	21.0	12.8	13.0	14.2	11.0
17	9.1	9.0	17.4	70.0	161.9	124.1	51.5	20.6	12.6	13.0	14.2	11.0
18	9.6	8.9	18.7	70.8	171.3	122.9	50.2	20.1	12.8	13.2	13.8	10.5
19	9.1	8.7	18.9	71.6	178.4	121.7	48.7	19.5	13.0	13.1	13.4	10.8
20	8.9	8.4	19.0	72.3	180.8	124.1	46.6	18.9	13.2	13.0	13.4	10.6
21	9.2	8.5	20.1	74.2	183.2	127.6	44.3	18.4	13.5	13.0	13.1	10.5
22	9.1	8.6	21.4	78.1	184.3	127.6	42.5	18.1	13.6	13.1	13.4	10.4
23	8.9	8.9	22.3	82.1	183.2	126.4	41.4	17.7	13.7	13.2	13.0	10.5
24	8.9	8.7	23.0	86.5	178.4	124.1	40.4	17.1	13.8	13.5	12.9	10.9
25	9.2	8.5	23.8	92.2	173.7	121.7	38.8	16.5	13.8	13.6	12.4	10.9
26	9.2	8.4	24.7	98.2	169.0	118.2	37.1	16.3	14.1	13.6	13.0	10.9
27	9.2	8.9	26.8	103.6	161.9	114.3	35.8	16.1	13.9	13.7	12.9	10.4
28	9.1	9.1	28.6	108.0	157.2	110.1	34.1	15.8	13.7	13.8	12.8	10.4
29	9.1		29.3	111.1	153.6	105.2	33.0	15.6	13.5	13.9	13.0	10.5
30	8.9		29.4	112.8	150.1	100.2	31.3	15.6	13.2	14.1	12.6	10.2
31	8.9		30.1		146.5		30.4	15.4		14.3		9.6

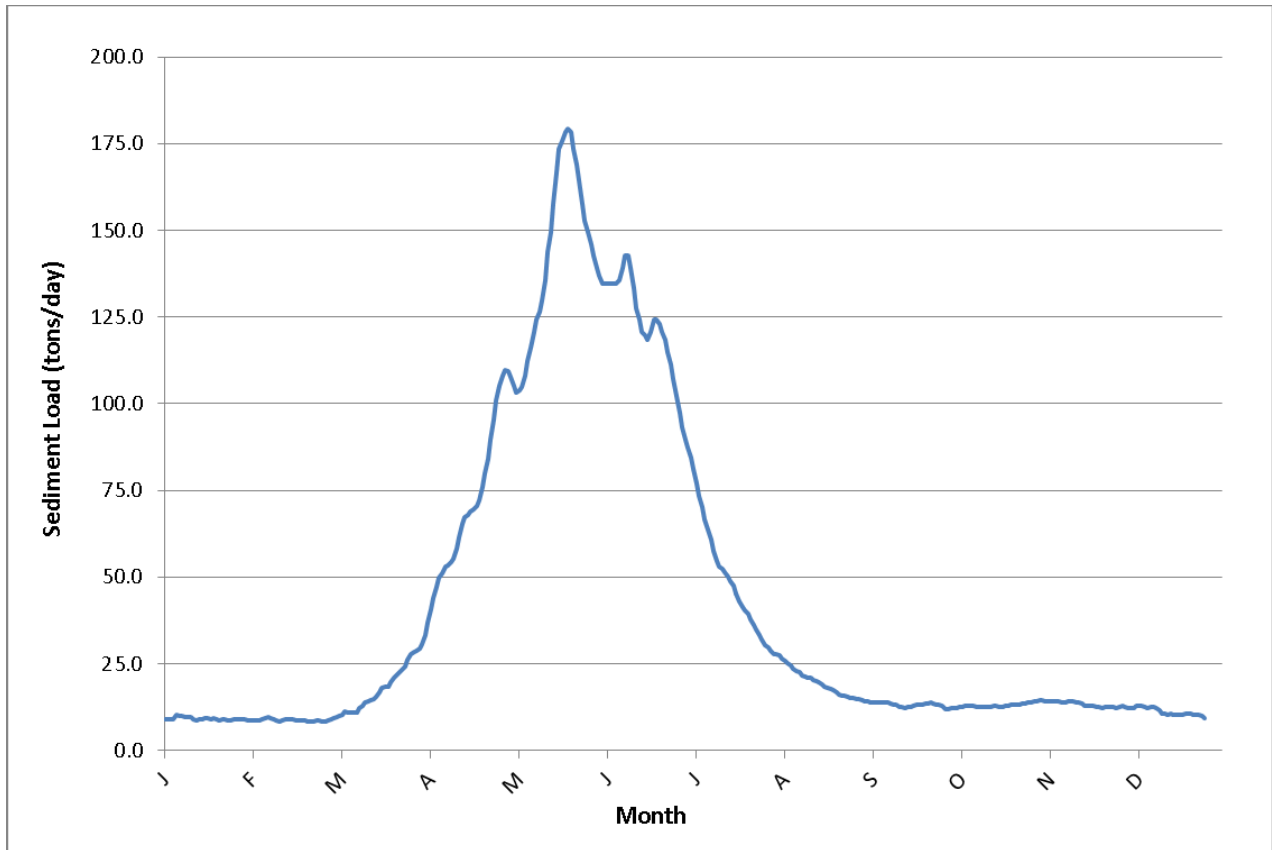


Figure D-1. Total maximum daily load for sediment in the Stillwater River

Table D-3. TMDLs expressed as an average annual load that can be used in conjunction with the values in Table D-1 to compute daily loads

Stream segment	Waterbody ID	TMDL expressed as average annual load (tons/year)
Ashley Creek, Ashley Lake to Smith Lake	MT76O002_010	344.3
Ashley Creek, Smith Lake to Kalispell Airport Road	MT76O002_020	652.7
Ashley Creek, Kalispell airport road to mouth (Flathead River)	MT76O002_030	934.2
Haskill Creek, Haskill Basin Pond to mouth (Whitefish River)	MT76P003_070	651.2
Logan Creek, headwaters to mouth (Tally Lake)	MT76P001_030	2,993.65
Sheppard Creek, headwaters to mouth (Griffin Creek)	MT76P001_050	546.1
Stillwater River, Logan Creek to mouth	MT76P001_010	15,117.9