

## **APPENDIX D - SEDIMENT TOTAL MAXIMUM DAILY LOADS**

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## **ACRONYMS**

<b>Acronym</b>	<b>Definition</b>
TMDL	Total Maximum Daily Load
TPA	TMDL Planning Area
USGS	United States Geological Survey

## D1.0 SEDIMENT

### D1.1 OVERVIEW

A percent reduction based on average yearly loading was used as the primary approach for expressing the sediment Total Maximum Daily Loads (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 Environmental Protection Agency 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. Since sediment loading in the Upper Clark Fork TMDL Planning Area (TPA) is associated with small point sources, 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 10 years of record (2003–2013) at the gage on the Clark Fork River at Goldcreek (#12324680) were used to calculate daily sediment values for TMDLs in the Upper Clark Fork 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 5.9** of the main document. For instance, the total allowable annual sediment load for the Clark Fork River (Little Blackfoot River to Flint Creek) is 21,478 tons. To determine the TMDL for January 1<sup>st</sup>, 21,478 tons is multiplied by 0.16% which provides a daily load for the Clark Fork River (Little Blackfoot River to Flint Creek) on January 1<sup>st</sup> of 34.1 tons. To conserve resources, this appendix contains the daily loads for the Clark Fork River (Little Blackfoot River to Flint Creek) 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 5.9** of the main document to the daily load.

**Table D-1. USGS Stream Gage 12324680 (Clark Fork River at Goldcreek, Montana) – Percent of Mean Annual Discharge Based on Mean of Daily Mean Discharge Values for each Day of Record (Calculation Period 2003-10-01 → 2013-09-30)**

Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.16%	0.17%	0.20%	0.27%	0.35%	0.67%	0.48%	0.14%	0.12%	0.15%	0.21%	0.21%
2	0.16%	0.17%	0.19%	0.26%	0.34%	0.71%	0.50%	0.14%	0.13%	0.16%	0.21%	0.20%
3	0.16%	0.17%	0.20%	0.25%	0.34%	0.77%	0.46%	0.14%	0.13%	0.16%	0.21%	0.20%
4	0.16%	0.18%	0.21%	0.24%	0.36%	0.81%	0.43%	0.13%	0.12%	0.16%	0.21%	0.20%
5	0.16%	0.19%	0.22%	0.25%	0.35%	0.81%	0.42%	0.13%	0.12%	0.17%	0.21%	0.19%
6	0.16%	0.19%	0.22%	0.27%	0.34%	0.84%	0.40%	0.13%	0.12%	0.18%	0.21%	0.20%
7	0.17%	0.19%	0.21%	0.28%	0.34%	0.90%	0.38%	0.13%	0.12%	0.18%	0.21%	0.19%
8	0.18%	0.18%	0.23%	0.28%	0.35%	0.93%	0.36%	0.14%	0.12%	0.18%	0.22%	0.19%
9	0.20%	0.18%	0.23%	0.28%	0.35%	0.94%	0.33%	0.13%	0.13%	0.19%	0.22%	0.18%
10	0.19%	0.17%	0.24%	0.28%	0.37%	0.96%	0.31%	0.13%	0.13%	0.19%	0.22%	0.19%
11	0.18%	0.18%	0.23%	0.28%	0.40%	0.96%	0.30%	0.13%	0.13%	0.19%	0.22%	0.19%
12	0.17%	0.18%	0.25%	0.30%	0.40%	0.90%	0.29%	0.13%	0.13%	0.19%	0.22%	0.19%
13	0.17%	0.18%	0.26%	0.32%	0.39%	0.84%	0.28%	0.13%	0.13%	0.20%	0.22%	0.19%
14	0.18%	0.18%	0.23%	0.32%	0.40%	0.78%	0.29%	0.13%	0.13%	0.20%	0.22%	0.18%
15	0.19%	0.19%	0.22%	0.31%	0.41%	0.76%	0.30%	0.13%	0.13%	0.20%	0.21%	0.17%
16	0.18%	0.19%	0.24%	0.30%	0.43%	0.78%	0.28%	0.13%	0.13%	0.21%	0.22%	0.17%
17	0.19%	0.17%	0.23%	0.29%	0.46%	0.85%	0.26%	0.13%	0.14%	0.21%	0.22%	0.17%
18	0.21%	0.17%	0.24%	0.30%	0.48%	0.85%	0.25%	0.12%	0.14%	0.21%	0.22%	0.17%
19	0.21%	0.17%	0.23%	0.31%	0.51%	0.78%	0.23%	0.12%	0.14%	0.21%	0.21%	0.17%
20	0.21%	0.17%	0.23%	0.31%	0.57%	0.72%	0.22%	0.12%	0.14%	0.22%	0.21%	0.17%
21	0.19%	0.17%	0.23%	0.32%	0.61%	0.69%	0.21%	0.12%	0.15%	0.22%	0.21%	0.18%
22	0.19%	0.20%	0.25%	0.34%	0.62%	0.68%	0.20%	0.12%	0.15%	0.22%	0.20%	0.18%
23	0.19%	0.20%	0.25%	0.36%	0.65%	0.67%	0.19%	0.12%	0.15%	0.21%	0.20%	0.18%
24	0.18%	0.19%	0.23%	0.36%	0.68%	0.64%	0.18%	0.12%	0.15%	0.21%	0.19%	0.18%
25	0.18%	0.18%	0.23%	0.36%	0.74%	0.60%	0.17%	0.12%	0.15%	0.21%	0.20%	0.19%
26	0.18%	0.18%	0.23%	0.36%	0.73%	0.58%	0.17%	0.12%	0.16%	0.21%	0.20%	0.19%
27	0.17%	0.18%	0.23%	0.37%	0.71%	0.54%	0.17%	0.11%	0.15%	0.21%	0.20%	0.19%
28	0.18%	0.19%	0.23%	0.37%	0.71%	0.52%	0.17%	0.11%	0.15%	0.21%	0.20%	0.18%
29	0.18%	0.17%	0.23%	0.36%	0.73%	0.49%	0.16%	0.11%	0.15%	0.21%	0.20%	0.19%
30	0.19%		0.23%	0.36%	0.72%	0.49%	0.15%	0.11%	0.15%	0.21%	0.20%	0.18%
31	0.18%		0.25%		0.69%		0.15%	0.11%		0.21%		0.17%

**Table D-2. Daily Sediment TMDL for the Clark Fork River (Little Blackfoot River to Flint Creek) in tons**

Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	34.1	37.4	42.0	57.3	75.7	144.6	103.8	30.5	26.6	33.1	44.8	44.1
2	34.8	36.6	40.5	56.5	73.1	152.4	106.4	30.5	28.1	33.5	45.2	43.6
3	34.6	36.4	42.3	53.9	73.7	164.8	98.9	29.8	27.2	34.1	45.9	43.0
4	33.7	38.1	45.9	52.5	76.3	173.4	92.5	28.5	26.4	35.1	46.1	42.8
5	35.0	40.0	47.1	52.7	74.3	175.0	91.3	28.0	26.3	37.2	46.0	41.5
6	35.1	40.5	46.5	57.3	73.5	181.2	86.7	27.8	26.2	39.0	45.6	42.5
7	35.9	39.8	44.4	59.9	73.2	192.5	82.2	28.9	26.2	38.9	45.5	40.8
8	39.2	39.2	49.2	59.3	74.4	200.7	78.1	29.8	26.2	39.4	47.0	40.3
9	42.0	38.6	49.4	60.6	75.7	201.5	71.8	28.7	27.2	40.2	47.9	39.7
10	40.8	37.5	51.7	59.1	79.7	205.2	67.4	27.9	28.6	40.4	46.5	39.8
11	38.8	37.8	50.4	60.6	86.3	205.4	63.9	27.6	28.7	41.2	46.3	40.8
12	36.1	37.6	54.8	63.9	85.5	192.6	61.3	27.6	28.6	41.6	46.5	41.0
13	37.3	38.8	56.0	67.9	84.7	180.3	60.3	27.6	28.2	42.1	47.7	41.1
14	39.1	39.3	49.4	68.0	86.0	168.5	63.1	27.7	28.0	42.7	48.2	38.2
15	41.1	39.9	46.9	67.4	88.8	162.4	64.4	27.6	28.0	43.3	46.0	37.3
16	39.6	40.5	50.8	63.6	91.4	167.5	60.2	27.1	28.7	44.4	46.2	37.2
17	41.2	36.9	50.4	62.7	99.4	181.9	56.4	27.0	29.6	45.4	46.4	36.3
18	44.7	36.5	50.8	65.3	103.9	181.9	53.6	26.8	30.1	45.0	46.5	35.5
19	44.6	36.7	48.6	67.2	110.1	166.9	50.2	25.9	30.3	44.9	46.1	35.8
20	44.7	37.3	48.4	67.5	121.5	153.8	48.0	25.3	31.0	46.7	45.6	36.6
21	41.0	36.6	48.8	68.6	130.5	149.2	45.5	25.0	31.5	47.2	45.2	38.3
22	41.2	42.8	53.9	72.5	132.1	145.2	42.9	25.1	31.7	46.5	43.9	38.6
23	40.2	42.0	53.4	76.9	138.9	144.4	41.0	25.4	32.3	46.0	42.9	38.8
24	39.0	40.1	48.8	77.2	145.1	137.7	39.1	25.4	33.1	45.8	41.7	39.2
25	39.2	39.2	48.4	77.3	159.4	129.7	37.1	25.1	33.2	46.0	42.7	40.3
26	38.7	38.0	49.1	77.7	156.5	123.6	36.1	24.9	33.3	45.5	42.8	40.8
27	37.5	38.1	48.5	79.5	152.1	116.9	37.1	24.4	32.9	45.3	42.7	40.5
28	37.7	41.6	48.9	78.5	153.3	110.9	37.5	23.8	32.7	45.1	42.7	39.6
29	39.4	36.8	49.5	76.9	157.6	105.9	35.3	23.6	32.2	45.5	42.4	41.7
30	40.6		49.6	76.3	153.9	104.7	32.5	24.1	33.0	46.0	42.8	39.7
31	39.1		53.7		148.3		31.2	24.4		45.2		36.3

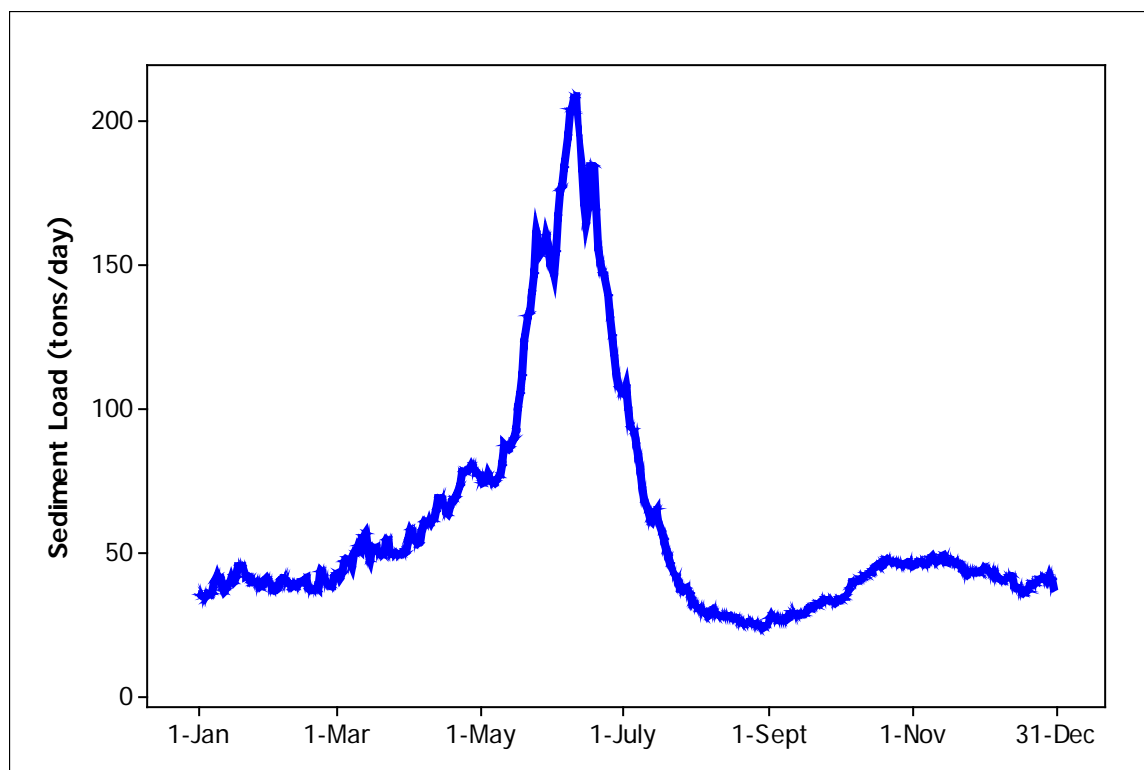


Figure D-1. TMDL for Sediment in the Clark Fork River (Little Blackfoot River to Flint Creek)

Table D-3. TMDLs Expressed as an Average Annual Load and Can Be Used in Conjunction with the Values in Table D-1 to Compute Daily Loads

Stream Segment	Waterbody Number	TMDL Expressed as Average Annual Load (tons/year)
SILVER BOW CREEK, headwaters to mouth (Clark Fork River)	MT76G003_020	2,109
CLARK FORK RIVER, Little Blackfoot River to Flint Creek	MT76G001_010	21,478
CLARK FORK RIVER, Cottonwood Creek to Little Blackfoot River	MT76G001_030	5,053
CLARK FORK RIVER, Warm Springs Creek to Cottonwood Creek	MT76G001_040	3,580