APPENDIX C
SEDIMENT TOTAL MAXIMUM DAILY LOADS

C.1 Sediment

C.1.1 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.

C.1.2 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 West Fork Gallatin River watershed, some limited monthly and short-term daily discharge measurements have been collected but there are no long-term daily discharge values. Within the entire Gallatin River watershed, there are several USGS gage stations with extensive discharge datasets but no gage stations with daily suspended sediment measurements. The closest gage to the West Fork Gallatin River is the Gallatin River near Gallatin Gateway (station #06043500) and it has discharge values dating back to 1889. The gage near Gallatin Gateway is downstream of the confluence with the West Fork and likely has similar hydrologic patterns to the West Fork (Van Voast 1972). Since sediment loading in the West Fork Gallatin River watershed is associated with nonpoint sources and storm water-related point sources, the hydrograph is assumed to be a reasonable surrogate for sediment loading to streams in the West Fork Gallatin River watershed (i.e. peak contributions during periods of runoff and high flow). Therefore, mean daily discharge values from 120 years of record (1889 - 2009) at the gage near Gallatin Gateway were used to calculate daily sediment values for TMDLs in the West Fork Gallatin River watershed.

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 C-1**). For each TMDL, the daily percentages in **Table C-1** were multiplied by the total average annual load associated with the TMDL percent reductions in **Section 5.7** to calculate the daily load. The daily loads are shown graphically in **Figure C-1** and may be computed by using the daily percentages in **Table C-1** and the TMDLs expressed as an average annual load, which are discussed in **Section 5.7** and also provided in **Table C-2**. For instance, the total allowable annual sediment load for the Middle Fork West Fork Gallatin River is 6,125 tons. To determine the TMDL for January 1, 6,125 tons is multiplied by 0.10% which provides a daily load for the Middle Fork on January 1st of 6.125 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.

Table C-1. USGS Stream Gage 06043500 (Gallatin River near Gallatin Gateway) – Percent of Mean Annual Discharge Based on Mean of Daily Mean Discharge Values for each Day of Record (Calculation Period 1889-08-01 -> 2009-09-30)

Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.10%	0.10%	0.10%	0.12%	0.29%	1.00%	0.70%	0.25%	0.17%	0.16%	0.14%	0.12%
2	0.10%	0.10%	0.10%	0.12%	0.30%	1.03%	0.68%	0.25%	0.17%	0.16%	0.14%	0.12%
3	0.10%	0.10%	0.10%	0.12%	0.32%	1.04%	0.67%	0.24%	0.17%	0.16%	0.14%	0.12%
4	0.10%	0.10%	0.10%	0.12%	0.34%	1.06%	0.64%	0.24%	0.17%	0.16%	0.14%	0.11%
5	0.10%	0.10%	0.10%	0.12%	0.35%	1.09%	0.62%	0.24%	0.17%	0.16%	0.14%	0.11%
6	0.10%	0.10%	0.10%	0.12%	0.37%	1.12%	0.60%	0.23%	0.17%	0.16%	0.14%	0.11%
7	0.10%	0.10%	0.10%	0.13%	0.39%	1.13%	0.58%	0.22%	0.17%	0.16%	0.14%	0.11%
8	0.10%	0.10%	0.10%	0.13%	0.41%	1.11%	0.55%	0.22%	0.17%	0.16%	0.14%	0.11%
9	0.10%	0.10%	0.10%	0.13%	0.43%	1.09%	0.53%	0.22%	0.17%	0.16%	0.14%	0.11%
10	0.10%	0.10%	0.10%	0.13%	0.44%	1.08%	0.51%	0.22%	0.17%	0.16%	0.13%	0.11%
11	0.10%	0.10%	0.10%	0.14%	0.46%	1.06%	0.50%	0.21%	0.17%	0.16%	0.13%	0.11%
12	0.10%	0.10%	0.10%	0.14%	0.48%	1.06%	0.48%	0.21%	0.17%	0.16%	0.13%	0.11%
13	0.10%	0.10%	0.10%	0.14%	0.51%	1.06%	0.45%	0.21%	0.17%	0.15%	0.13%	0.11%
14	0.10%	0.10%	0.10%	0.15%	0.54%	1.05%	0.44%	0.21%	0.17%	0.15%	0.13%	0.11%
15	0.10%	0.10%	0.10%	0.16%	0.57%	1.05%	0.42%	0.20%	0.16%	0.15%	0.13%	0.11%
16	0.10%	0.10%	0.10%	0.16%	0.59%	1.05%	0.40%	0.20%	0.16%	0.16%	0.13%	0.11%
17	0.10%	0.10%	0.10%	0.17%	0.63%	1.04%	0.38%	0.20%	0.16%	0.15%	0.13%	0.11%
18	0.10%	0.10%	0.10%	0.17%	0.67%	1.02%	0.37%	0.19%	0.16%	0.15%	0.13%	0.11%
19	0.10%	0.10%	0.11%	0.18%	0.69%	1.02%	0.36%	0.19%	0.16%	0.15%	0.13%	0.11%
20	0.10%	0.10%	0.11%	0.19%	0.72%	1.01%	0.35%	0.19%	0.16%	0.15%	0.12%	0.10%
21	0.10%	0.10%	0.11%	0.19%	0.75%	0.97%	0.34%	0.19%	0.16%	0.15%	0.12%	0.11%
22	0.10%	0.10%	0.11%	0.20%	0.77%	0.95%	0.32%	0.19%	0.16%	0.15%	0.12%	0.11%
23	0.10%	0.10%	0.11%	0.21%	0.78%	0.92%	0.32%	0.19%	0.16%	0.15%	0.12%	0.10%
24	0.10%	0.10%	0.11%	0.22%	0.80%	0.91%	0.31%	0.19%	0.16%	0.15%	0.12%	0.11%
25	0.10%	0.10%	0.11%	0.22%	0.83%	0.89%	0.30%	0.18%	0.16%	0.15%	0.12%	0.11%
26	0.10%	0.10%	0.11%	0.22%	0.87%	0.87%	0.29%	0.18%	0.16%	0.15%	0.12%	0.10%
27	0.10%	0.10%	0.11%	0.23%	0.90%	0.83%	0.29%	0.18%	0.16%	0.14%	0.12%	0.10%
28	0.10%	0.10%	0.11%	0.24%	0.94%	0.79%	0.28%	0.18%	0.16%	0.15%	0.12%	0.10%
29	0.10%	0.10%	0.11%	0.25%	0.97%	0.76%	0.27%	0.18%	0.16%	0.14%	0.12%	0.10%
30	0.10%		0.11%	0.27%	0.98%	0.74%	0.27%	0.18%	0.16%	0.14%	0.12%	0.11%
31	0.10%		0.11%		0.98%		0.26%	0.17%		0.14%		0.11%

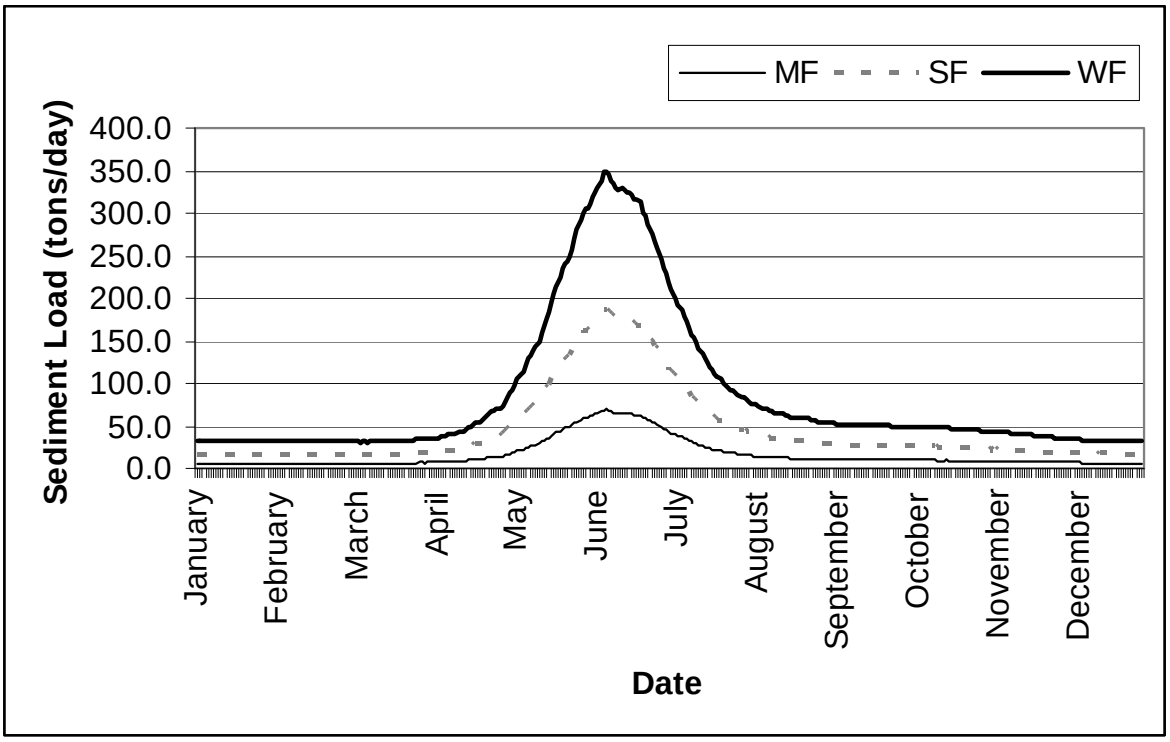

Figure C-1. Average Daily Sediment Load for the Middle Fork West Fork (MF), South Fork West Fork (SF), and the West Fork Gallatin River (WF).

Table C-2. TMDLs expressed as an average annual load and can be used in conjunction with the values in Table C-1 to compute daily loads.

Stream Segment	Waterbody #	TMDL Expressed as Average Annual Load (tons/year)
Middle Fork West Fork Gallatin River	MT41H005_050	6,125
South Fork West Fork Gallatin River	MT41H005_060	16,583
West Fork Gallatin River	MT41H005_040	31,038

REFERENCES

Van Voast, WA. 1972. *Hydrology of the West Fork Drainage of the Gallatin River, southwestern Montana, prior to commercial recreational development.* Special Publication 57. Montana Bureau of Mines and Geology.