

## **APPENDIX I**

### **SEDIMENT LOADS AND REDUCTION DETERMINATIONS**

#### **I.1 Introduction**

The TMDLs for sediment in **Section 5.0** of this document only presents current sediment loads and allocations for the three major sediment source type categories. This appendix however expands on the information used to quantify sediment loads, and provides additional detail which may assist in the prioritization for watershed restoration planning at both the stream/stream segment scale, and watershed as a whole.

The following information is included within this appendix and is organized by listed stream/stream segment:

##### **Bank Erosion**

For each stream/stream segment of interest, tables are included that present the estimated percent influence of various factors on bank erosion. The percent influence of bank erosion was determined for every delineated reach within that stream/stream segment. Reaches were delineated through the aerial assessment and stream reach delineation process developed by DEQ, and percent influence on bank erosion was estimated using aerial imagery and GIS information as part of that process. The resulting information is only an estimate of the distribution in influencing factors on bank erosion but provides watershed planners, agency personnel, and local stakeholders with some direction to focus additional investigation and restoration planning.

##### **Road Sediment**

A coarse approach was taken to estimate sediment loads from roads in the Upper Clark Fork TPA where a determined annual sediment load was applied to each identified road crossing in a given subwatershed. This method does not identify true loads from any given road crossing, nor does it identify which crossings are in need of restoration work, or which crossings have all applicable BMPs in place. Consequently, significant additional investigation is needed to determine the true sediments loads from road crossings in a given watershed. However, review of the distribution in ownership of the road crossings may provide a starting place for gathering information and further developing the investigation of road sediment. Road ownership information and distribution of current estimated load and allocation is provided for each stream/stream segment below.

##### **Upland Sediment**

Through the use of a SWAT model, upland sediment loads were determined for each major land use category, for each stream/stream segment of interest. Existing conditions were estimated, as well as the resultant loads assuming the implementation of BMPs. Additionally, riparian condition estimations (conducted during the aerial assessment and reach delineation) were applied to the upland sediment loads to simulate the existing loads that would occur given improvement of the riparian corridor. The upland sediment loads from SWAT, riparian condition assessment information, and reduction calculations are included for each stream/stream segment below.

## I.2 Sediment Source Loads and Reduction Determinations by Stream

### I.2.1 Antelope Creek (MT76G002\_140)

#### Bank Erosion

**Table I-1. Antelope Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	0	(*4.9/1000')	-	(Length*4.9/1000')	-	
Anthro Influence:	32107	(*11.4/1000')	366	(Length*4.9/1000')	157	
Total:	32107		366		157	209

**Table I-2. Antelope Creek Influence on Bank Erosion**

Reach ID	Reach Length	Transportation %	Grazing %	Irrigation %	Cropland %	Other %
ANT-01	2753	30	50	20		
ANT-02	455	70	30			
ANT-03	281	70	30			
ANT-04	1218	50	50			
ANT-05	1992	40	60			
ANT-06	1152	10	90			10
ANT-07	7261	30	20	40		20
ANT-08	5641	50	30			10
ANT-09	1112	90				10
ANT-10	5150	10	30	50		
ANT-11	987	50	50			
ANT-12	2044	50			50	
ANT-13	2062				100	
Total Length		10,892	9622	6030	3083	2480
% of Total Length		34%	30%	19%	10%	8%

#### Road Sediment

**Table I-3. Antelope Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	13.7	13	17.9	8.1
USFS	.01	-	-	-
State of MT	0.4	1	1.4	0.6
Unknown	0.2	-	-	-
Total	14.3	14	19.3	8.7

**Upland Sediment**

**Table I-4. Antelope Creek - SWAT Land Use Sediment Loads**

Scenario	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	Wetlands	Total
Existing	0.0	0.4	0.0	0.1	16.8	8.7	17.9	0.0	44
BMPs	0.0	0.2	0.0	0.1	14.4	7.6	17.9	0.0	40
Severe	0.0	0.4	0.0	0.1	19.0	14.4	17.9	0.0	52

**Table I-5. Antelope Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	38%	15	0%	0	15
Fair	62%	25	25%	6	19
Poor	-	0	50%	0	0
Total		40			34

**I.2.2 Brock Creek (MT76G005\_100)**

**Bank Erosion**

**Table I-6. Brock Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	20,460	(*4.9/1000')	100	(Length*4.9/1000')	100	
Anthro Influence:	45,539	(*11.4/1000')	519	(Length*4.9/1000')	223	
Total:	65,999		619		323	296

**Table I-7. Brock Creek Influence on Bank Erosion**

		Natural	Transportation	Grazing	Irrigation	Forest	Mining
Reach ID	Reach Length	%	%	%	%	%	%
BRK-01	1726	100					
BRK-02	569	100					
BRK-03	1451	100					
BRK-04	1477	100					
BRK-05	657	100					
BRK-06	2633	100					
BRK-07	757	100					
BRK-08	1453	70				30	
BRK-09	2812	90	10				
BRK-10	678	20	30	40		10	
BRK-11	4980	20	30	40		10	
BRK-12	1209	20	30	40		10	
BRK-13	6446	10	40	40		10	
BRK-14	1118	10	40	50			
BRK-15	5647	10	40	50			
BRK-16	1340	20	30	50			
BRK-17	1122		10	50			40
BRK-18	912		10	50			40
BRK-19	19045	20	40	40			
BRK-20	5182	20	40	40			
BRK-21	1973		60	20	20		
BRK-22	1926		60		40		
BRK-23	540				100		
BRK-24	348		100				
Total Length		20,625	20,608	20,479	1706	1767	813
% of Total Length		31%	31%	31%	3%	3%	1%

## Road Sediment

**Table I-8. Brock Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	88.8	32	44.2	19.9
BLM	17.9	7	9.7	4.4
State of MT	2.6	-	-	-
Unknown	0.4	-	-	-
Total	109.8	39	53.9	24.3

## Upland Sediment

**Table I-9. Brock Creek – SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	2.7	0.3	2.8	0.1	1378.9	1829.7	20.9	3238
BMPs	2.7	0.1	2.8	0.1	1204.2	1611.8	20.9	2846
Severe	2.7	0.3	2.8	0.1	1551.4	2868.9	20.9	4450

**Table I-10. Brock Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	15%	427	0%	0	427
Fair	84%	2391	25%	598	1793
Poor	1%	28	50%	14	14
Total		2846		612	2234

## I.2.3 Cable Creek (MT76G002\_030)

### Bank Erosion

**Table I-11. Cable Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	16785	(*4.9/1000')	82	(Length*4.9/1000')	82	
Anthro Influence:	16785	(*11.4/1000')	191	(Length*4.9/1000')	82	
Total:	33570		273		164	109

**Table I-12. Cable Creek Influence on Bank Erosion**

		Natural	Transportation	Forest
Reach ID	Reach Length	%	%	%
CBL-01	2890	100		
CBL-02	570	50	50	
CBL-03	2456	30	70	
CBL-04	1528		40	60
CBL-05	1557	50	50	
CBL-06	753	70	30	
CBL-07	720	60	40	
CBL-08	1214	10	30	60
CBL-09	1486	70	30	
CBL-10	730	60	40	
CBL-11	2694	40	60	
CBL-12	7736	80	20	
CBL-13	1189	50	50	
CBL-14	1463	20	80	
CBL-15	2784	40	60	
CBL-16	3800	10	90	
Total Length		16,752	14,813	2005
% of Total Length		50%	44%	6%

**Road Sediment**

**Table I-13. Cable Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	9.5	4	5.5	2.5
USFS	32.3	9	12.4	5.6
Unknown	1.4	-	-	-
Total	42.9	13	17.9	8.1

**Upland Sediment**

**Table I-14. Cable Creek SWAT Land Use Sediment Loads**

	Alfalfa	Forest	Lawn	Range-Brush	Range-Grass	Urban	Wetland	TOTAL
Existing	0.0	0.6	0.0	146.0	43.1	16.6	0.0	206
BMPs	0.0	0.6	0.0	126.1	37.6	16.6	0.0	181
Severe	0.0	0.6	0.0	165.9	70.4	16.6	0.0	253

**Table I-15. Cable Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	20%	36	0%	0	36
Fair	80%	145	25%	36	109
Poor	-	0	50%	0	0
Total		181		36	145

### I.2.4 Dempsey Creek (MT76G002\_100)

#### Bank Erosion

**Table I-16. Dempsey Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	42669	(*4.9/1000')	209	(Length*4.9/1000')	209	
Anthro Influence:	48821	(*11.4/1000')	557	(Length*4.9/1000')	239	
Total:	91490		766		448	318

**Table I-17. Dempsey Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Cropland	Grazing	Irrigation
		%	%		%	%
DMP-01	6214	100				
DMP-02	4165	90	10			
DMP-03	1745	100				
DMP-04	354	100				
DMP-05	3701	90	10			
DMP-06	1029	100				
DMP-07	3395	100				
DMP-08	568	100				
DMP-09	2134	70	30			
DMP-10	1208	70	30			
DMP-11	822	100				
DMP-12	1797	100				
DMP-13	1803	100				
DMP-14	1065	100				
DMP-15	3108	90	10			
DMP-16	2060	100				
DMP-17	953	80	20			
DMP-18	4224	80	20			

**Table I-17. Dempsey Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Cropland	Grazing	Irrigation
		%	%		%	%
DMP-19	1278	80	20			
DMP-20	2640	80	20			
DMP-21	2585	90	10			
DMP-22	989				50	50
DMP-23	2892		10		50	
DMP-24	2164				40	60
DMP-25	2966				60	40
DMP-26	8152				50	50
DMP-27	1247		20		20	60
DMP-28	3350		20			80
DMP-29	2829					100
DMP-30	4557					100
DMP-31	3661					100
DMP-32	5310		30	20		50
DMP-33	1659				50	50
DMP-34	3350		40		30	30
DMP-35	1518		20		30	50
Total Length		42,669	6771	1593	12,521	27,936
% of Total Length		47	7	2	14	31

**Road Sediment**

**Table I-18. Dempsey Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	35.1	23	31.7	14.3
USFS	15.2	6	8.3	3.7
State of MT	5.7	5	6.9	3.1
Unknown	2.0	-	-	-
Total	58.1	34	46.9	21.1

**Upland Sediment**

**Table I-19. Dempsey Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	910.2	1.1		0.2	277.9	6204.2	71.8	7498
BMPs	910.2	0.1		0.2	244.3	5752.0	71.8	7012
Severe	910.2	1.1		0.2	244.3	8200.4	71.8	9527

**Table I-20. Dempsey Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	25%	1753	0%	0	1753
Fair	74%	5189	25%	1297	3892
Poor	1%	70	50%	45	35
Total		7012		1332	5680

### I.2.5 Hoover Creek, Upper (MT76G005\_081)

#### Bank Erosion

**Table I-21. Upper Hoover Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	3564	(*4.9/1000')	18	(Length*4.9/1000')	18	
Anthro Influence:	25588	(*11.4/1000')	292	(Length*4.9/1000')	125	
Total:	29153		310		143	167

**Table I-22. Upper Hoover Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Forest	Other
		%	%	%	%
HVR-01	7013	30	20	50	
HVR-02	763		50	50	
HVR-03	339		60	40	
HVR-04	924		50	50	
HVR-05	11733	10	40	50	
HVR-06	1435	20	40	40	
HVR-07	5163		50	50	
HVR-08	1783				100
Total Length		3564	10,298	13,507	1783
% of Total Length		13%	35%	46%	6%

#### Road Sediment

**Table I-23. Upper Hoover Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	103.6	47	64.9	29.2
State of MT	6.0	2	2.8	1.3
Total	109.6	49	67.7	30.5

## Upland Sediment

**Table I-24. Upper Hoover Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	6.0	0.2	1.4	0.0	81.7	111.3	4.5	205
BMPs	6.0	0.1	1.4	0.0	70.6	97.8	4.5	181
Severe	6.0	0.2	1.4	0.0	92.6	175.9	4.5	281

**Table I-25. Upper Hoover Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	-	0	0%	0	0
Fair	100%	181	25%	45	136
Poor	-	0	50%	0	0
Total		181			136

## I.2.6 Hoover Creek, Lower (MT76G005\_082)

### Bank Erosion

**Table I-26. Lower Hoover Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	2964	(*4.9/1000')	15	(Length*4.9/1000')	15	
Anthro Influence:	29373	(*11.4/1000')	335	(Length*4.9/1000')	144	
Total:	32337		350		159	191

**Table I-27. Lower Hoover Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural %	Transportation %	Grazing %	Irrigation %	Cropland %	Forest %
HVR-09	1886	10	50				40
HVR-10	1558	10	50				40
HVR-11	9109	10	50				40
HVR-12	2185	10	50	20			20

**Table I-27. Lower Hoover Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Grazing	Irrigation	Cropland	Forest
		%	%	%	%	%	%
HVR-13	1671	20	50	20			20
HVR-14	6617		40	30			10
HVR-15	2351			20	80		
HVR-16	4384			20	40	40	
HVR-17	1204		100				
HVR-18	1371		20	20	60		
Total Length		2964	12,330	4378	4457	1754	6454
% of Total Length		9%	38%	14%	14%	5%	20%

**Road Sediment**

**Table I-28. Lower Hoover Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	53.6	22	30.4	13.7
State of MT	0.3	-	-	-
Unknown	0.8	-	-	-
Total	54.7	22	30.4	13.7

**Upland Sediment**

**Table I-29. Lower Hoover Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	11.6	0.4	2.8	0.1	158.5	216	8.8	399
BMPs	11.6	0.2	2.8	0.1	137.1	189.9	8.8	351
Severe	11.6	0.4	2.8	0.1	179.8	341.5	8.8	545

**Table I-30. Lower Hoover Creek Riparian Condition Improvement Plan**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	-	0	0%	0	0
Fair	96%	337	25%	84	253
Poor	4	14	50%	7	7
Total		351		91	260

## I.2.7 Peterson Creek, Upper (MT76G002\_131)

### Bank Erosion

**Table I-31. Upper Peterson Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	9406	(*4.9/1000')	46	(Length*4.9/1000')	46	
Anthro Influence:	26794	(*11.4/1000')	306	(Length*4.9/1000')	131	
Total:	36200		352		177	175

**Table I-32. Upper Peterson Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Grazing	Irrigation
		%	%	%	%
PTR-01	2558	50	10	40	
PTR-02	3306	30	40	30	
PTR-03	2060	30	40	30	
PTR-04	3226	20	60	20	
PTR-05	2772	30	40	30	
PTR-06	1331	30	50	20	
PTR-07	5029		60	20	20
PTR-08	1793	40		60	
PTR-09	8630	20		80	
PTR-10	3834	40		60	
PTR-11	1661	40		60	
Total Length		9406	9129	16,659	1006
% of Total Length		26%	25%	46%	3%

### Road Sediment

**Table I-33. Upper Peterson Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	15.4	13	17.9	8.1
USFS	23.7	6	8.3	3.7
State of MT	1.0	-	-	-
Unknown	2.4	-	-	-
Total	42.5	19	26.2	11.8

**Upland Sediment**

**Table I-34. Upper Peterson Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	169.2	0.3	56.1	0.1	492.0	561.9	624	1906
BMPs	169.2	0.0	56.1	0.1	433.6	499.4	624	1785
Severe	169.2	0.1	56.1	0.1	548.4	856.1	624	2257

**Table I-35. Upper Peterson Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	-	0	0%	0	0
Fair	100%	1785	25%	446	1339
Poor	-	0	50%	0	0
Total		1785		446	1339

**I.2.8 Peterson Creek, Lower (MT76G002\_132)**

**Bank Erosion**

**Table I-36. Lower Peterson Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	942	(*4.9/1000')	5	(Length*4.9/1000')	5	
Anthro Influence:	39859	(*11.4/1000')	454	(Length*4.9/1000')	195	
Total:	40801		459		200	259

**Table I-37. Lower Peterson Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Grazing	Irrigation
		%	%	%	%
PTR-12	4708	20	10	70	
PTR-13	14628		10		90
PTR-14	934				100
PTR-15	10532			40	60
PTR-16	9999		40		60
Total Length		942	5933	7508	26,418
% of Total Length		2%	15%	18%	65%

## Road Sediment

**Table I-38. Lower Peterson Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	46.3	14	19.3	8.7
USFS	7.9	5	6.9	3.1
State of MT	4.2	-	-	-
Total	58.4	19	26.2	11.8

## Upland Sediment

**Table I-39. Lower Peterson Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	156.2	0.3	51.8	0.1	454.1	518.7	576.0	1760
BMPs	156.2	0.0	51.8	0.1	400.3	461.0	576.0	1648
Severe	156.2	0.1	51.8	0.1	506.3	506.3	576.0	2083

**Table I-40. Lower Peterson Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	-	0	0%	0	0
Fair	100%	1648	25%	412	1236
Poor	-	0	50%	0	0
Total		1648		412	1236

## I.2.9 Storm Lake Creek (MT76G002\_040)

### Bank Erosion

**Table I-41. Storm Lake Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	20879	(*4.9/1000')	102	(Length*4.9/1000')	102	
Anthro Influence:	35630	(*11.4/1000')	406	(Length*4.9/1000')	175	
Total:	56479		508		277	231

**Table I-42. Storm Lake Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Forest	Other
		%	%	%	%
STL-01	2001	90	10		
STL-02	894	100			
STL-03	544				
STL-04	2420				
STL-05	855	50	50		
STL-06	1567	50	50		
STL-07	2308	50	50		
STL-08	1881	60	40		
STL-09	3319	100			
STL-10	1279	100			
STL-11	2671	80	20		
STL-12	3327	80	20		
STL-13	751	40	60		
STL-14	1306	20	40	40	
STL-15	2672	20	20	60	
STL-16	5508	20		80	
STL-17	6365	20	50	30	
STL-18	556	60	40		
STL-19	11626		50	50	
STL-20	4631		10	20	70
Total Length		19,389	15,705	15,180	3241
% of Total Length		34	28	27	6

**Road Sediment**

**Table I-43. Storm Lake Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	22.1	8	11.0	5.0
USFS	18.5	5	6.9	3.1
US Government	1.7	1	1.4	0.6
Total	42.3	14	19.3	8.7

**Upland Sediment**

**Table I-44. Storm Lake Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	0	0	0.9	0	230.5	68.1	26.2	326
BMPs	0	0	0.9	0	199.1	59.3	26.2	286
Severe	0	0	0.9	0	261.9	111.1	26.2	400

**Table I-45. Storm Lake Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	15%	43	0%	0	43
Fair	84%	240	25%	60	180
Poor	1%	3	50%	1	1
Total		286		61	225

**I.2.10 Tin Cup Joe Creek (MT76G005\_110)**

**Bank Erosion**

**Table I-46. Tin Cup Joe Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)	Allowable Load (Tons/year)	Reduction (Tons/year)
Natural Influence:	44953	(*4.9/1000') 220	(Length*4.9/1000') 220	
Anthro Influence:	33912	(*11.4/1000') 387	(Length*4.9/1000') 166	
Total:	78865	607	386	221

**Table I-47. Tin Cup Joe Creek Influence on Bank Erosion**

<b>Reach ID</b>	<b>Reach Length</b>	<b>Natural %</b>	<b>Transportation %</b>	<b>Grazing %</b>	<b>Irrigation %</b>	<b>Other %</b>
TCJ-01	4719	100				
TCJ-02	1186	100				
TCJ-03	6209	100				
TCJ-04	7636	100				
TCJ-05	7162	100				
TCJ-06	1549	100				
TCJ-07	4178	100				
TCJ-08	5287	100				
TCJ-09	671	100				
TCJ-10	1549	90	10			
TCJ-11	728			20		80
TCJ-12	1049	80		20		
TCJ-13	1204	50		50		
TCJ-14	1402	-	-	-	-	-
TCJ-15	2965	50	20	30		
TCJ-16	4450	20	40	40		
TCJ-17	725		40	60		
TCJ-18	8977		20	40	40	
TCJ-19	4405			40	60	
TCJ-20	2892				100	
TCJ-21	2747		60		40	
TCJ-22	4348		10	40	50	
TCJ-23	2829		60		40	
Total Length		43,803	8394	11,154	13,530	583
% of Total Length		57	11	14	17	1

**Road Sediment**

**Table I-48. Tin Cup Joe Creek Ownership and Load Distribution**

<b>Road Ownership</b>	<b>Road Miles</b>	<b>Road Crossings</b>	<b>Existing Load</b>	<b>Allowable Load</b>
Private/County	10.1	6	8.3	3.7
USFS	10.2	3	4.1	1.9
State of MT	48.7	27	37.3	16.8
Unknown	2.6	-	-	-
Total	71.6	36	49.7	22.4

**Upland Sediment**

**Table I-49. Tin Cup Joe Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	158.2	0.1	0.0	0.1	207.1	1154.2	148.8	1681
BMPs	158.2	0.1	0.0	0.1	183.0	1026.7	148.8	1530
Severe	158.2	0.1	0.0	0.1	231.0	1748.2	148.8	2299

**Table I-50. Tin Cup Joe Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	51%	780	0%	0	780
Fair	45%	689	25%	172	517
Poor	4%	61	50%	31	30
Total		1530		203	1327

**I.2.11 Warm Springs Creek, near Phosphate, Lower (MT76G005\_112)**

**Bank Erosion**

**Table I-51. Lower Warm Springs Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	3071	(*4.9/1000')	15	(Length*4.9/1000')	15	
Anthro Influence:	30030	(*11.4/1000')	342	(Length*4.9/1000')	147	
Total:	33101		357		162	195

**Table I-52. Lower Warm Springs Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Grazing	Irrigation	Forest
		%	%	%	%	%
WSP-24	3151	20	40			40
WSP-25	7832	20	50	30		
WSP-26	1570	20	40	40		
WSP-27	2799	20	30	50		
WSP-28	3387		20	20	60	
WSP-29	14361		30	20	50	
Total Length		3071	11,630	7927	9213	1261
% of Total Length		9	35	24	28	4

## Road Sediment

**Table I-53. Lower Warm Springs Creek Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	68.8	36	49.7	22.4
Total	68.8	36	49.7	22.4

## Upland Sediment

**Table I-54. Lower Warm Springs Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range- Brush	Range- Grass	Urban	TOTAL
Existing	16.6	0.1	0.0	0.0	330.2	454.8	7.7	811
BMPs	16.6	0.0	0.0	0.0	289.5	402.0	7.7	718
Severe	16.6	0.1	0.0	0.0	370.4	705.4	7.7	1102

**Table I-55. Lower Warm Springs Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	-	0	0%	0	0
Fair	100%	718	25%	179	538
Poor	-	0	50%	0	0
Total		718		179	538

## I.2.12 Willow Creek, Upper (MT76G002\_061)

### Bank Erosion

**Table I-56. Upper Willow Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	19365	(*4.9/1000')	95	(Length*4.9/1000')	95	
Anthro Influence:	8830	(*11.4/1000')	101	(Length*4.9/1000')	43	
Total:	28,195		196		138	58

**Table I-57. Upper Willow Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Forest
		%	%	%
WLW-01	3443	100		
WLW-02	1612	40		60
WLW-03	1136	50		50
WLW-04	1328	80		20
WLW-05	2098	90		10
WLW-06	4072	90	10	
WLW-07	671	90	10	
WLW-08	3218	30	50	20
WLW-09	4784	80	20	
WLW-10	3158	60	40	
WLW-11	2676	30	70	
Total Length		19,365	6177	2654
% of Total Length		69	22	9

**Road Sediment**

**Table I-58. Upper Willow Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
State of MT	22.9	17	23.5	10.6
Total	22.9	17	23.5	10.6

**Upland Sediment**

**Table I-59. Upper Willow Creek SWAT Land Use Sediment Loads**

	Alfalfa	Barnyard	Forest	Lawn	Range-Brush	Range-Grass	Urban	TOTAL
Existing	0.7	0.4	0.0	0.2	131.2	114.4	16.2	263
BMPs	0.7	0.2	0.0	0.2	113.0	99.6	16.2	230
Severe	0.7	0.4	0.0	0.2	149.4	188.0	16.2	355

**Table I-60. Upper Willow Creek Riparian Condition Improvement Potential**

Riparian Condition	Percent Stream Length	Associated Upland Load	Reduction Potential	Upland Load Reduction	Desired Load
Good	43%	99	0%	0	99
Fair	57%	131	25%	33	98
Poor	-	0	50%	0	0
Total		230		33	197

### I.2.13 Willow Creek, Lower (MT76G002\_062)

#### Bank Erosion

**Table I-61. Lower Willow Creek Bank Erosion Stream Load Derivation**

	Stream Length (ft)	Existing Load (Tons/year)		Allowable Load (Tons/year)		Reduction (Tons/year)
Natural Influence:	1025	(*4.9/1000')	5	(Length*4.9/1000')	5	
Anthro Influence:	40813	(*11.4/1000')	465	(Length*4.9/1000')	200	
Total:	41838		470		205	265

**Table I-62. Lower Willow Creek Influence on Bank Erosion**

Reach ID	Reach Length	Natural	Transportation	Grazing	Irrigation
		%	%	%	%
WLW-12	4145	10	60	30	
WLW-13	6102	10	20	60	10
WLW-14	4782		20	50	30
WLW-15	1115		10	40	50
WLW-16	2925		10	30	60
WLW-17	4796		10		90
WLW-18	3268				100
WLW-19	14705		30	40	30
Total Length		1025	9959	14,501	16,353
% of Total Length		2	24	35	39

#### Road Sediment

**Table I-63. Lower Willow Creek Road Ownership and Load Distribution**

Road Ownership	Road Miles	Road Crossings	Existing Load	Allowable Load
Private/County	28.1	30	41.4	18.6
Unknown	9.0	5	6.9	3.1
Total	37.1	35	48.3	21.7

**Upland Sediment**

**Table I-64. Lower Willow Creek SWAT Land Use Sediment Loads**

	<b>Alfalfa</b>	<b>Barnyard</b>	<b>Forest</b>	<b>Lawn</b>	<b>Range-Brush</b>	<b>Range-Grass</b>	<b>Urban</b>	<b>TOTAL</b>
Existing	0.6	0.3	0.0	0.2	111.8	97.5	13.8	224
BMPs	0.6	0.2	0.0	0.2	96.3	84.8	13.8	196
Severe	0.6	0.3	0.0	0.2	127.3	160.2	13.8	303

**Table I-65. Lower Willow Creek Riparian Condition Improvement Potential**

<b>Riparian Condition</b>	<b>Percent Stream Length</b>	<b>Associated Upland Load</b>	<b>Reduction Potential</b>	<b>Upland Load Reduction</b>	<b>Desired Load</b>
Good	25%	49	0%	0	49
Fair	75%	147	25%	37	110
Poor	-	0	50%	0	0
Total		196		37	159