

APPENDIX B

Forest Road Sediment Assessment Method (FROSAM)

Introduction

Section 303 of the Clean Water Act requires the identification of all impaired waterbodies in the United States. Once identified, the Clean Water Act further requires the establishment of a maximum pollutant load that can be assimilated by a given impaired waterbody and the implementation of an explicit plan to keep total pollutant loads below that maximum. The water quality improvement plans that are developed to meet these requirements are known as TMDLs (Total Maximum Daily Load).

The development of TMDLs for waterbodies impaired by siltation has become one of the major challenges for states that have substantial numbers of watersheds with agriculture and timber harvest as the dominant land uses. The challenge has two facets: first, an accurate assessment of the existing sources of siltation must be conducted and second, an accurate measure of any improvements must be made.

In most of the managed forested watersheds in the Western United States, forest roads are frequently one of the largest sources of non-point source pollution. The following discussion presents a practical approach for quantifying sediment load from forest roads as well as predicting and measuring improvements made during TMDL implementation.

The assessment method presented here is a refinement of the methods developed by the Washington Forest Practices Board, which is essentially an accounting procedure involving field observations of erosion and sediment delivery to streams. Streams are defined as any drainage depression containing a defined bed and banks extending continuously below the drainage site. Flow regime can be ephemeral, intermittent, or perennial. Therefore, erosion that is delivered to a drainage feature known to be discontinuous below (i.e. the flow goes subsurface and does not deliver to fish-bearing waters) should not be counted into the sediment load calculation.

Methods

Step 1: Measure Source Area

The source area for sediment load quantification encompasses all areas of road tread, ditches, cut slope, and fill slope from which water could flow to a stream. As an example in determining sediment load, suppose water flow over a road tread and cut slope is diverted by a drain-dip 100 feet from a stream crossing, and then passes into a heavily vegetated, flat area that precludes overland flow from reaching the stream. The area uphill of the drain-dip would not be counted into the sediment load to the stream, since the drain-dip serves to isolate it from the stream.

The length (longitudinally along the road) and width (across the road prism) of the tread, cut slope and fill slope are measured to derive the total areal extent (acres) of source area. If the cut and fill slopes vary significantly in width along a reach of road, the observer must estimate an average width of those features.

Step 2: Apply Modifying Factors

Several modifying factors which are described below and summarized in **Table B-1** are applied to the measurement of actual eroding surface area. These are applied as average factors over each individual eroding area.

Cover Factor

The cover factor is the percent of non-erodible cover on each of three road features: tread, cut slope, and fill slope. Cover percent translates into the modifying factors shown in **Table B-2**.

Gravel Factor

The gravel factor accounts for reduced erosion from roads that have gravel applications. With a gravel lift of 2 to 6 inches in depth, the factor is 0.50. With a gravel lift of greater than 6 inches, the factor is 0.20.

TrafficFactor

The traffic multiplier accounts for the fact that roads receiving heavy truck traffic have higher erosion rates. This factor ranges from 1 to 50, as shown in **Table B-3**. The value assigned depends on the use that the road experiences, with heavier traffic volume resulting in a greater multiplier.

Percent Delivery

The determination of the percent of eroded fine sediment delivered to a stream is perhaps the most challenging part of this assessment methodology. This factor must take into account the observer's sense of sediment delivery over time and, without an accurate way to characterize historical or potential future sedimentation, it becomes a matter of professional judgment.

Another difficulty in establishing sediment delivery is the potential for "double mitigation". For example, the calculated amount of sediment generated at a given location would be overly reduced if the gravel factor was applied while the percent delivery was simultaneously reduced due to the lack of sediment generation. This would result in a double mitigation. The amount of fine sediment *generated* and the amount of fine sediment *delivered* are two different factors. To avoid this pitfall, "delivery" is considered as the *potential* for sediment to be carried to a stream once it is eroded. If there is no sediment being eroded, the lack of erosion is accounted for with the modifying factors of cover, gravel, etc.

Table B-4 describes the categories of sediment delivery to streams. These can be adjusted based on the experience and judgment of the observer.

Step 3: Calculate Road Sediment Load

To calculate the volume of sediment contribution from each road location, the following steps should be applied:

1. Assign a base (natural) erosion rate from roads in tons/acre/year. This can be derived from a combination of published values and professional knowledge of the soils in the watershed.
2. Calculate the area of erosion (length times width) for the tread, cut and fill slopes, and convert it to acres.
3. Apply each modifying factor: cover, gravel, traffic, and percent delivery.
4. Multiply all of these together to derive the sediment volume from each of these road features (road tread, cut slope and fill slope) individually.
5. Sum these three values for the total delivery for that location, which will yield a figure in tons of sediment per year.

Location totals thus derived can be summed for the entire watershed to arrive at a total fine sediment contribution from roads.

Table B-1. Factors Applied in Forest Road Surface Sediment Assessment.

Factor	Definition
Cover	Percent of non-soil cover.
Gravel	A categorical factor accounting for mitigating that results in gravel road surfacing.
Traffic	Factor accounting for higher erosion from higher traffic roads.
Delivery	Percent of displaced fine sediment which is delivered into a waterbody.

Table B-2. Factor for Percent Cover Values.

Cover Percent	Factor
>80%	0.18
50%	0.37
30%	0.53
20%	0.63
10%	0.77
0%	1.00

Table B-3. Traffic Factors.

Traffic Use/Road	Annual Precipitation
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Category	<1200 mm	1200 mm-3000 mm
Heavy Traffic--active mainline	20	50
Moderate Traffic--active secondary	2	4
Light Traffic--not active	1	1

Table B-4. Categories of Sediment Delivery to Streams.

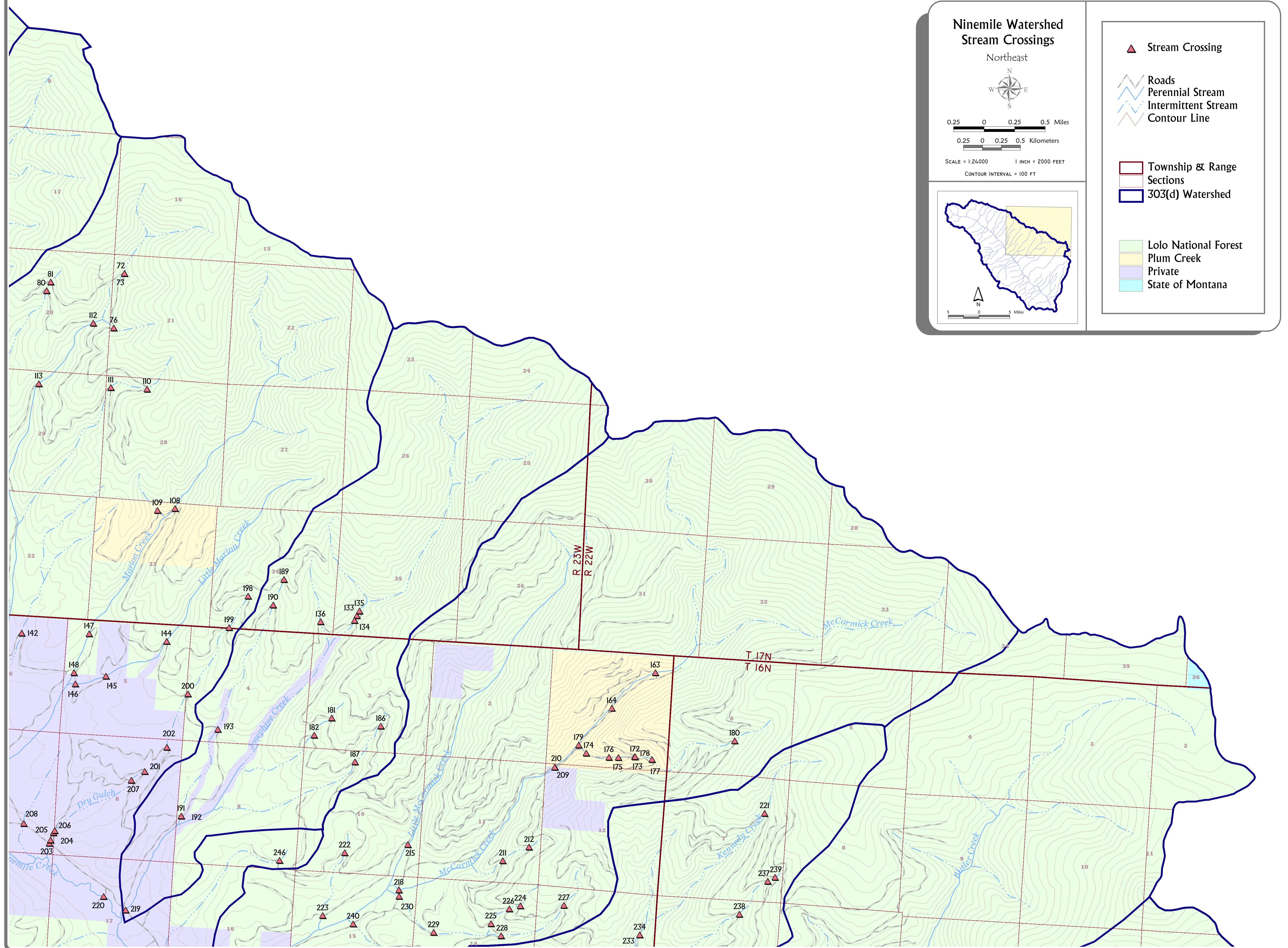
Percent Category	Description
100%	Chronic direct delivery under most erosional scenarios.
75%	Direct delivery evident but not chronic; effective buffer (provided by distance, gentle topography, or vegetation) during low intensity erosional events.
50%	Direct sediment delivery, but minor amounts or older events.
25%	Direct delivery unlikely except in moderate to major erosional events.
5%	Effective buffer, but proximity of road to stream makes 5% necessary.

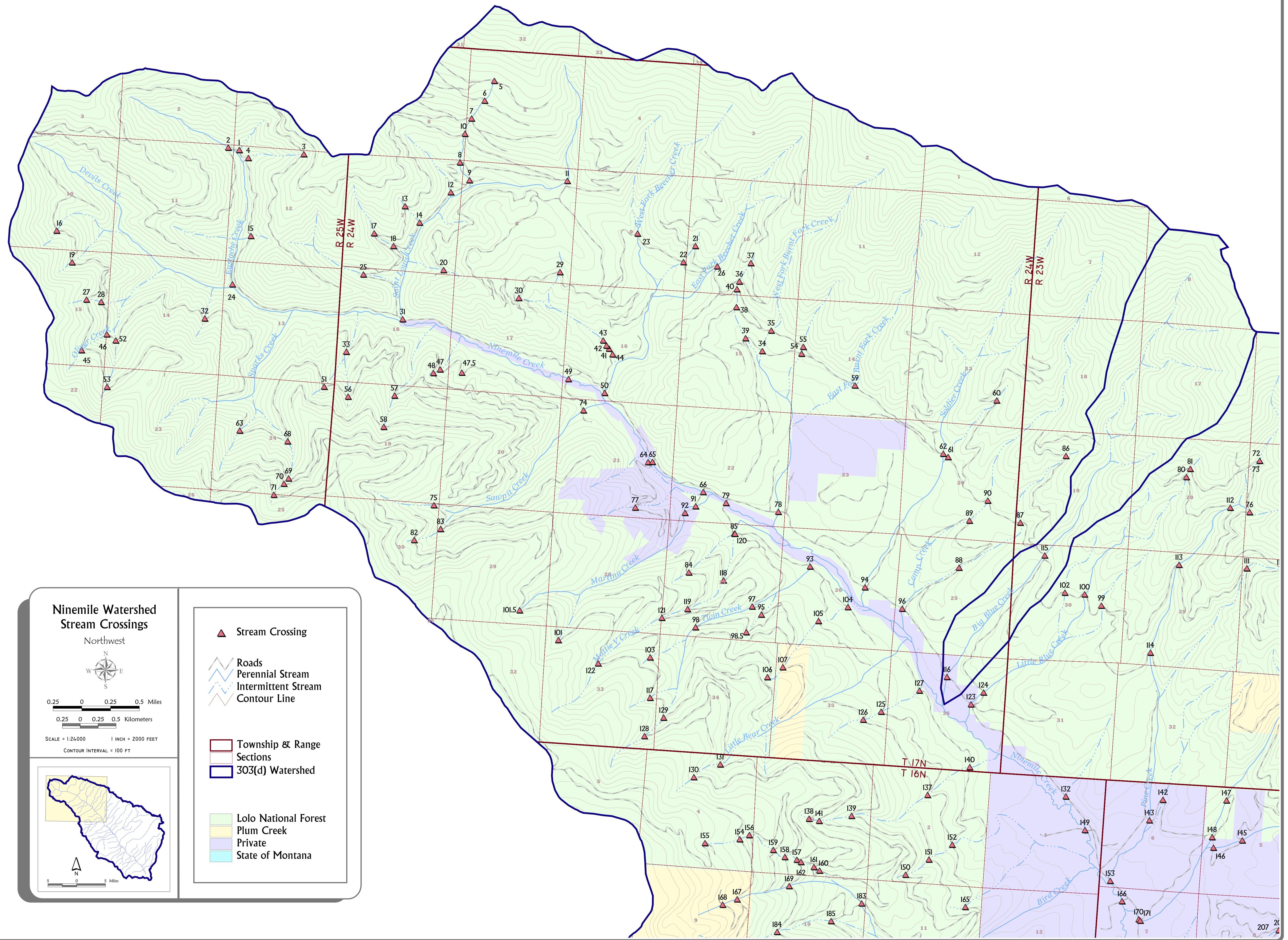
Ninemile TMDL - Existing Road Sediment Sources		CUTSLOPE												FILLSLOPE																			
	TREAD																																
Location Number	Drainage	Tread length (ft)	Tread Width (ft)	Acres of Tread	Base Erosion Rate (tons/ac/yr)	Gravel Factor	Traffic Factor	Percent Cover	Cover Factor	Delivery Factor	Tread Delivery (tons/yr)	Cutslope Length (ft)	Avg. Cutslope Width (ft)	Acres of Cutslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Delivery Factor	Cutslope Delivery (tons/yr)	Fillslope Length (ft)	Avg. Fillslope Width (ft)	Acres of Fillslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Delivery Factor	Fillslope Delivery (tons/yr)	Location Total Sediment (tons/yr)	Comments				
1	Ninemile	325	20	0.149219	30	1	2	10	0.77	50	0.5	3.4469697	270	16	0.0991736	30	75	0.21	50	0.5	0.1239669	75	6	0.0103306	30	95	0.12	90	0.9	0.033471074	3.793		
2	Ninemile	370	20	0.169881	30	1	2	10	0.77	75	0.75	5.88636364	280	28	0.1799816	30	50	0.37	65	0.65	1.29856749	110	6	0.0151515	30	90	0.15	90	0.9	0.061363636	7.246		
3	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0.000	No crossing; no channel.		
4	Ninemile	1430	20	0.656566	30	1	2	10	0.77	80	0.8	24.2666667	770	12	0.2121212	30	65	0.27	80	0.8	1.37454545	104	6	0.0143251	30	90	0.15	90	0.9	0.058016529	25.699		
5	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0.000	Non-contributing. Road obliterated, recontoured and revegetated.	
6	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Road obliterated, recontoured and revegetated.
7	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Road obliterated, recontoured and revegetated.
8	Ninemile	200	15	0.068871	30	1	1	30	0.53	20	0.2	0.21900826	0	0	0	30	0	0	0	0	0	0	55	6	0.0075758	30	100	0.1	90	0.9	0.020454545	0.239	
9	Ninemile	630	15	0.216942	30	1	1	40	0.45	55	0.55	1.61079545	120	10	0.0275482	30	90	0.15	50	0.5	0.06198347	65	12	0.0179063	30	95	0.12	95	0.95	0.061239669	1.734		
10	Ninemile	230	22	0.116162	30	1	2	5	0.9	25	0.25	1.56818182	210	60	0.2892562	30	45	0.41	25	0.25	0.88946281	90	40	0.0826446	30	90	0.15	100	1	0.371900826	2.830		
11	Ninemile	320	24	0.176309	30	1	2	5	0.9	25	0.25	2.38016529	240	16	0.0881543	30	75	0.21	20	0.2	0.1107438	90	8	0.0165289	30	90	0.15	90	0.9	0.066942149	2.558		
12	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0.000	Non-contributing. Abandoned, overgrown road, dense vegetation.	
13	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	No crossing; no channel.
14	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Abandoned, overgrown road, dense vegetation.
15	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	No crossing. No channel or pipe.
16	Ninemile	210	18	0.086777	30	1	1	20	0.63	70	0.7	1.14805785	195	10	0.0447658	30	90	0.15	60	0.6	0.12086777	70	25	0.0401745	30	80	0.18	95	0.95	0.206095041	1.475		
17	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	No crossing; no channel.
18	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Abandoned, overgrown road, dense vegetation.
19	Ninemile	220	18	0.090909	30	1	1	10	0.77	40	0.4	0.84	180	12	0.0495868	30	70	0.23	40	0.4	0.1368595	60	16	0.0220386	30	90	0.15	70	0.7	0.069421488	1.046		
20	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Overgrown, abandoned. Kelly hump at @29.
21	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Dense mature vegetation on tread, abandoned.
22	Ninemile	450	20	0.206612	30	1	2	5	0.9	45	0.45	5.02066116	410	14	0.1317723	30	50	0.37	35	0.35	0.51193526	80	15	0.0275482	30	95	0.12	90	0.9	0.089256198	5.622		
23	Ninemile	440	22	0.222222	30	1	2	5	0.9	50	0.5	6	370	18	0.1528926	30	45	0.41	15	0.15	0.28208678	75	8	0.0137741	30	90	0.15	95	0.95	0.058884298	6.341		
24	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0.000	Non-contributing. Abandoned, overgrown road, no pipe.
25	Ninemile	1320	16	0.484848	30	1	2	5	0.9	45	0.45	11.7818182	1190	8	0.2185491	30	90	0.15	40	0.4	0.39338843	40	6	0.0055096	30	90	0.15	90	0.9	0.02231405	12.198		

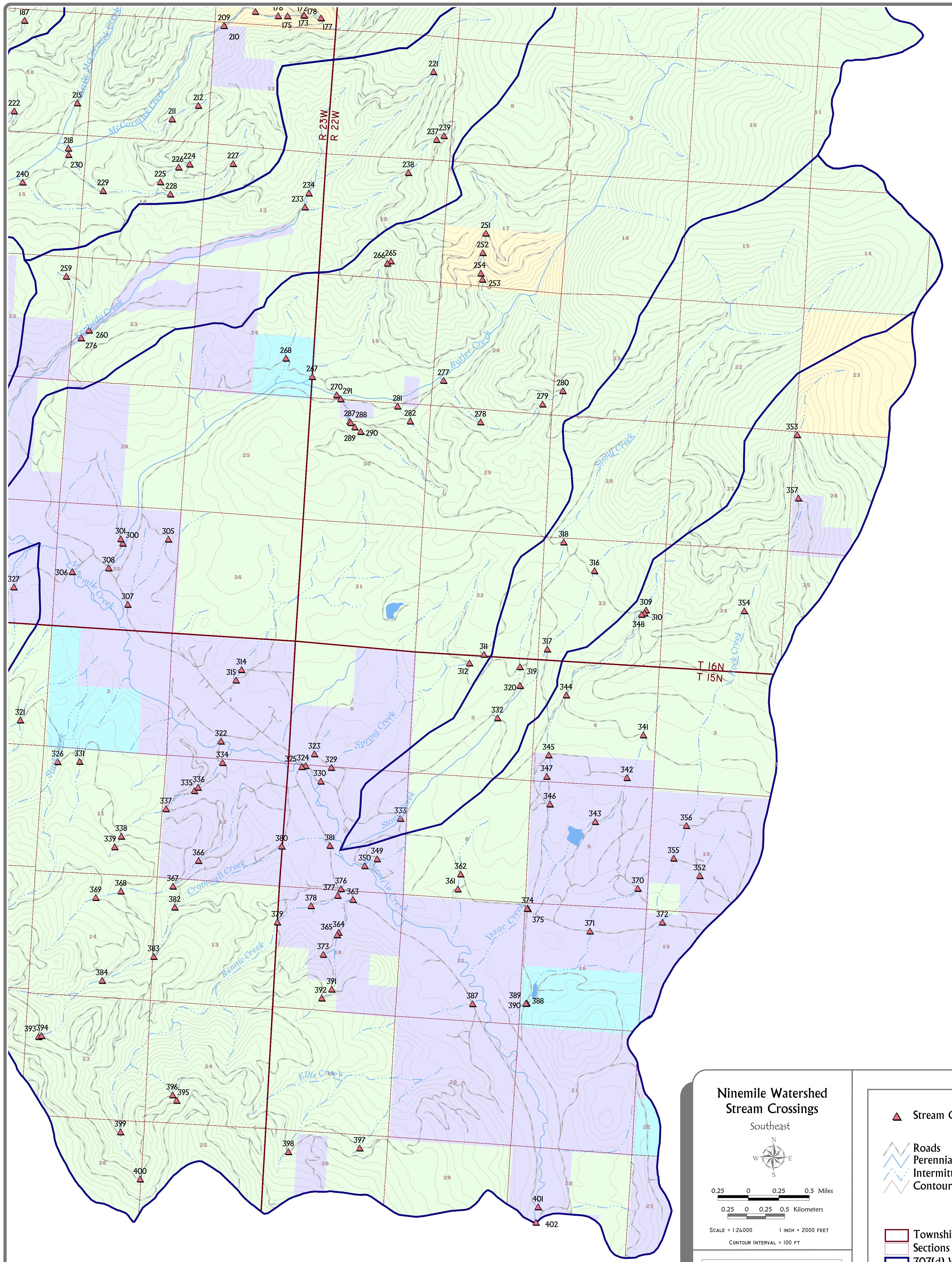
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92	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Dense veg on road tread	
93	Ninemile	35	10	0.008035	30	1	1	100	0.1	5	0.05	0.00120523	0	0	0	30	0	0	0	0	0	35	5	0.0040174	30	100	0.1	20	0.2	0.002410468	0.004	
94	Ninemile	260	26	0.155188	30	1	1	5	0.9	20	0.2	0.83801653	0	0	0	30	0	0	0	0	0	45	4	0.0041322	30	80	0.18	90	0.9	0.020082645	0.858	Bridge.
95	Ninemile	200	10	0.045914	30	1	1	50	0.37	20	0.2	0.10192837	160	15	0.0550964	30	90	0.15	25	0.25	0.06198347	111	10	0.0254821	30	100	0.1	80	0.8	0.061157025	0.225	
96	Ninemile	300	26	0.179063	30	1	1	5	0.9	35	0.35	1.69214876	0	0	0	30	0	0	0	0	0	35	4	0.003214	30	90	0.15	90	0.9	0.013016529	1.705	
97	Ninemile	575	10	0.132002	30	1	1	40	0.45	10	0.1	0.17820248	46	10	0.0105601	30	90	0.15	15	0.15	0.0071281	100	8	0.0183655	30	100	0.1	60	0.6	0.033057851	0.218	
98	Ninemile	550	10	0.126263	30	1	1	75	0.21	30	0.3	0.23863636	520	8	0.0955005	30	50	0.37	0	0	0	100	10	0.0229568	30	100	0.1	90	0.9	0.061983471	0.301	
98.5	Ninemile	250	10	0.057392	30	1	1	50	0.37	20	0.2	0.12741047	25	12	0.0068871	30	25	0.58	20	0.2	0.02396694	495	60	0.6818182	30	100	0.1	90	0.9	1.840909091	1.992	
99	Ninemile	1200	26	0.716253	30	1	1	40	0.45	40	0.4	3.8677686	350	16	0.1285583	30	60	0.3	45	0.45	0.52066116	135	9	0.0278926	30	95	0.12	95	0.95	0.095392562	4.484	
100	Ninemile	1350	24	0.743802	30	1	1	25	0.58	40	0.4	5.1768595	350	24	0.1928375	30	30	0.53	35	0.35	0.10731405	250	18	0.103058	30	95	0.12	90	0.9	0.334710744	6.585	
101	Ninemile	1360	15	0.46832	30	1	2	10	0.77	30	0.3	6.49090909	1360	20	0.6244261	30	80	0.18	30	0.31	0.1157025	35	40	0.0321396	30	100	0.1	90	0.9	0.08677686	7.589	Needs drain dips.
101.5	Ninemile	52	15	0.017906	30	1	1	10	0.77	15	0.15	0.06204545	175	12	0.0482094	30	75	0.21	25	0.25	0.07592975	100	8	0.0183655	30	100	0.1	90	0.9	0.049586777	0.188	Pipe and running water present.
102	Ninemile	600	15	0.206612	30	1	1	50	0.37	25	0.25	0.57334711	300	8	0.0550964	30	70	0.23	40	0.4	0.15206612	35	4	0.003214	30	90	0.15	90	0.9	0.013016529	0.738	
103	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing; no road, very dense vegetation.	
104	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing; dense vegetation, flat terrain.	
105	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing; dense foliage.	
106	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing; dense vegetation. Not able to visit road-grown over.	
107	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing; no channel, dense vegetation.	
108	Ninemile	145	18	0.059917	30	1	1	20	0.63	85	0.85	0.96257231	70	10	0.016098	30	80	0.18	90	0.9	0.07809917	70	8	0.0128558	30	85	0.16	90	0.9	0.05553719	1.096	
109	Ninemile	105	30	0.072314	30	1	1	40	0.45	50	0.5	0.48811983	90	12	0.0247934	30	75	0.21	50	0.5	0.07809917	170	18	0.0702479	30	90	0.15	95	0.95	0.300309917	0.867	
110	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing, due to dense vegetation.	
111	Ninemile	1350	25	0.774793	30	1	1	10	0.77	25	0.25	4.47443182	1150	15	0.3960055	30	40	0.45	30	0.31	1.60382231	85	8	0.0156107	30	90	0.15	90	0.9	0.06322314	6.141	
112	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing. Dense mature vegetation, abandoned road.	
113	Ninemile	1250	24	0.688705	30	1	1	25	0.58	50	0.5	5.99173554	1000	12	0.2754821	30	50	0.37	40	0.4	1.2231405	145	16	0.0532599	30	95	0.12	95	0.95	0.18214876	7.397	Perched pipe.
114	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	Non-contributing due to dense mature vegetation on road tread (did not visit).	
115	Ninemile	550	22	0.277778	30	0.75	2	15	0.7	50	0.5	4.375	0	0	0	30	0	0	0	0	0	40	8	0.0073462	30	50	0.37	100	1	0.0815427	4.457	Mitigated by trap.
116	Ninemile	60	24	0.033058	30	1	2	5	0.9	25	0.25	0.44628099	0	0	0	30	0	0	0	0	0	45	4	0.0041322	30	95	0.12	90	0.9	0.01338		

Ninemile TMDL - Existing Road Sediment Sources																															
	TREAD			CUTSLOPE																		FILLSLOPE									
Location Number	Drainage	Tread length (ft)	Tread Width (ft)	Acres of Tread	Base Erosion Rate (tons/ac/yr)	Gravel Factor	Traffic Factor	Percent Cover	Cover Factor	Delivery Factor	Tread Delivery (tons/yr)	Cutslope Length (ft)	Avg. Cutslope Width (ft)	Acres of Cutslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Delivery Factor	Cutslope Delivery (tons/yr)	Fillslope Length (ft)	Avg. Fillslope Width (ft)	Acres of Fillslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Delivery Factor	Fillslope Delivery (tons/yr)	Location Total Sediment (tons/yr)	Comments		
184	Ninemile	1800	12	0.495868	30	1	1	95	0.12	10	0.1	0.1785124	720	15	0.2479339	30	100	0.1	0.07438017	280	20	0.1285583	30	100	0.1	80	0.8	0.308539945	0.561		
185	Ninemile	1260	10	0.289256	30	1	1	50	0.37	25	0.25	0.80268595	100	25	0.0573921	30	95	0.12	0.25	0.05165289	60	10	0.0137741	30	100	0.1	90	0.9	0.037190083	0.892	
186	Ninemile	270	18	0.11157	30	1	2	15	0.7	30	0.3	1.40578512	95	15	0.0327135	30	40	0.45	0.25	0.11040806	70	12	0.0192837	30	100	0.1	90	0.9	0.052066116	1.568	
187	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.		
188	Ninemile	5300	20	2.433425	30	1	1	20	0.63	40	0.4	18.3966942	1300	12	0.3581267	30	70	0.23	0.4	0.98842975	370	40	0.3397612	30	100	0.1	90	0.9	0.917355372	20.302	
189	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Drain dips could decrease length.		
190	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.	
191	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0.000	GIS error.	
192	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.	
193	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.	
194	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; dense vegetation.	
195	Ninemile	1260	12	0.347107	30	1	1	50	0.37	40	0.4	1.54115702	950	20	0.43618	30	95	0.12	0.35	0.54958678	200	30	0.137741	30	100	0.1	90	0.9	0.371900826	2.463	
196	Ninemile	1600	25	0.918274	30	1	1	30	0.53	30	0.3	4.38016529	700	20	0.3213958	30	75	0.21	30	0.31.60743802	300	50	0.3443526	30	100	0.1	90	0.9	0.929752066	5.917	
197	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Bridge with wooden deck		
198	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; these crossings are eliminated by #204.		
199	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; these crossings are eliminated by #204.		
200	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; these crossings are eliminated by #204.		
201	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; these crossings are eliminated by #204.		
202	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; these crossings are eliminated by #204.		
203	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.		
204	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; channel.		
205	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.		
206	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.		
207	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; these crossings are eliminated by #204.		
208	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.		
209	Ninemile	50	16	0.018365	30	1	2	60	0.3	50	0.5	0.16528926	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.165	Bridge.		
210	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	GIS error.		
211	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.		
212	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.		
213	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000			
214	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0.000			
215	Ninemile	202	16	0.074197	30	1	2	10	0.77	90	0.9	3.08509091	50	8	0.0091827	30	90	15	20	0.2	0.82644628	160	12	0.0440771	30	95	0.12	80	0.8	0.126942149	4.038
216	Ninemile	200	12	0.055096	30	1	1	30	0.53	4																					

Ninemile TMDL - Existing Road Sediment Sources																																
	TREAD				CUTSLOPE										FILLSLOPE																	
Location Number	Drainage	Tread length (ft)	Tread Width (ft)	Acres of Tread	Base Erosion Rate (tons/ac/yr)	Gravel Factor	Traffic Factor	Percent Cover	Cover Factor	Percent Delivery	Delivery Factor	Tread Delivery (tons/yr)	Cutslope Length (ft)	Avg. Cutslope Width (ft)	Acres of Cutslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Percent Delivery	Delivery Factor	Cutslope Delivery (tons/yr)	Fillslope Length (ft)	Avg. Fillslope Width (ft)	Acres of Fillslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Percent Delivery	Delivery Factor	Fillslope Delivery (tons/yr)	Location Total Sediment (tons/yr)	Comments
278	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; no channel.	
279	Ninemile	285	18	0.117769	30	1	2	10	0.77	60	0.6	3.26454545	105	24	0.0578512	30	75	0.21	40	0.4	0.14578512	90	12	0.0247934	30	85	0.16	100	1	0.119008264	3.529	
280	Ninemile	630	18	0.260331	30	1	1	10	0.77	75	0.75	4.51022727	520	16	0.191009	30	70	0.23	70	0.7	0.92253444	80	15	0.0275482	30	90	0.15	90	0.9	0.111570248	5.544	
281	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.	
282	Ninemile	440	20	0.20202	30	1	2	10	0.77	40	0.4	3.73333333	0	0	0	30	0	0	0	0	0	60	5	0.0068871	30	90	0.15	90	0.9	0.027892562	3.761	Buffered.
283	Ninemile	55	30	0.037879	30	1	1	15	0.7	25	0.25	0.19886364	0	0	0	30	0	0	0	0	0	45	5	0.0051653	30	40	0.45	100	1	0.069731405	0.269	County bridge.
284	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	private, no access	
285	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	private, no access	
286	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	private, no access	
287	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; channel.	
288	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.	
289	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; channel.	
290	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.	
291	Ninemile	0	0	0	30	1	2	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing; no channel.	
292	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.	
293	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing, channel doesn't reach the 9 mile	
294	Ninemile	270	16	0.099174	30	2	1	80	0.18	35	0.35	0.37487603	90	4	0.0082645	30	80	0.18	30	0.3	0.01338843	70	6	0.0096419	30	100	0.1	100	1	0.02892562	0.417	
295	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing; obliterated.	
296	Ninemile	95	14	0.030533	30	0.5	1	70	0.23	75	0.75	0.0790031	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0.079	Little contributing area because it's a bridge	
297	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Dense veg on tread and isn't really even a road	
298	Ninemile	190	18	0.078512	30	1	1	30	0.53	50	0.5	0.62417355	150	13	0.0447658	30	35	0.49	50	0.5	0.32902893	160	20	0.0734619	30	100	0.1	90	0.9	0.198347107	1.152	
299	Ninemile	230	18	0.095041	30	1	1	70	0.23	30	0.3	0.19673554	210	14	0.0674931	30	20	0.63	30	0.3	0.38268595	170	18	0.0702479	30	100	0.1	90	0.9	0.189669421	0.769	
300	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing - GIS Error	
301	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	No crossing - GIS Error	
302	Ninemile	295	18	0.121901	30	1	1	10	0.77	30	0.3	0.84477273	180	18	0.0743802	30	100	0.1	30	0.3	0.06694215	180	12	0.0495868	30	95	0.12	95	0.95	0.169586777	1.081	
303	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Non-contributing due to dense vegetation.	
304	Ninemile	200	16	0.073462	30	2	1	75	0.21	140	1.4	1.29586777	170	15	0.0585399	30	40	0.45	40	0.4	0.3161157	110	18	0.0454545	30	100	0.1	95	0.95	0.129545455	1.742	
305	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	private	
306	Ninemile	0	0	0	30	1	1	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	Pine Creek swimming hole, no channel - bridge (paved).	
307	Ninemile	0	0	0	30	1																										







Ninemile Watershed Stream Crossings

Southeast



0.25 0 0.25 0.5 Miles

0.25 0 0.25 0.5 Kilometers

SCALE = 1:24000 1 INCH = 2000 FEET

CONTOUR INTERVAL = 100 FT

▲ Stream Crossing

Roads
Perennial Stream
Intermittent Stream
Contour Line

■ Township & Range
Sections
303(d) Watershed

■ Lolo National Forest
■ Plum Creek
■ Private
■ State of Montana

