APPENDIX E – ROAD SEDIMENT ASSESSMENT

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ACRONYM LIST

Acronym	Definition
BMP	Best Management Practices
BMPS	Best Management Practices
CWAIC	Clean Water Act Information Center (DEQ)
DEQ	Department of Environmental Quality (Montana)
DNRC	Department of Natural Resources & Conservation
EA	Environmental Assessment
GIS	Geographic Information System
HNF	Helena National Forest
HUC	Hydrologic Unit Code
NRCS	National Resources Conservation Service
NRIS	Natural Resource Information System (Montana)
TMDL	Total Maximum Daily Load
TPA	TMDL Planning Area
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey

E1.0 INTRODUCTION

This appendix is derived from a roads assessment report prepared by Water and Environmental Technologies (2009a) for the Montana Department of Environmental Quality (DEQ). This report presents a sediment load analysis and culvert assessment of the road network within the Little Blackfoot River TMDL Planning Area (TPA) that was performed to assist with sediment TMDL development. Roads located near stream channels can impact stream function through degradation of riparian vegetation, channel encroachment, and sediment loading. The degree of impact is determined by a number of factors, including road type, construction specifications, drainage, soil type, topography, precipitation, and the use of Best Management Practices (BMPs). Through a combination of GIS analysis, field assessment, and computer modeling, estimated sediment loads were developed for unpaved road crossings and parallel segments. Existing road conditions were modeled and future road conditions were estimated after the application of sediment-reducing BMPs. Additionally, paved segments of road were evaluated for loading from traction sand and existing culverts were assessed for fish passage and potential loading during failure associated with runoff events.

E2.0 DATA COLLECTION

The Little Blackfoot road sediment assessment consisted of three primary tasks:

1) GIS Layer development and summary statistics,
2) Field assessment and sediment modeling, and
3) Sediment load calculations and load reduction allocations for sediment listed watersheds.

E2.1 SPATIAL ANALYSIS

Using road layers provided by the Helena National Forest (HNF) and from the Tiger 2000 Census Data, crossings and parallel segments in the road network were identified and classified relative to 6th code subwatershed, landscape setting, land ownership, and soil erosion hazard class (**Figures E1-E5**). Based on the GIS analysis, there are approximately 485 total unpaved crossings, 51 paved crossings, and 22.79 miles of parallel segments within 50 feet of surface water. A summary of road crossings by landscape setting in the Little Blackfoot TPA is shown in **Table E2-1**. Additional summary information is presented in **Tables EA-1, EA-2,** and **EA-5** of **Attachment EA**.

Table E2-1. Assessment Sites by Landscape Setting

Landscape Type	Total Road Crossings	% Total Road Crossings	Unpaved Road Crossings	% Unpaved Road Crossings	Number of Assessment Sites
Mountain	296	55.5	296	61.0	15
Mountain (USFS Roadless Area)	13	2.4	13	2.7	0
Foothill	156	29.3	139	28.7	5
Valley	68	12.8	37	7.7	2
Total	**533**	**100**	**485**	**100**	**22**

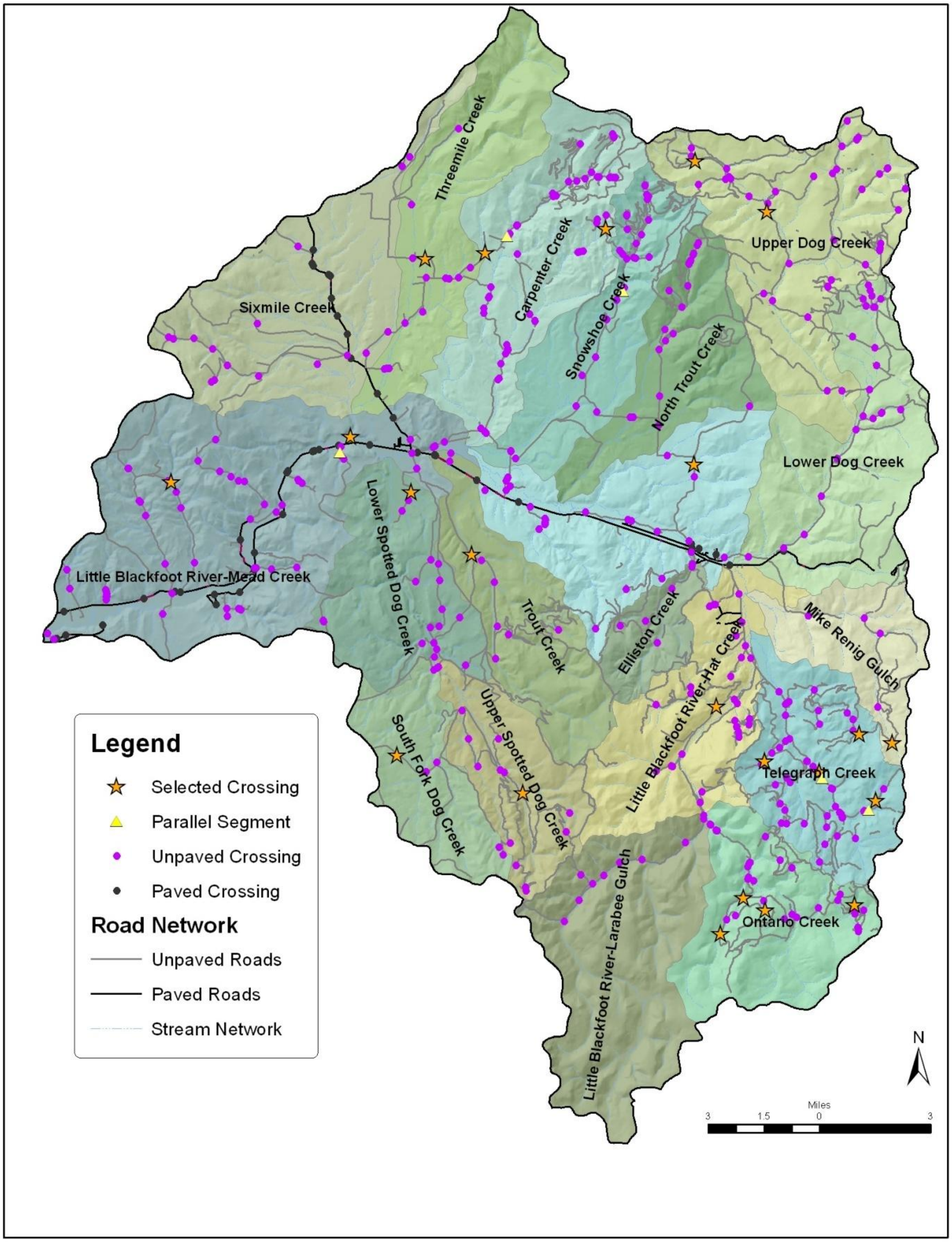

Figure E-1. Unpaved and Paved Crossings in the Little Blackfoot TPA.

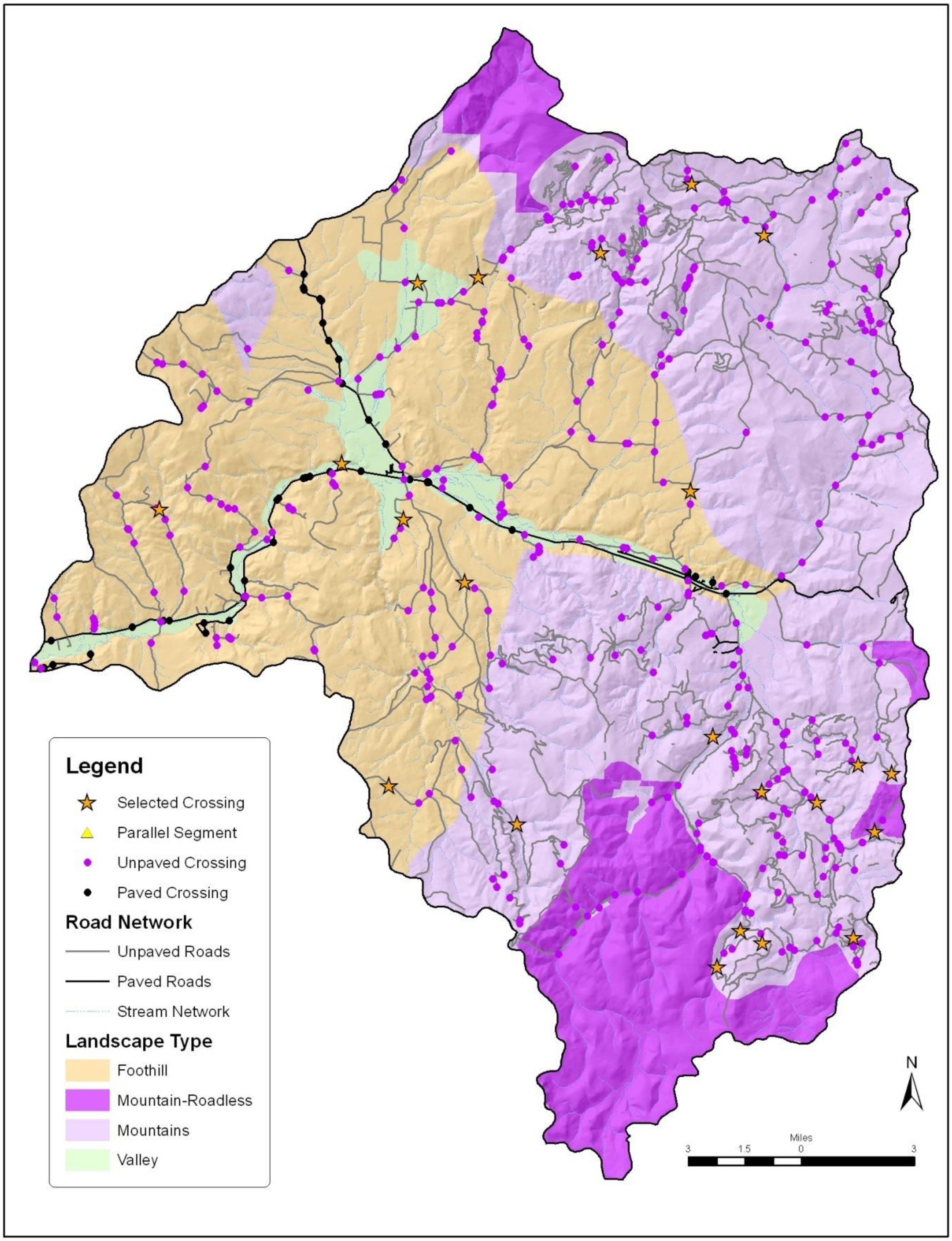

Figure E-2. Unpaved and Paved Crossings by Landscape Setting.

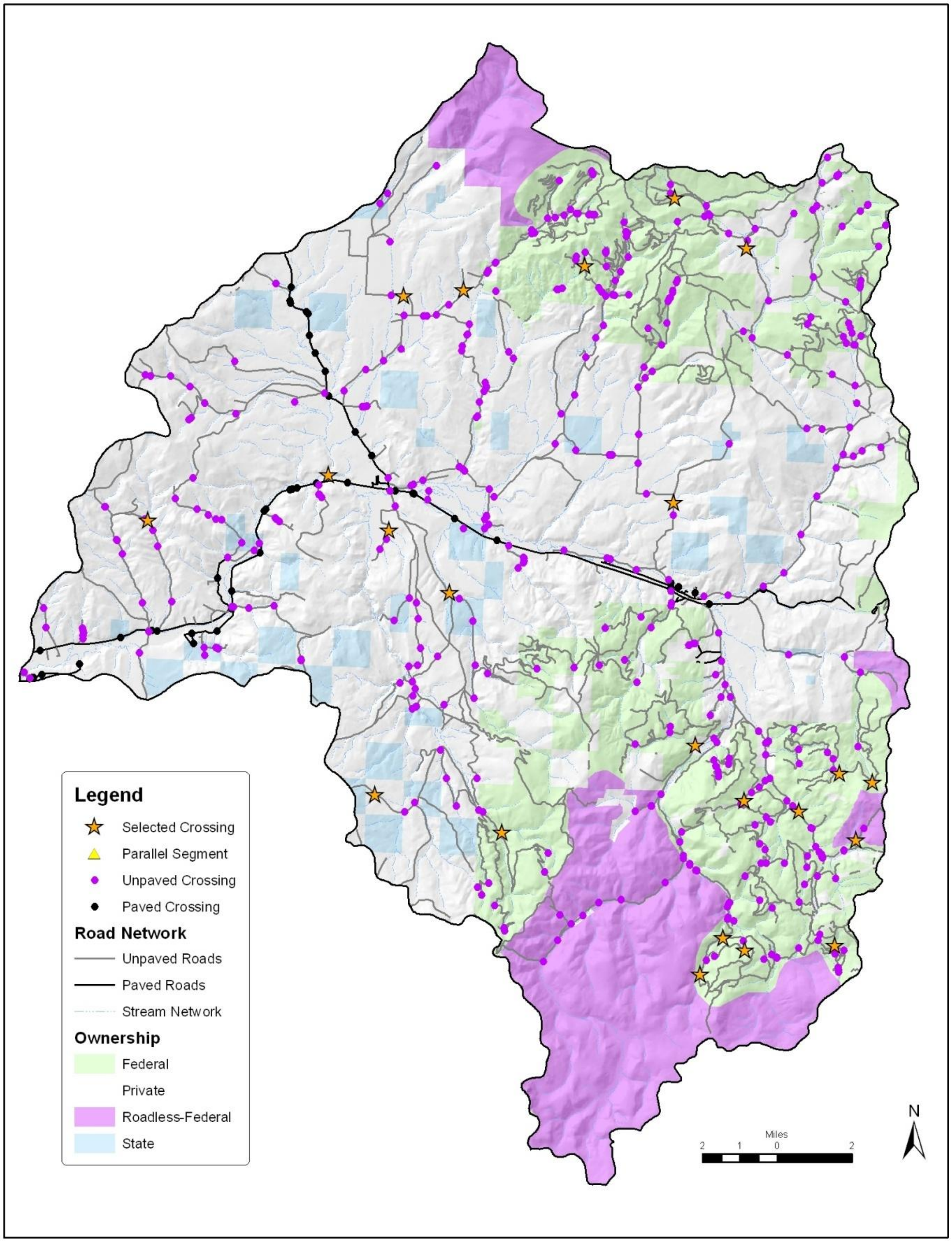

Figure E-3. Unpaved and Paved Crossings by Land Ownership.

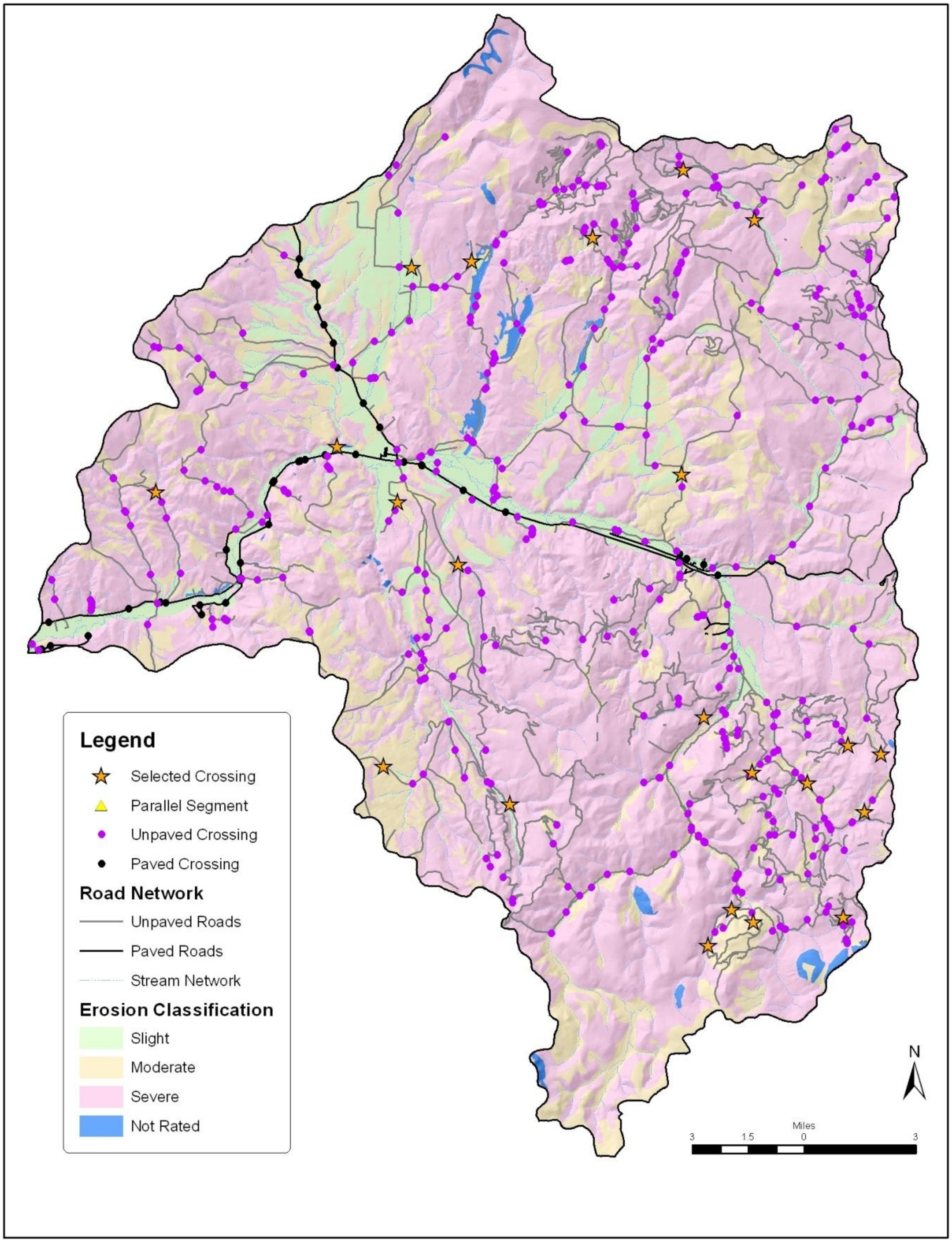

Figure E-4. Unpaved and Paved Crossings by Soil Erosion Hazard Classification.

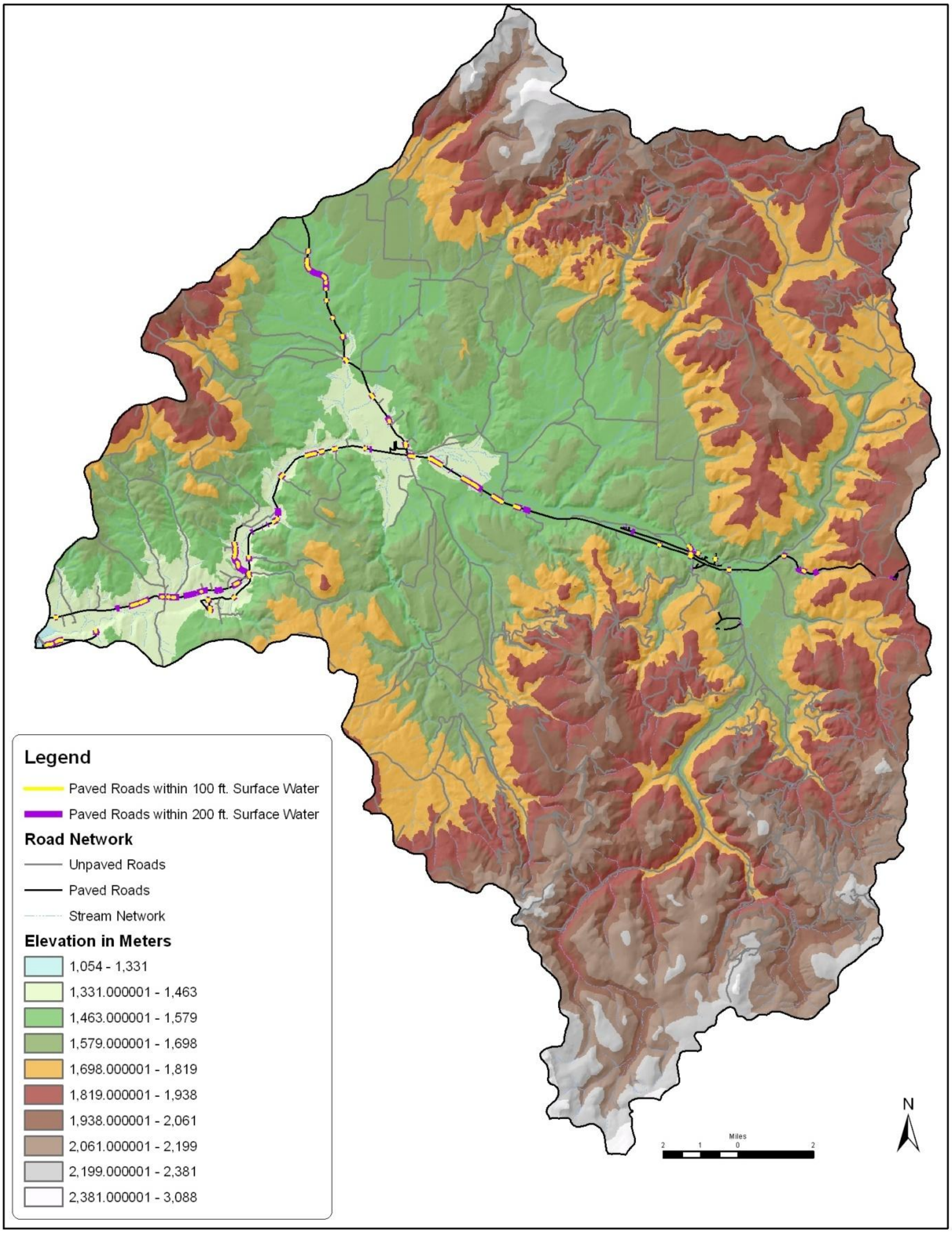

Figure E-5. Parallel road segments within 100 and 200 feet of surface water and watershed elevation.

E2.2 Field Data Collection

The goal of the field effort was to characterize approximately five percent of the road network. Using GIS, a random subset of 22 unpaved crossing sites were chosen for field assessment based on the proportion of total crossings within each landscape type. Parallel segment sites were selected in the field based on best professional judgment while traveling roads on which specific crossings were selected for evaluation. Although some site locations were relocated during the field effort due to ownership or vehicle access restrictions, a total of 22 unpaved crossings and 5 parallel segments were evaluated in the field (**Figure E1**).

Fifteen crossings were assessed in the mountain landscape, five crossings were assessed in the foothill landscape, and two crossings were assessed in the valley landscape type. Generally, the majority of parallel road segments are located in narrow stream valleys or canyons in foothill and mountain landscapes, where roads are constructed near streams. Four parallel segments were assessed in the mountain landscape type and one segment was assessed in the foothill landscape type. No parallel segments were assessed in the valley landscape type due to the small overall area of the valley landscape.

Crossing and parallel sites were named with the first three letters representing the 6th code HUC, the fourth letter represents the ownership category (Federal, Private or State), the fifth letter represents the landscape type (Mountain, Foothill or Valley) and the sixth letter represents the site type (crossing, X, or parallel segment, P). The last three numbers were automatically assigned through GIS software to ensure that each site is unique.

E2.3 Sediment Assessment Methodology

The road sediment assessment was conducted following a Sampling and Analysis Plan (Water & Environmental Technologies, PC., 2009b), which was based on inputs needed for the WEPP:Road forest road erosion prediction model (http://forest.moscowfsl.wsu.edu/fswepp/). WEPP:Road is an interface to the Water Erosion Prediction Project (WEPP) model (Flanagan and Livingston, 1995), developed by the USDA Forest Service and other agencies, and is used to predict runoff, erosion, and sediment delivery from forest roads. The model predicts sediment yields based on specific soil, climate, ground cover, and topographic conditions. Specifically, the following model input data was collected in the field: soil type, percent rock, road surface, road design, traffic level, and specific road topographic values (road grade, road length, road width, fill grade, fill length, buffer grade, and buffer length). In addition, supplemental data was collected on vegetation condition of the buffer, evidence of erosion from the road system, the presence of road BMPs, and potential for fish passage and culvert failure.

Site specific climate profiles were created using data from the Western Regional Climate Center (http://www.wrcc.dri.edu). The Little Blackfoot River TPA encompasses a wide range of annual precipitation: Precipitation quantity ranges from 11 to 38 inches per year with an average value of 22 inches and a median value of 22 inches. The sites assessed in the field ranged in elevation from 4,462 to 6,562 feet. The only weather station located within the TMDL planning area is Elliston, Montana (#242738, 17.23 inches annual precipitation; 5080 feet elevation). However, several stations are located near the TPA: Moulton Reservoir, Boulder, Rimini, and two sites in Deer Lodge.

Climate stations were selected that exhibited similar conditions for each specific landscape type. The Moulton Reservoir, Montana station (245886: 6700 ft elevation, 21.53-inches annual precipitation) was selected for mountain sites, and the Elliston, Montana station (242738: 5080-feet elevation, 17.23-inches annual precipitation) was selected to model the foothill sites (**Attachment EB**). The nearby climate stations did not appear to represent the precipitation quantity for the valley landscapes: Deer Lodge 3W, Montana station (10.77 inches), Deer Lodge COOP station (10.62 inches) and Boulder, Montana station (11.02 inches). The PRISM result for the TMC-P-V-X-442 site with 16.77 inches appeared to be the best conservative and representative climate station for the valley sites (**Attachment EB**).

The mean precipitation layer available on NRIS(Montana Department of Natural Resources and Conservation, 2008) predicted an average, area-weighted annual precipitation of 12.5 inches and 31.2 inches for the two valley landscape types (LBM-P-V-X-198 and TMC-P-V-X-442 respectively). The PRISM climate estimator based on specific latitude and longitude, as available on the WEPP:Road website, predicted 12.12 inches and 16.77 inches of annual precipitation respectively. These specific PRISM results from WEPP:Road are within the average values for the polygon layer on the NRIS GIS layer at the location of the culvert. Thus the custom climate station for valley landscapes was developed through PRISM software on the WEPP:Road website based on latitude and longitude of one site: TMC-P-V-X-442.

Per WEPP:Road documentation, 30 year simulations were run for unpaved road crossings and parallel segments in the mountain landscape since the quantity of precipitation exceeded 500 millimeters (19.69 inches). Fifty year simulations were run for crossings and parallel segments in the foothill and valley landscapes.

Some road conditions encountered in the field are not accurately represented in the WEPP:Road design options; as a result, some adjustments were made to the model to more appropriately represent these types of roads. **Attachment EB** contains a description of model or site condition adjustments, as recommended by WEPP:Road technical documentation, the model author or by best professional judgment. **Attachment EB** includes a table with specific adjustments per site name.

E2.4 Mean Sediment Loads from Field Assessed Sites – Stream Crossings

Field assessment data and WEPP:Road modeling results were used to develop existing sediment loads based on various watershed criteria. A standard statistical breakdown of loads from the unpaved road network within each sediment-listed watershed was generated using the applicable dataset of field assessed crossing and parallel sites. Mean load and contributing length, median load, maximum and minimum loads, and 25th and 75th percentile loads were calculated for unpaved road crossings within each landscape type that was the basis of the field assessment. Mean sediment loads from unpaved road crossings were estimated at 0.07 tons/year in mountain landscapes, 0.11 tons/year in the foothill landscapes, and 0.03 tons/year in the valley landscapes. A statistical summary of sediment loads for field assessed sites are included in **Table E2-2**.

Table E2-2. Sediment Load Summary for Field Assessed Crossings by Landscape Type

Statistical Parameter	Mountain	Foothill	Valley	Total of Field Assessed Crossings
Number of Sites (n)	15	5	2	22
Mean Contributing Length (ft)	450	394	588	
Mean Load (tons/year)	0.07	0.11	0.03	
Median Load (tons/year)	0.02	0.01	0.03	
Maximum Load (tons/year)	0.32	0.47	0.04	
Minimum Load (tons/year)	0.00	0.01	0.01	
25th Percentile (tons/year)	0.01	0.01	0.02	
75th Percentile (tons/year)	0.08	0.06	0.03	

The sediment load summary shows significant differences between minimum and maximum load values, as well as between mean and median values for mountain and foothill landscape types. These data suggest that a small number of high sediment load crossing sites impact the average values.

For the purposes of estimating the sediment load from each road crossing in the Little Blackfoot River TPA, the average of all field sites by landscape type assumes that the random subset of crossings assessed as part of this study is representative of the road crossing conditions in the TPA.

The random selection of sites as described in **Section E2.2** selected one crossing in the USFS designated Roadless Area (Federal ownership). This crossing was not accessible during the field effort. Although would likely have a smaller average sediment load, because no data could be collected, the average sediment loads for Federal sites (0.06 tons/year) will be used for the thirteen crossings in the Federal – USFS Roadless Areas.

E2.5 Mean Sediment Loads from Field Assessed Sites – Parallel Segments

Mean sediment loads were calculated for parallel road segments, and loads were then normalized to a per-mile value to account for differences in contributing road length. Mean sediment loads from unpaved parallel road segments were estimated at 0.021 tons/year/mile in mountain landscapes and 0.003 tons/year/mile in foothill landscapes. No valley parallel segments were assessed in the field due to the small overall area of the valley landscape and the majority presence of paved roads or roads that did not parallel streams. As a result, the mean sediment loads from the mountain and foothill parallel segments were averaged together to obtain an estimated sediment load of 0.012 tons/year/mile for valley parallel segments (**Table E2-3**). A summary of modeling results from field assessed sites is located in **Attachment EC**.

Table E2-3. Sediment Load Summary from Unpaved Field Assessed Parallel Sites

Statistical Parameter	Mountain	Foothill	Valley (Average of Mountain/Foothill)
Number of Segments (n)	4	1	0
Mean Contributing Length (ft)	377	355	366
Mean Road Gradient (%)	6.3	8	N/A
Mean Buffer Length (ft)	22.3	49.5	N/A
Mean Buffer Gradient (%)A	8.7	27.5	N/A
Mean Load (tons/year/mile)	0.021	0.003	0.012
Median Load (tons/year/mile)	0.005	N/A	N/A
Maximum Load (tons/mile/ year)	0.075	N/A	N/A
Minimum Load (tons/year/mile)	0.001	N/A	N/A

[A]A minimum buffer gradient value of 0.3 % and a minimum buffer length of 1 foot was used for parallel sites that did not have a buffer.

For the purposes of estimating the sediment load from each parallel segment in the Little Blackfoot River TPA, the average of all field sites by landscape type assumes that the random subset of crossings assessed as part of this study is representative of the parallel segment conditions in the TPA.

E2.6 Traction Sand Analysis

As shown in **Figure E-5**, few of the parallel roads are paved. Per telephone conversations with the Powell County Road Department and Department of Transportation employees, estimates of traction sand are shown in **Table E2-4.**

Table E2-4. Traction Sand Quantity

Department	Number of Miles	Quantity of Traction Sand (yards[3])	Tons/mile/year
Powell County Road Department, District I ▪ Secondary Roads	60	50-300	6.25
Montana Department of Transportation ▪ Highway 12 (mile marker 0 to 12.5)	12.5	500	50
Montana Department of Transportation ▪ Highway 12 (Avon to Elliston)	11	845	96
Montana Department of Transportation ▪ Highway 141	19	885	58

[A] Conversions were calculated with an assumed bulk density of 1.25 tons per cubic yard.

The road assessments for the Blackfoot Headwaters (Montana Department of Environmental Quality, et al., 2004) and Bitterroot Headwater TPAs (Montana Department of Environmental Quality, 2005) assumed a traction sand delivery rate of 10% for roads within 100 feet and 5% for roads within 200 feet of surface water. BMP reductions were not developed with these reports. The TMDL for the St. Regis TPA (Montana Department of Environmental Quality, 2008) included an in-depth study of traction sand and quantified deposits at set distances from the road. Per best professional judgment and per the cumulative percent of mean deposit measured at set distances from the road, it was determined that sediment did not travel from distances greater than 112 feet to surface water. The St. Regis report did not quantify potential BMP reductions. The Prospect Creek TMDL report quantified sediment application based on buffer length and vegetative cover. Completed TMDL projects that included a BMP reduction for traction sand include:

- Upper Lolo Creek: 33% consistent with parallel and crossing reductions

- Prospect Creek TPA: 31% for all sites with a low buffer mitigation

In order to determine traction sand contributions per HUC for the Little Blackfoot River watershed, the GIS database was queried for paved parallel road lengths within 100 feet of streams. The distance to surface water was not further refined into smaller increments due to the inherent inaccuracies between the GIS road and stream layers. The Powell County Road Department applies traction sand to a few steep gravel roads; these contributions are not included in traction sand estimates.

The quantity of traction sand from parallel segments that may annually contribute to surface water was taken from the Prospect Creek report (Montana Department of Environmental Quality, 2009) assuming a buffer length of 50-100 feet and a vegetative cover of 50%. This equates to a 15% delivery rate for all parallel segments. The improvement of BMPs included a vegetative cover improvement from 50% to 60% for an overall delivery rate of 10%. All traction sand contributions and potential BMP reductions (33%) are shown in **Table EA-4 (Attachment EA)**.

E3.0 Road Network Load Analysis

E3.1 Unpaved Roads Loading Results

The annual mean sediment loads for unpaved road crossings and parallel segments from the three landscape types (mountain, foothill, and valley) were extrapolated to all sites in the Little Blackfoot TPA to determine total sediment load. Mean loads for unpaved crossings within mountain (0.07 tons/year), foothill (0.11 tons/year), and valley (0.03 tons/year) landscape types were applied to the total number of crossings within the TPA, and further classified by 6^{th} code HUC and land ownership (**Attachment EA**, **EA-6** and **EA-7)**.

The total sediment load was 38.03 tons/year from 485 unpaved crossings and 0.35 tons/year from parallel road segments (**Table E3-1**). The majority of sediment load is generated from crossings on private land (21.2 tons/year), followed by Federal land (15.1 tons/year), and State land (1.8 tons/year). Per crossing, the load averaged 0.08 tons/year across all landscape settings; federal crossings (which were all in the mountain setting) contribute an average annual load of 0.06 tons/year, and private crossings (which are in all landscape settings) contribute an average annual load of 0.095 tons/year. The greatest load is likely produced from privately-owned road crossings due to the large quantity of private land in the foothill landscape.

Sediment load results were compared to the USDA NRCS Soil Hazard Classification as a possible tool to predict problem areas. The results from this study did not appear to correlate with hazard class, which is likely due to the greater sensitivity of the WEPP:road model to road length and road gradient for specific high-load crossings in the Little Blackfoot River TPA, rather than to the variables of the USDA NRCS rating system (soil erosion factor K, slope, and content of rock fragments).

Table E3-1. Extrapolated Sediment Load Summary from Unpaved Road Crossings and Parallel Segments– Existing Conditions

Road Feature	Landscape Type	Total Number of Crossings	Mean Sediment Load (Tons/year)	Total Sediment Load (Tons/year)
Crossing	Mountain	309	0.07	21.63
Crossing	Foothill	139	0.11	15.29
Crossing	Valley	37	0.03	1.11
Total:		**485**		**38.03**
Road Feature	**Landscape Type**	**Total Parallel Distance w/in 50-feet (Mi)**	**Mean Sediment Load (Tons/year/mile)**	**Total Sediment Load (Tons/year)**
Parallel	Mountain	14.5	0.021	0.30
Parallel	Foothill	6.5	0.003	0.02
Parallel	Valley	1.8	0.012	0.02
Total:		**22.8**		**0.35**
Total Little Blackfoot River TPA:				**38.38**

E3.2 Culvert Assessment – Fish Passage

Culverts were analyzed for their ability to allow for fish passage. Measurements were collected at each field assessed crossing site, and these values were used to determine if culverts represented fish passage barriers at various flow conditions. Of the 22 field assessed road crossing sites, field sites with bridges, along with any sites where any of the required screening data could not be accurately collected, were removed from the dataset. After removing these sites from the dataset, fifteen culverts were determined to be suitable for fish passage assessment.

The fish passage evaluation was completed using the criteria in *A Summary of Technical Considerations to Minimize the Blockage of Fish at Culverts on National Forests in Alaska* (U.S. Department of Agriculture, Forest Service, Alaska Region, 2002). The analysis uses site-specific information to classify culverts as green (passing all lifestages of salmonids), red (partial or total barrier to salmonids), or grey (needs additional analysis). Indicators used in the classification are the ratio of the culvert width to bankfull width (constriction ratio), culvert slope, and outlet drop, with large (>48-inches) and small (<48-inches) culvert groups evaluated differently. Failure of any one of the three indicators results in a red classification. Using the Alaska fish passage analysis, 12 of 15 culverts (80%) were classified as partial or total fish barriers (red), and 3 of 15 (20%) were classified as needing additional evaluation (grey). None of the field assessed culverts were classified as capable of passing fish at all flows and life stages (**Table E3-2, Table EA-8**). The predominant cause for preventing fish passage was steep culvert gradient.

Table E3-2. Culvert Fish Passage Analysis Results

Culvert Classification	Definition of Indicator	Number of Culverts	Percentage of Total Culverts Assessed
Red[1]	High certainty of not providing juvenile fish passage at all desired stream flows	12	80%
Green[2]	High certainty of meeting juvenile fish passage at all flows	0	0%
Grey[3]	Additional and more detailed analysis is required to determine juvenile fish passage ability	3	20%

The seven crossings that could not be assessed for fish passage were due to: the lack of a culvert (4 ford crossings), the culvert slope could not be determined (culvert plugged, 2 crossings), or the bankfull width was not well defined in a dry channel (1 culvert). Eighteen of the 22 culverts had visual stream flow during the visit; all of the crossings that were assessed for fish passage had visual flow. Flow was visually estimated and ranged from 1 cfs to 16 cfs.

E3.3 Culvert Assessment – Storm Event Failure Potential

Each culvert with a field measured bankfull width was evaluated using USGS regression equations developed by Parrett and Johnson (Parrett and Johnson, 2004). Previous studies by Chuck Parrett of the USGS (DNRC, Montana floodplain) have indicated that regression equations based on bankfull width may be more reliable if the basin characteristic and climate are not unique to the specific crossing. Regardless of the method, as peak discharge increases, so does the percentage of culverts incapable of passing the greater flows. Based on the peak flow analysis with bankfull width as the independent variable, it appears that most culverts were designed to pass the Q25 flow, as the majority of culverts (79%) passed this flow (**Table E3-4** and **Attachment EA, Table EA-9)**.

Table E3-4. Percent of Culverts Passing Design Storm Events based on bankfull width

Design Storm Event	Number of Culverts Passing	Number of Culverts Failing Design Flow	Cumulative Percent Passing
Total Culverts	14[A]		100%
Q2	14	14	100%
Q5	11	3	79%
Q10	11	3	79%
Q25	11	3	79%
Q50	8	6	53%
Q100	6	8	43%

[A] NTC-P-F-X-348 bankfull width could not be determined due to the heavily vegetated swale, thus only 14 culverts were assessed with this method.

Potential road fill volume at risk for delivery in the event of a culvert failure was calculated using field measurements of the road prism over the culvert. The volumes calculated are conservative, assuming that the entire road prism above the culvert fails to bankfull width and is delivered to the stream, which will likely not always be the case. One crossing did not have bankfull width and twice the culvert width was used for fill at risk calculations. Bulk density was assumed to be 0.969 tons/yd^3 (1.15 Mg/m^3) for all sites. In some instances, only part of the road fill may be delivered, and in other cases, water may overtop the road but the culvert will stay intact.

It is difficult to develop a specific road crossing allocation for sediment delivered in the event of a culvert failure, as there are several factors that may impact the accuracy of the data. First, peak flows generated using the USGS regression equations are subject to large standard errors that may substantially over or underestimate peak discharge. In addition, peak flows generated using Manning's equation rely heavily on culvert slope. Slope values measured during field activities were estimated using a handheld inclinometer, where accessible, and visual estimates were recorded where access or use of an inclinometer was not possible. Different slope estimates may lead to variations in peak flow calculations. Second, the culvert assessment was conducted on a small subset of culverts, which may or may not be representative of the entire Little Blackfoot River TPA. Third, it is difficult to estimate which culverts will fail in any given year, and what percentage of at-risk fill material will be delivered to the stream.

Despite these difficulties, the potential load associated with culvert failure was estimated. A conservative failure probability of 25% was used to estimate the annual potential sediment delivery using the average fill at risk multiplied by the number of crossings estimated to not be able to pass a 25-year storm event. Given a 25% annual probability of failure for culverts that are not sized for a Q25 event, it is estimated that 196 tons of sediment are at-risk for the Little Blackfoot TPA (**Attachment EA**, **Table EA-10**).

E4.0 Application of Best Management Practices

Sediment impacts are widespread throughout the Little Blackfoot TPA, and sediment loading from the unpaved road network is one of several sources within the watershed. Application of BMPs on the unpaved road network will result in a decrease in sediment loading to streams. BMP sediment reduction was evaluated based on a reduction in contributing road length.

E4.1 Contributing Road Length Reduction Scenario

A contributing road length reduction scenario for road crossings was selected assuming a total road length reduction to 200 feet (100-feet on each road for a crossing with two contributing road segments or 200 feet on crossings with one contributing segment). On crossing locations in excess of this length reduction scenario, road lengths were reduced to the corresponding post-BMP scenario of 200-feet. No changes were made to crossing locations where the contributing road length was less than the 200-foot BMP reduction scenario. The 200-foot BMP scenario was evaluated using the WEPP:Road model, so potential sediment load reductions could be estimated. The results for each field site are included in **Attachment ED**.

Due to the overall minimal contribution from parallel segments (i.e., <1%), BMP reduction scenarios were not developed for parallel road segments. There were culvert drains installed on parallel roads within the Snowshoe Creek, Telegraph Creek and Elliston Creek watersheds that were well maintained. The minimized contributing road length is evident in the overall annual average sediment load per mile, which ranged from 0.003 to 0.012 tons/year.

For the 200-foot BMP scenario, mean sediment loads would be reduced from 0.07 tons/year to 0.02 tons/year for mountain crossings, from 0.11 tons/year to 0.02 tons/year for foothill crossings, and from 0.03 tons/year to 0.01 tons/year for valley crossings. The most significant reduction in sediment load occurs in the foothill landscape type (0.11 tons/year average annual sediment to 0.02 tons/year). This reduction is likely due to the large change in the average road length from existing conditions (394 feet) to the reduced road length conditions (182 feet). Under the BMP scenario, total sediment load from road crossings would be reduced from 38.03 tons/year to 9.33 tons/year (75.5% reduction). Estimated summary load reductions are shown by landscape setting in **Table E4-1** and by 6^{th} code HUC/303(d) watershed in **Table E4-2.**

Due to the extent of the unpaved road network and the resulting inability to assess it in its entirety, generalized assumptions are necessary for modeling the effects of BMPs. Restoration efforts would need to consider site-specific BMPs that, on average, would likely be represented by the modeling assumptions. Other management issues that will impact BMP scenarios are the ability to perform restoration work within the different land ownership categories.

Table E4-1. Extrapolated Sediment Load Summary from Unpaved Road Crossing– 200' Road Length Reduction

Landscape Type	Total Number of Sites	Mean Sediment Load (Tons/year)	Total Sediment Load (Tons/year)	Load Reduction %
Mountain	309	0.02	6.18	71.4%
Foothill	139	0.02	2.78	81.8%
Valley	37	0.01	0.37	66.7%
Total:	**485**		**9.33**	**75.5%**

Table E4-2. Percent Sediment Reduction per HUC: Road Length Reduction

HUC	Annual Sediment Load (tons/year)	Road Length Reduction Annual Sediment Load (tons/year)	Load Reduction %
Little Blackfoot River-Hat Creek	2.13	0.61	71.4%
Little Blackfoot River-Larabee Gulch	0.7	0.2	71.4%
Little Blackfoot River-Mead Creek	5.5	1.05	80.9%
Little Blackfoot River (Previously Elliston Creek)	1.74	0.42	75.9%
Elliston Creek	0.45	0.13	71.1%
Upper Upper Dog Creek	1.33	0.38	71.4%
Lower Dog Creek	1.65	0.46	72.1%
Lower Upper Dog Creek	2.1	0.6	71.4%
Snowshoe Creek	2.28	0.56	75.4%
Lower Spotted Dog Creek	2.2	0.4	81.8%
Lower Upper Spotted Dog Creek	0.54	0.12	77.8%
South Fork Dog Creek	0.69	0.14	79.7%
Upper Telegraph Creek	3.71	1.06	71.4%
Lower Threemile Creek	0.63	0.16	74.6%
Lower Carpenter Creek	3.96	0.88	77.8%
Upper Carpenter Creek	0.56	0.16	71.4%
Lower Telegraph Creek	0.35	0.1	71.4%
Mike Renig Gulch	0.35	0.1	71.4%
North Trout Creek	1.81	0.46	74.6%
Ontario Creek	2.45	0.7	71.4%
Sixmile Creek	1.45	0.28	80.7%
Trout Creek	0.78	0.18	76.9%
Upper Upper Spotted Dog Creek	0.56	0.16	71.4%
Upper Threemile Creek	0.11	0.02	81.8%
	38.03	**9.33**	**75.5%**

E4.2 Summary of Total Loads and Potential Reductions

Sediment loading from unpaved crossings, parallel segments, culvert failure, and traction sand application are summarized in **Attachment EA**, **Table EA-11**.

E4.3 Assessment of Existing BMPs

Besides reducing the contributing road length, other potential BMPs are available that would reduce sediment loading from the unpaved road network. Road sediment reduction strategies such as the installation of full structural BMPs at existing road crossings (drive through dips, culvert drains, settling basins, silt fence, etc), road surface improvement, reduction in road traffic levels (seasonal or permanent road closures), and timely road maintenance to reduce surface rutting are all BMPs that will reduce sediment loading from the road network. The presence of BMPs was noted for each of the field-assessed stream crossing sites. Of the 22 sites, 12 had at least one of the following BMPs: graveled surface, water bar, culvert drain, or drive through dip (**Figure E-6**).

The sediment yield for each crossing was impacted by the road surface (gravel or native) and the traffic level (high, low or none) in the WEPP model. Conclusions from **Figure E-6** are preliminary due to the small sample sizes; however, it appears that the minimized traffic may reduce sediment yield regardless of the presence of BMPs. The presence of gravel did not appear to decrease sediment yield; however this may be due to traffic level rather than to the presence of gravel, as noted in the comparison of the following category one and two (no BMPS and gravel only BMP). Based on the small sample sizes, drive-through dips, culvert drains and water bars appeared to be equally effective for the Little Blackfoot River assessed crossings. WEPP software does not allow for specific modeling of BMPs and the results may not completely indicate effectiveness.

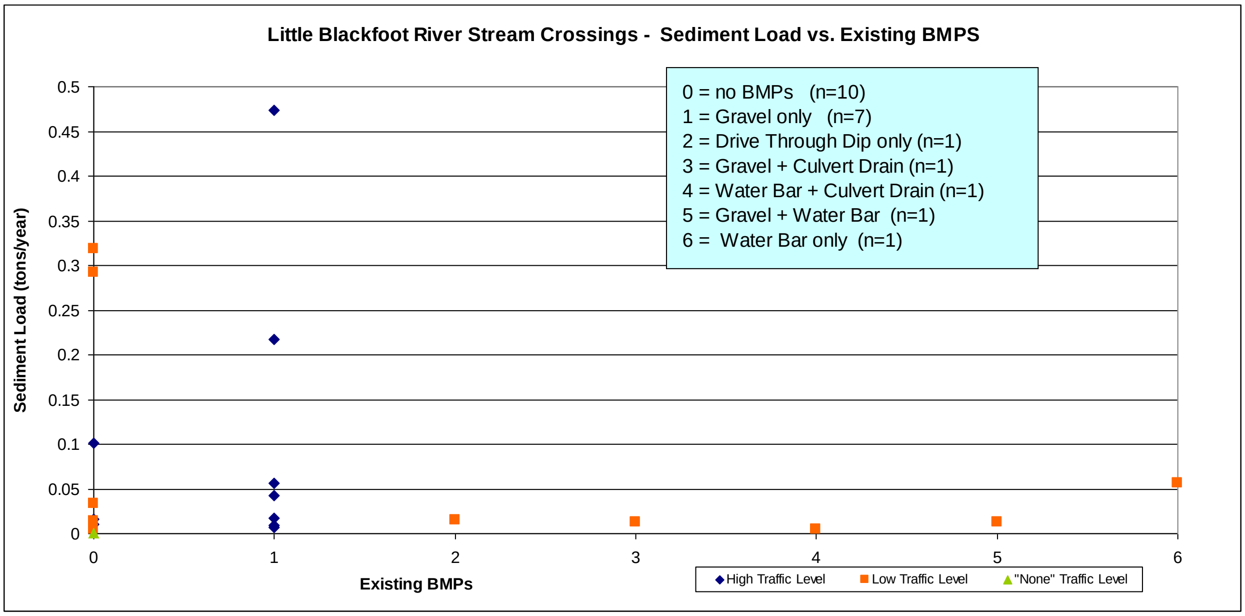

Figure E-6. WEPP:Road Sediment Results for each BMP Category

E5.0 Quality Assurance / Quality Control Results

E5.1 Representativeness

Representativeness refers to the extent to which measurements represent an environmental condition in time and space. Twenty two sites were randomly selected through GIS based on watershed and ownership categories with the intent that at least twenty sites would be assessed. A total of 22 road crossings were assessed in the field. Spatial representation is shown in **Attachment EA**, **Table EA-3**. Temporal variations were not accounted for in this study, as the field data collected at road crossing locations does not change during the year.

E5.2 Comparability

Comparability is the applicability of the project's data to the WEPP:Road model input data. The WEPP:Road model includes a high and low data value for each input parameter. Field data was compared to the model input range and sites with data outside these ranges were flagged for additional evaluation through the review of photographs, field comments, personal communication and other field data. No sites were determined to have unacceptable field data for the WEPP:Road model.

E5.3 Completeness

Completeness is a measure of the amount of data prescribed for assessment activities and the usable data actually collected, expressed as a percentage.

Completeness as % = (No. Valid Data Points or Samples / Total # Data Points or Samples) x 100
The overall project goal was 90% completeness. A total of 27 sites were assessed in the field. As documented in **Attachment EB,** all sites were deemed valid through data adjustments based on comments, conversations with the field crew and through analysis of photographs for input into the WEPP:model. This equates to a completeness of 100%. Incomplete field notes that were altered through the use of photographs were fill gradient for NTC-P-M-X-387, and road gradient for CPC-P-M-P-465. The road design for TGC-F-M-X-74 was difficult to determine with the recent snow and the road was determined as rutted through best professional judgment. The rock content in the prism material for TGC-F-M-X-48 was adjusted downward from 80% to 50% per WEPP guidance. The field notes were erroneous for the road length of LBM-P-F-X-185: the length was recorded as 100 feet and was actually 1000 feet. The modeled output (**Attachment ED**) includes these five updates.

E6.0 References

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ATTACHMENT EA - ATTACHED TABLES

Table EA-1. Little Blackfoot River TPA Road Summary by 6th Code Subwatershed (USGS HUC 12)

2008 303(d) Listed Segments	6th Code Subwatershed (USGS HUC 12)	Area (Mi^2)	Stream Miles (Mi)	Unpaved Crossings	Unpaved Crossing Density (Crossing / Mi^2)	Paved Crossings	Total Crossings	Total Road Length (Mi)	Total Road Density (Mi/Mi^2)	% of Total Roads which are unpaved	Total Unpaved Road Length w/in 50 ft Streams (Mi)	Total Unpaved Road Density w/in 50 ft of Streams (Mi/Mi^2)
Upper Little Blackfoot River	**Little Blackfoot River-Hat Creek**	21.12	34.56	31	1.47	1	32	44.32	2.10	94.7%	1.15	5.5%
	Little Blackfoot River-Larabee Gulch	28.43	44.15	10	0.35	0	10	10.23	0.36	100.0%	0.31	1.1%
Lower Little Blackfoot River	**Little Blackfoot River-Mead Creek**	49.02	99.09	58	1.18	27	85	65.80	1.34	68.1%	2.93	6.0%
	Little Blackfoot River (Previously Elliston Creek)	25.44	44.62	26	1.02	4	30	32.04	1.26	65.9%	1.33	5.2%
Elliston Creek	**Elliston Creek**	6.09	9.23	7	1.15	3	10	15.34	2.52	94.4%	0.42	6.9%
Upper Dog Creek	**Upper Dog Creek – Listed Waterbody MT76G004_071**	9.14	16.25	19	2.08	0	19	21.72	2.38	100.0%	1.00	11.0%
Lower Dog Creek	**Lower Dog Creek - Listed Waterbody MT76G004_072**	25.84	34.00	23	0.89	1	24	40.62	1.57	88.5%	1.10	4.3%
	Upper Dog Creek – Listed Waterbody MT76G004_072	22.58	30.92	30	1.33	0	30	46.37	2.05	100.0%	1.67	7.4%
Snowshoe Creek	**Snowshoe Creek**	18.13	33.88	28	1.54	0	28	40.74	2.25	100.0%	1.83	10.1%
Lower Spotted Dog Creek	**Lower Spotted Dog Creek**	18.18	32.92	20	1.10	0	20	21.51	1.18	100.0%	1.11	6.1%
	Upper Spotted Dog Creek - Listed	6.57	12.09	6	0.91	0	6	14.78	2.25	100.0%	0.17	2.6%
	South Fork Dog Creek	13.10	25.07	7	0.53	0	7	14.88	1.14	100.0%	0.24	1.8%
Upper Telegraph Creek	**Telegraph Creek - Listed**	16.03	31.02	53	3.31	0	53	44.43	2.77	100.0%	1.77	11.1%
Lower Threemile Creek	**Threemile Creek - Listed**	15.41	26.46	13	0.84	1	14	10.86	0.70	90.1%	0.43	2.8%
Not Listed for Sediment	Lower Carpenter Creek	21.33	31.74	44	2.06	0	44	42.76	2.00	100.0%	2.46	11.5%
Not Listed for Sediment	Upper Carpenter Creek	4.92	10.78	8	1.63	0	8	3.93	0.80	100.0%	0.37	7.5%
Not Listed for Sediment	Telegraph Creek – Not Listed	3.05	4.21	5	1.64	0	5	8.51	2.79	100.0%	0.15	4.8%
Not Listed for Sediment	Mike Renig Gulch	11.43	16.57	5	0.44	0	5	13.05	1.14	100.0%	0.52	4.6%
Not Listed for Sediment	North Trout Creek	16.44	22.74	23	1.40	0	23	26.24	1.60	100.0%	1.26	7.7%
Not Listed for Sediment	Ontario Creek	20.00	33.70	35	1.75	0	35	36.24	1.81	100.0%	0.95	4.7%
Not Listed for Sediment	Sixmile Creek	29.52	64.35	15	0.51	10	25	35.16	1.19	86.1%	0.91	3.1%
Not Listed for Sediment	Trout Creek	17.18	33.36	10	0.58	4	14	29.77	1.73	94.8%	0.39	2.3%
Not Listed for Sediment	Upper Spotted Dog Creek – Not Listed	7.05	11.19	8	1.13	0	8	19.71	2.80	100.0%	0.27	3.9%
Not Listed for Sediment	Threemile Creek – Not Listed	6.70	8.90	1	0.15	0	1	1.50	0.22	100.0%	0.03	0.5%
	Total	**412.6**	**711.8**	**485**	**1.18**	**51**	**536**	**640.5**	**1.5**	**92.6%**	**22.8**	**5.5%**

Note: USGS HUC 12 boundaries were further divided based on CWAIC 303(d) listings. These are denoted with a "Listed or Not-Listed suffix.
[A]USGS HUC 12 combines Little Blackfoot River with Elliston Creek. Elliston Creek is 303(d) Listed and was separated from the HUC 12 classification. The second row, Little Blackfoot River does not include Elliston Creek information.
Bold text indicates that segment is 303(d) listed for sediment impairment

Table EA-2. Road Summary by Landscape Type, Land Ownership, and Soil Erosion Hazard Classification

Landscape Type	Area (Mi^2)	Stream Miles (Mi)	Unpaved Crossings	Unpaved Crossing Density (Crossing/Mi^2)	Paved Crossings	Total Crossings	Total Road Length (Mi)	Total Road Density (Mi/Mi^2)	% of Total Roads which are unpaved	Total Unpaved Road Length w/in 50 ft Streams (Mi)	Total Unpaved Road Density w/in 50 ft of Streams (Mi/Mi^2)
Valley	18.27	75.72	37	2.03	31	68	48.90	2.68	43.31%	1.751	9.58%
Foothill	151.78	275.60	139	0.92	20	156	166.18	1.09	91.22%	6.538	4.31%
Mountain	187.44	284.75	296	1.58	0	296	409.12	2.18	98.78%	13.94	7.44%
Mountain (USFS Roadless Area)	55.20	75.74	13	0.24	0	13	16.31	0.30	100.00%	0.563	1.02%
Total	***412.6***	***711.8***	***485***	***1.18***	***51***	***533***	***640.5***	***1.5***	***92.6%***	***22.8***	***5.5%***

Table EA-2. Road Summary by Landscape Type, Land Ownership, and Soil Erosion Hazard Classification

Land Ownership	Area (Mi^2)	Stream Miles (Mi)	Unpaved Crossings	Unpaved Crossing Density (Crossing/Mi^2)	Paved Crossings	Total Crossings	Total Road Length (Mi)	Total Road Density (Mi/Mi^2)	% of Total Roads which are unpaved	Total Unpaved Road Length w/in 50 ft Streams (Mi)	Total Unpaved Road Density w/in 50 ft of Streams (Mi/Mi^2)
Federal Land	102.37	145.90	202	1.97	0	202	308.87	3.02	99.72%	9.532	9.31%
Private	231.51	451.95	250	1.08	49	296	298.30	1.29	85.15%	11.889	5.14%
State Land	23.50	38.22	20	0.85	2	22	17.03	0.72	87.55%	0.809	3.44%
Federal (USFS Roadless)	55.20	75.74	13	0.24	0	13	16.31	0.30	100.00%	0.563	1.02%
Total	***412.6***	***711.8***	***485***	***1.18***	***51***	***533***	***640.5***	***1.5***	***92.6%***	***22.8***	***5.5%***
Soil Erosion Hazard Classification	**Area (Mi^2)**	**Stream Miles (Mi)**	**Unpaved Crossings**	**Unpaved Crossing Density (Crossing/Mi^2)**	**Paved Crossings**	**Total Crossings**	**Total Road Length (Mi)**	**Total Road Density (Mi/Mi^2)**	**% of Total Roads which are unpaved**	**Total Unpaved Road Length w/in 50 ft Streams (Mi)**	**Total Unpaved Road Density w/in 50 ft of Streams (Mi/Mi^2)**
Moderate	83.72	149.59	142	1.70	6	148	150.44	1.80	94.56%	5.41	6.47%
NR	3.62	13.27	10	2.76	0	10	4.11	1.14	99.17%	0.55	15.23%
Severe	292.06	394.07	248	0.85	14	259	410.82	1.41	96.71%	13.33	4.56%
Slight	32.91	154.88	85	2.58	31	116	75.14	2.28	65.99%	3.50	10.63%
Total	***412.6***	***711.8***	***485***	***1.17***	***51***	***533***	***640.5***	***1.5***	***92.6%***	***22.8***	***5.5%***

Table EA-3. Proposed Field Sites and Actual Field Assessed Sites

6th Code Subwatershed (USGS HUC 12)	Number of Sites Randomly Selected with GIS	Number of Actual Field Assessed Sites (Crossing / Parallel)	Landscape Type	Number of Sites Randomly Selected with GIS	Number of Actual Field Assessed Sites (Crossing/Parallel)
Carpenter Creek	2	1 / 1	Valley	2	2/ 0
Little Blackfoot River[A]			Foothill	6	5 / 1
Elliston Creek[A]	1		Mountain	13	15 / 4
Little Blackfoot River-Hat Creek	1	1 / 0	Mountain (USFS Roadless Area)	1	0 / 0
Little Blackfoot River-Larabee Gulch			**Land Ownership**	**Number of Field Sites Randomly Selected**	**Number of Assessed Sites (Crossing/Parallel)**
Little Blackfoot River-Mead Creek	2	3 / 1	Federal Land	11	11 / 1
Lower Dog Creek			Private	10	10 / 4
Lower Spotted Dog Creek	1		State Land	0	1 / 0
Mike Renig Gulch	1		Federal (USFS Roadless)	1	0 / 0
North Trout Creek		2 / 0	**Soil Erosion Hazard Classification**	**Number of Field Sites Randomly Selected**	**Number of Assessed Sites (Crossing/Parallel)**
Ontario Creek	4		Moderate	10	3 / 1
Sixmile Creek			NR	1	0 / 1
Snowshoe Creek		2 / 1	Severe	10	15 / 3
South Fork Dog Creek	1		Slight	1	4 / 0
Telegraph Creek	4	6 / 2			
Threemile Creek	1	1 / 0			
Trout Creek	1	3 / 0			
Upper Dog Creek	2	1 / 0			
Upper Spotted Dog Creek	1	2 / 0			

[A]USGS HUC 12 combines Little Blackfoot River with Elliston Creek. Elliston Creek is 303(d) Listed and was separated from the HUC 12 classification. The second row, Little Blackfoot River does not include Elliston Creek information.

Table EA-4. Traction Sand Contribution by HUC; Paved and Unpaved Roads within 100 feet of Surface Water

Department	HUCs	Miles within 100 feet of surface water	Application Rate Tons/mile/year	Tons /year 15% delivery	BMP Application Total Sediment Load (t/y) 10% delivery	Total Reduction
Powell County Road Department, District I Secondary Roads*	Little Blackfoot River – Mead Creek	1.21	6.25	1.13	0.76	33%
	Little Blackfoot River (previously Elliston Creek)	0.11	6.25	0.10	0.07	33%
Highway 12 (mile marker 0 to 12.5)	Little Blackfoot River – Mead Creek	1.52	50	11.40	7.60	33%
Highway 12 (Avon to Elliston)	Trout Creek	0.68	96	9.79	6.53	33%
	Elliston Creek	0.03	96	0.43	0.29	33%
	Little Blackfoot River (previously Elliston Creek)	0.55	96	7.92	5.28	33%
Highway 141	Little Blackfoot River – Mead Creek	0.15	58	1.31	0.87	33%
	Lower Threemile Creek	0.11	58	0.96	0.64	33%
	Sixmile Creek	0.69	58	6.00	4.00	33%

Secondary roads were calculated as all paved roads within the HUC not including Highway 141 or Highway 12. Traction sand contributions from unpaved secondary roads are not included in these calculations

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Table EA-5. Unpaved Road Crossings by HUC/303(d) Subwatershed, Ownership and Landscape Type

Ownership	Private			Federal Land			Federal (USFS Roadless Designation)			State			Total
6th Code/303(d) Subwatershed	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Crossings
Little Blackfoot River-Hat Creek	1	-	13	-	-	14	-	-	3	-	-	-	31
Little Blackfoot River-Larabee Gulch	-	-	1	-	-	1	-	-	8	-	-	-	10
Little Blackfoot River-Mead Creek	9	41	-	-	-	-	-	-	-	2	6	-	58
Little Blackfoot River (Previously Elliston Creek)	8	8	5	-	-	3	-	-	-	2	-	-	26
Elliston Creek	1	-	3	-	-	3	-	-	-	-	-	-	7
Upper Dog Creek – Listed Waterbody MT76G004_071	-	-	7	-	-	12	-	-	-	-	-	-	19
Lower Dog Creek - Listed Waterbody MT76G004_072	-	1	14	-	-	8	-	-	-	-	-	-	23
Upper Dog Creek – Listed Waterbody MT76G004_072	-	-	9	-	-	21	-	-	-	-	-	-	30
Snowshoe Creek	-	7	2	-	-	18	-	-	-	-	1	-	28
Lower Spotted Dog Creek	-	18	-	-	-	-	-	-	-	-	2	-	20
Upper Spotted Dog Creek - Listed	-	3	2	-	-	1	-	-	-	-	-	-	6
South Fork Dog Creek	-	4	-	-	-	2	-	-	-	-	1	-	7
Upper Telegraph Creek - Listed	-	-	11	-	-	40	-	-	2	-	-	-	53
Threemile Creek - Listed	10	3	-	-	-	-	-	-	-	-	-	-	13
Lower Carpenter Creek	-	22	8	-	-	14	-	-	-	-	-	-	44
Upper Carpenter Creek	-	-	3	-	-	5	-	-	-	-	-	-	8
Telegraph Creek – Not Listed	-	-	2	-	-	3	-	-	-	-	-	-	5
Mike Renig Gulch	-	-	2	-	-	2	-	-	-	-	-	1	5
North Trout Creek	-	5	1	-	-	16	-	-	-	-	-	1	23
Ontario Creek	-	-	5	-	-	30	-	-	-	-	-	-	35
Sixmile Creek	2	10	1	-	-	-	-	-	-	-	2	-	15
Trout Creek	2	2	3	-	-	1	-	-	-	-	2	-	10

Table EA-5. Unpaved Road Crossings by HUC/303(d) Subwatershed, Ownership and Landscape Type

Ownership	Private			Federal Land			Federal (USFS Roadless Designation)			State			Total
6th Code/303(d) Subwatershed	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Crossings
Upper Spotted Dog Creek – Not Listed	-	-	-	-	-	8	-	-	-	-	-	-	8
Threemile Creek – Not Listed	-	1	-	-	-	-	-	-	-	-	-	-	1
Total	***33***	***125***	***92***	***0***	***0***	***202***	***0***	***0***	***13***	***4***	***14***	***2***	***485***

Bold text indicates that segment is 303(d) listed for sediment impairment.

Table EA-6. Detailed Extrapolated Sediment Load From Unpaved Road Crossings by HUC/303(d) Subwatershed, Ownership and Landscape Type – Existing Conditions (tons/year)

Ownership	Private			Federal Land			Federal (USFS Roadless Designation)			State			Total Annual Sediment Load (tons/year)
6th Code/303(d) Subwatershed	Valley	Foothill	Mountain	Valley	Total Annual Sediment Load	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Little Blackfoot River-Hat Creek	0.03	0.00	0.91	0.00	0.00	0.98	0.00	0.00	0.21	0.00	0.00	0.00	2.13
Little Blackfoot River-Larabee Gulch	0.00	0.00	0.07	0.00	0.00	0.07	0.00	0.00	0.56	0.00	0.00	0.00	0.70
Little Blackfoot River-Mead Creek	0.27	4.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.66	0.00	5.50
Little Blackfoot River (Previously Elliston Creek)	0.24	0.88	0.35	0.00	0.00	0.21	0.00	0.00	0.00	0.06	0.00	0.00	1.74
Elliston Creek	0.03	0.00	0.21	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.45
Upper Dog Creek – Listed Waterbody MT76G004_071	0.00	0.00	0.49	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	1.33
Lower Dog Creek - Listed Waterbody MT76G004_072	0.00	0.11	0.98	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	1.65

Table EA-6. Detailed Extrapolated Sediment Load From Unpaved Road Crossings by HUC/303(d) Subwatershed, Ownership and Landscape Type – Existing Conditions (tons/year)

Ownership	Private			Federal Land			Federal (USFS Roadless Designation)			State			Total Annual Sediment Load (tons/year)
6^{th} Code/303(d) Subwatershed	Valley	Foothill	Mountain	Valley	Total Annual Sediment Load	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Upper Dog Creek – Listed Waterbody MT76G004_072	0.00	0.00	0.63	0.00	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	2.10
Snowshoe Creek	0.00	0.77	0.14	0.00	0.00	1.26	0.00	0.00	0.00	0.00	0.11	0.00	2.28
Lower Spotted Dog Creek	0.00	1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	2.20
Upper Spotted Dog Creek - Listed	0.00	0.33	0.14	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.54
South Fork Dog Creek	0.00	0.44	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.11	0.00	0.69
Upper Telegraph Creek - Listed	0.00	0.00	0.77	0.00	0.00	2.80	0.00	0.00	0.14	0.00	0.00	0.00	3.71
Threemile Creek - Listed	0.30	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63
Lower Carpenter Creek	0.00	2.42	0.56	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	3.96
Upper Carpenter Creek	0.00	0.00	0.21	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.56
Telegraph Creek – Not Listed	0.00	0.00	0.14	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.35
Mike Renig Gulch	0.00	0.00	0.14	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.07	0.35
North Trout Creek	0.00	0.55	0.07	0.00	0.00	1.12	0.00	0.00	0.00	0.00	0.00	0.07	1.81
Ontario Creek	0.00	0.00	0.35	0.00	0.00	2.10	0.00	0.00	0.00	0.00	0.00	0.00	2.45
Sixmile Creek	0.06	1.10	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	1.45
Trout Creek	0.06	0.22	0.21	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.22	0.00	0.78
Upper Spotted Dog Creek – Not Listed	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.56
Threemile Creek – Not Listed	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Total	***0.99***	***13.75***	***6.44***	***0.00***	***0.00***	***14.14***	***0.00***	***0.00***	***0.91***	***0.12***	***1.54***	***0.14***	***38.03***

Bold text indicates that segment is 303(d) listed for sediment impairment

Table EA-7. Detailed Extrapolated Sediment Load From Parallel Segments by HUC/303(d) Subwatershed, Ownership and Landscape Type – Existing Conditions (tons/year)

Ownership	Private			Federal Land			Federal (USFS Roadless Designation)			State			Total Annual Sediment Load (tons/year)
6th Code/303(d) Subwatershed	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Little Blackfoot River-Hat Creek	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Little Blackfoot River-Larabee Gulch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Little Blackfoot River-Mead Creek	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Little Blackfoot River (Previously Elliston Creek)	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Elliston Creek	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Upper Dog Creek – Listed Waterbody MT76G004_071	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Lower Dog Creek - Listed Waterbody MT76G004_072	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Upper Dog Creek – Listed Waterbody MT76G004_072	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Snowshoe Creek	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Lower Spotted Dog Creek	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Spotted Dog Creek - Listed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Fork Dog Creek	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Telegraph Creek - Listed	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Threemile Creek - Listed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table EA-7. Detailed Extrapolated Sediment Load From Parallel Segments by HUC/303(d) Subwatershed, Ownership and Landscape Type – Existing Conditions (tons/year)

Ownership	Private			Federal Land			Federal (USFS Roadless Designation)			State			Total Annual Sediment Load (tons/year)
6th Code/303(d) Subwatershed	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Lower Carpenter Creek	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Upper Carpenter Creek	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Telegraph Creek – Not Listed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mike Renig Gulch	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
North Trout Creek	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Ontario Creek	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Sixmile Creek	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trout Creek	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Upper Spotted Dog Creek – Not Listed	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Threemile Creek – Not Listed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	***0.02***	***0.02***	***0.09***	***0.00***	***0.00***	***0.20***	***0.00***	***0.00***	***0.01***	***0.00***	***0.00***	***0.00***	***0.35***

Bold text indicates that segment is 303(d) listed for sediment impairment.

Table EA-8. Fish Passage Analysis for Selected Road Crossings Using Alaska Region Criteria

Location ID	Structure Type	Structure Diameter or Dimensions (in)	Width (ft)	Culvert Slope (%)	Bf in Riffle Above Culvert (ft)[A]	Culvert /BF ratio	Perch (in)	Streambed Materials in Culvert	Final Classification	Notes/Comments
Fish passage evaluation criteria: Circular CMP 48" span and smaller										
TGC-F-M-X-115	CMP / WOOD	12 OR 24	1	2.0[1]	3.5	0.29[1]	13.0[1]	N/A	[1]RED	Downstream end wood; damaged upstream end - crushed and sunken; closed road - bridge "temporarily out", road non-existant
LBM-S-F-X-270	CMP	24	2	6.0[1]	3	0.67[3]	0.0[2]	Yes	[1]RED	

Table EA-8. Fish Passage Analysis for Selected Road Crossings Using Alaska Region Criteria

Location ID	Structure Type	Structure Diameter or Dimensions (in)	Width (ft)	Culvert Slope (%)	Bf in Riffle Above Culvert (ft)[A]	Culvert /BF ratio	Perch (in)	Streambed Materials in Culvert	Final Classification	Notes/Comments
TGC-F-M-X-127	CMP	24	2	3.0[1]	3.5	0.57[3]	4.0[3]	No	[1]RED	Lip on culvert upstream
TGC-F-M-X-130	CMP	24	2	2.5[1]	3	0.67[3]	4.0[3]	No	[1]RED	newly constructed road
TRC-F-M-X-168	CMP	24	2	5.0[1]	4.5	0.44[1]	6.0[1]	No	[1]RED	Cattle impact, dam above u/s end
LBM-P-V-X-198	CMP	30	2.5	1.5[1]	8	0.31[1]	0.0[2]	No	[1]RED	Recently installed, erosion present on upstream end
USD-P-M-X-116	CMP	30	2.5	2.5[1]	3	0.83[2]	24.0[1]	No	[1]RED	
NTC-P-M-X-387	CMP	36	3	4.5[1]	4	0.75[3]	3.3[3]	No	[1]RED	approx 3-4 cfs
TGC-F-M-X-48	CMP	36	3	1.5[1]	4.5	0.67[3]	11.0[1]	No	[1]RED	culvert ponded w/s end, perched d/s end
SSC-F-M-X-462	CMP	36	3	3.0[1]	3	1.00[2]	15.0[1]	No	[1]RED	Mountain drainage, ~ 1-2 cfs
TMC-P-V-X-442	squash CMP	30 x 42	3.5	1.5[1]	7	0.50[3]	0.0[2]	No	[1]RED	culvert & stream parallel to three mile creek, fed from private pond, 2-3 cfs; landowner said culvert installed 4 years ago.
SSC-P-F-X-347	CMP	45	3.75	0.0[2]	6	0.63[3]	0.0[2]	No	[3]GREY	Slough / Pond at d/s end
Fish passage evaluation criteria: Circular CMP greater than 48" and less than 100% substrate cover										
LBH-P-M-X-134	ARCH CMP	52	4.3	1.0[3]	6	0.72[3]	0.0[2]	Yes	[3]GREY	Model culvert (arch), streambed material well placed
TGC-F-M-X-74	squash CMP	36 X 55	4.6	2.0[3]	6.5	0.71[3]	0.0[2]	No	[3]GREY	Well constructed culvert in stream
USD-F-M-X-96	squash CMP	45 x 57	4.75	2.5[1]	8	0.59[3]	0.0[2]	No	[1]RED	

Legend: [1]High certainty of not providing juvenile fish passage [2]High certainty of providing juvenile fish passage [3]Additional and more detailed analysis is required
[A]Flowing water was noted at all 15 crossing locations.

Table EA-9. Peak Discharges Using Parrett and Johnson Equations (West Region) and Manning's Equation

Site Information					Peak Discharges Using Parrett and Johnson Equations (West Region)						Peak Discharges Using Manning's Equation, pipes flowing full					
Site ID	**Structure**	**Bankfull Width (ft)**	**CMP Diameter or Height (ft)**	**X-sect Area (ft2)**	**Q2 (cfs)**	**Q5 (cfs)**	**Q10 (cfs)**	**Q25 (cfs)**	**Q50 (cfs)**	**Q100 (cfs)**	**Streambed Materials in Culvert**	**n[A]**	**Slope %**	**Velocity (ft/sec)**	**Peak Flow (cfs)**	**Max. Conveyance Manning's > Omang**
TMC-P-V-X-442	Squashed CMP	7.00	2.5	4.91	13.24	25.30	35.17	49.73	62.72	75.60	No	0.027	1.5	4.93	24.2	**Q2**
LBM-P-V-X-198	CMP	8.00	2.5	4.91	17.25	32.43	44.66	62.57	78.60	94.36	No	0.027	1.5	4.93	24.2	**Q2**
SSC-P-F-X-347	CMP	6.00	3.8	11.04	9.76	18.99	26.69	38.15	48.34	58.53	No	0.027	0.1	1.67	18.4	**Q2***
TGC-F-M-X-127	CMP	3.50	2.0	3.14	3.36	6.97	10.17	15.10	19.44	23.92	No	0.027	3.0	6.01	18.9	**Q25**
TRC-F-M-X-168	CMP	4.50	2.0	3.14	5.52	11.12	15.95	23.26	29.73	36.31	No	0.027	5.0	7.75	24.4	**Q25**
TGC-F-M-X-74	Squashed CMP	6.50	3.0	7.07	11.44	22.04	30.80	43.78	55.34	66.85	No	0.027	2.0	6.43	45.4	**Q25**
TGC-F-M-X-130	CMP	3.00	2.0	3.14	2.47	5.23	7.72	11.58	14.98	18.52	No	0.027	2.5	5.48	17.2	**Q50**
USD-F-M-X-96	Squashed CMP	8.00	3.8	11.04	17.25	32.43	44.66	62.57	78.60	94.36	No	0.027	2.5	8.34	92.1	**Q50**
LBM-S-F-X-270	CMP	3.00	2.0	3.14	2.47	5.23	7.72	11.58	14.98	18.52	Yes	0.027	6.0	8.49	26.7	**Q100**
USD-P-M-X-116	CMP	3.00	2.5	4.91	2.47	5.23	7.72	11.58	14.98	18.52	No	0.027	2.5	6.36	31.2	**Q100**
NTC-P-M-X-387	CMP	4.00	3.0	7.07	4.37	8.93	12.92	18.99	24.36	29.86	No	0.027	4.5	9.64	68.1	**Q100**
TGC-F-M-X-48	CMP	4.50	3.0	7.07	5.52	11.12	15.95	23.26	29.73	36.31	No	0.027	1.5	5.56	39.3	**Q100**
SSC-F-M-X-462	CMP	3.00	3.0	7.07	2.47	5.23	7.72	11.58	14.98	18.52	No	0.027	3.0	7.87	55.6	**Q100**
LBH-P-M-X-134	Arch CMP	6.00	4.3	14.75	9.76	18.99	26.69	38.15	48.34	58.53	Yes	0.027	1.0	5.81	85.6	**Q100**
TGC-F-M-X-115	CMP/Wood	3.50	1.0	0.79	3.36	6.97	10.17	15.10	19.44	23.92	N/A	0.02	N/A	N/A	N/A	**N/A**
TGC-F-M-X-94	CMP	2.00	1.3	1.23	1.11	2.46	3.73	5.77	7.55	9.45	Yes	0.027	N/A	N/A	N/A	**N/A**
NTC-P-F-X-348	CMP	N/A	2.0	3.14	N/A	N/A	N/A	N/A	N/A	N/A	No	0.027	1.5	4.25	13.3	**N/A**
LBM-P-F-X-185	CMP / Concrete	3.00	3.0	7.07	2.47	5.23	7.72	11.58	14.98	18.52	N/A	0.02	N/A	N/A	N/A	**N/A**
CPC-F-M-X-502	Ford crossing	Ford crossing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
UDC-F-M-X-411	Ford crossing	Ford crossing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
TRC-P-F-X-237	Ford crossing	Ford crossing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
TRC-P-M-X-232	Ford crossing	Ford crossing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**

The slope of SSC-P-F-X-347 was changed from 0 to 0.1 percent in order to complete Manning's equation calculations. *** Assumed 0.1% slope**

[A]n, Manning's Equation Roughness Coefficient Reference: (Wanielista, et al., 1997)

Table EA-10. Culvert Failure Load Potential Per 25% Probability and Per Storm Event (tons/year)

6th Code Subwatershed (USGS HUC 12)	Q2	Q5, Q10 & Q25	Q50	Q100
Percent of Culverts Passing Storm Event	**0%**	**21%**	**47%**	**57%**
Little Blackfoot River-Hat Creek	0.0	12.5	28.0	34.0
Little Blackfoot River-Larabee Gulch	0.0	4.0	9.0	11.0
Little Blackfoot River-Mead Creek	0.0	23.4	52.5	63.6
Little Blackfoot River (Previously Elliston Creek)	0.0	10.5	23.5	28.5
Elliston Creek	0.0	2.8	6.3	7.7
Upper Dog Creek – Listed Waterbody MT76G004_071	0.0	7.7	17.2	20.8
Lower Dog Creek - Listed Waterbody MT76G004_072	0.0	9.3	20.8	25.2
Upper Dog Creek – Listed Waterbody MT76G004_072	0.0	12.1	27.1	32.9
Snowshoe Creek	0.0	11.3	25.3	30.7
Lower Spotted Dog Creek	0.0	8.1	18.1	21.9
Upper Spotted Dog Creek - Listed	0.0	2.4	5.4	6.6
South Fork Dog Creek	0.0	2.8	6.3	7.7
Telegraph Creek - Listed	0.0	21.4	48.0	58.2
Threemile Creek - Listed	0.0	5.3	11.8	14.3
Lower Carpenter Creek	0.0	17.8	39.8	48.3
Upper Carpenter Creek	0.0	3.2	7.2	8.8
Telegraph Creek – Not Listed	0.0	2.0	4.5	5.5
Mike Renig Gulch	0.0	2.0	4.5	5.5
North Trout Creek	0.0	9.3	20.8	25.2
Ontario Creek	0.0	14.1	31.7	38.4
Sixmile Creek	0.0	6.1	13.6	16.5
Trout Creek	0.0	4.0	9.0	11.0
Upper Spotted Dog Creek – Not Listed	0.0	3.2	7.2	8.8
Threemile Creek – Not Listed	0.0	0.4	0.9	1.1
Total	***0.0***	***195.7***	***437.9***	***532.2***

Sample calculation: Little Blackfoot River – Hat Creek , Q5 Storm Event

$$Load = (probability) \times (percent\_passing) \times (\#crossings) \times (average\_fill\_at\_risk\_TableA\!-\!10)$$

$$Load = (0.25) \times (0.21) \times (31 crossings) \times (7.7 tons) = 12.5 \frac{tons}{year}$$

Table EA-11. Total Annual Sediment Load from all Sources and Potential BMP Reduction

6th Code Subwatershed (USGS HUC 12)	Total Annual Sediment Load Crossings (t/y)	Total Annual Sediment Load Parallel Segments (t/y)	Total Annual Sediment Load – Traction Sand (t/y)	Culvert Failure- Q2 Storm Event	Culvert Failure- Q5, Q10 and Q25 Storm Events	Culvert Failure- Q50 Storm Event	Culvert Failure- Q100 Storm Event	Sum [A] (Crossings, Parallel Segments, &Traction Sand)	Sum with All Available Sediment Reductions[B] (t/y)	Percent Reduction[C] %
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Little Blackfoot River-Hat Creek	2.13	0.02	-	0.0	12.5	28.0	34.0	2.15	0.63	70.7%
Little Blackfoot River-Larabee Gulch	0.70	0.01	-	0.0	4.0	9.0	11.0	0.71	0.21	70.4%
Telegraph Creek - Listed	3.71	0.04	-	0.0	21.4	48.0	58.2	3.75	1.1	70.7%
Telegraph Creek – Not Listed	0.35	0.00	-	0.0	2.0	4.5	5.5	0.35	0.1	71.4%
Ontario Creek	2.45	0.02	-	0.0	14.1	31.7	38.4	2.47	0.72	70.9%
Mike Renig Gulch	0.35	0.01	-	0.0	2.0	4.5	5.5	0.36	0.11	69.4%
Upper Little Blackfoot River Total	***9.69***	***0.10***			***56.0***	***125.7***	***152.6***	***9.79***	***2.87***	***70.7%***
Little Blackfoot River-Mead Creek	5.50	0.01	13.85	0.0	23.4	52.5	63.6	19.36	10.29	46.8%
Little Blackfoot River (Previously Elliston Creek)	1.74	0.02	7.24	0.0	10.5	23.5	28.5	9.78	5.79	40.8%
Elliston Creek	0.45	0.01	0.45	0.0	2.8	6.3	7.7	0.89	0.43	51.7%
Upper Dog Creek – Listed Waterbody MT76G004_071	1.33	0.02	-	0.0	7.7	17.2	20.8	1.35	0.4	70.4%
Lower Dog Creek - Listed Waterbody MT76G004_072	1.65	0.02	-	0.0	9.3	20.8	25.2	1.67	0.48	71.3%
Upper Dog Creek – Listed Waterbody MT76G004_072	2.10	0.04	-	0.0	12.1	27.1	32.9	2.14	0.64	70.1%
Snowshoe Creek	2.28	0.03	-	0.0	11.3	25.3	30.7	2.31	0.59	74.5%
Lower Spotted Dog Creek	2.20	0.00	-	0.0	8.1	18.1	21.9	2.2	0.4	81.8%

Table EA-11. Total Annual Sediment Load from all Sources and Potential BMP Reduction

6th Code Subwatershed (USGS HUC 12)	Total Annual Sediment Load Crossings (t/y)	Total Annual Sediment Load Parallel Segments (t/y)	Total Annual Sediment Load – Traction Sand (t/y)	Culvert Failure-Q2 Storm Event	Culvert Failure-Q5, Q10 and Q25 Storm Events	Culvert Failure-Q50 Storm Event	Culvert Failure-Q100 Storm Event	Sum [A] (Crossings, Parallel Segments, &Traction Sand)	Sum with All Available Sediment Reductions[B] (t/y)	Percent Reduction[C] %
	1	2	3	4	5	6	7	8	9	10
Upper Spotted Dog Creek - Listed	0.54	0.00	-	0.0	2.4	5.4	6.6	0.54	0.12	77.8%
South Fork Dog Creek	0.69	0.00	-	0.0	2.8	6.3	7.7	0.69	0.14	79.7%
Threemile Creek - Listed	0.63	0.00	0.96	0.0	5.3	11.8	14.3	1.59	0.8	49.7%
Lower Carpenter Creek	3.96	0.03	-	0.0	17.8	39.8	48.3	3.99	0.91	77.2%
Upper Carpenter Creek	0.56	0.01	-	0.0	3.2	7.2	8.8	0.57	0.17	70.2%
North Trout Creek	1.81	0.02	-	0.0	9.3	20.8	25.2	1.83	0.48	73.8%
Sixmile Creek	1.45	0.00	6.00	0.0	6.1	13.6	16.5	7.45	4.28	42.6%
Trout Creek	0.78	0.01	9.79	0.0	4.0	9.0	11.0	10.58	6.72	36.5%
Upper Spotted Dog Creek – Not Listed	0.56	0.01	-	0.0	3.2	7.2	8.8	0.57	0.17	70.2%
Threemile Creek – Not Listed	0.11	0.00	-	0.0	0.4	0.9	1.1	0.11	0.02	81.8%
Lower Little Blackfoot River Total	***38.03***	***0.35***	***39.04***	***0.0***	***195.7***	***437.9***	***532.2***	***76.65***	***35.7***	***53.4%***

Bold text indicates that segment is 303(d) listed for sediment impairment
[A]Sum = Column 1+2+3
[B]Sum = Sediment load per crossing (**Table EA-13** Total Load) + Column 2 + Sediment Load per Traction Sand BMPs (**Table EA-4**)
[C]Percent Reduction = (Column 8-Column 9) / Column 8

.

Table EA-12. Comparability of Field Data to WEPP:Road Parameters

WEPP:Road Variable	Road gradient (%)	Road length (ft)	Road width (ft)	Fill gradient (%)	Fill length (ft)	Buff gradient (%)	Buff length (ft)	Rock content (%)
Minimum Value	0.3%	3 ft	1 ft	0.3%	1 ft	0.3%	1 ft	0%
Maximum Value	40%	1000 ft	300 ft	150%	1000 ft	100%	1000 ft	100%
Measured Range from the Field Data	0.5 - 13%	35 – 1000 feet	8 – 33 ft	0.3 – 145 %	1 – 37 ft	0.3 – 27.5%	1 – 60 ft	5 – 50%
Non-compliant values	CPC-P-M-P-465 (Not recorded)	TMC-P-V-X-442 (1147 feet)	None.	Multiple entries (-)	Multiple entries (-)	Multiple entries (-)	Multiple entries (-)	TGC-F-M-X-48 (80%)
Action Taken	Assumptions listed in **Attachment EC**.	Assumptions listed in **Attachment EC**.	None.	Minimum values entered for (-) entries.	Minimum values entered for (-) entries.	Minimum values entered for (-) entries.	Minimum values entered for (-) entries.	50% entered per WEPP guidance.

ATTACHMENT EB - WEPP: ROAD MODEL ADJUSTMENTS AND CUSTOM CLIMATE PARAMETERS

WEPP: ROAD MODEL ADJUSTMENTS

Heavily vegetated road conditions are not properly represented in the standard WEPP:Road assumption. As a result, William J. Elliott, author of the model, was consulted to determine how best to represent these roads within the confines of the model.

There are three traffic scenarios available in the model. For roads where vegetation has grown up on the edges, the no traffic scenario is most appropriate as this scenario grows a limited amount of vegetation on the road. It uses the same plant growth for the road that the high traffic used for the fillslope. **Table EB-1** explains the model assumptions for the three traffic scenarios.

Table EB-1. Model assumptions for the three traffic scenarios

Traffic	High	Low	None
Erodibility	100%	25%	25%
Hydraulic Conductivity	100%	100%	100%
Vegetation on Road Surface	0	0	50%
Vegetation on fill	50%	50%	100% Forested
Buffer	Forested	Forested	Forested

Based on conversations with Dr. Elliott, it was not appropriate to use the forest buffer to describe the road as the hydraulic conductivity of the soil would be too high. However, the hydraulic conductivity of the fillslope would be reasonable to use to describe the road surface for a fully forested scenario. This means, for the fully vegetated/forested road surface scenario, minimize the road segment length, put the remainder of the road surface length and gradient into the fillslope box, and minimize the buffer length and gradient at stream crossings.

PARALLEL ROAD ADJUSTMENTS

The WEPP:Road model has a maximum contributing road length of 1000-feet. According to Dr. Elliott, it is rare that the contributing road length ever exceeds this distance. As a result, any field assessed parallel road segment in excess of this distance was reduced to 1000-feet for modeling purposes. **Table EB-2** explains the model adjustments.

ROAD CROSSING MODEL ADJUSTMENTS

Some road crossing locations had contributing road length on each side of the crossing, and road conditions were significantly different on each side. In these situations, each road segment was modeled separately and the two segments were then summed to get the total sediment load for the crossing. Also, some crossing locations were located at the convergence of two or more roads, with all roads contributing to sediment load at the crossing. In these cases, road segments were modeled separately and then summed to get the total sediment load for the crossing. **Table EB-2** explains the model adjustments..

Table EB-2. Specific WEPP: Road Modeling Adjustments Per Crossing or Parallel Segment

Site Name	Road Design	Model Adjustments
LBM-P-F-P-316	OR	Insloped, Rutted road - modeled as OR per WEPP guidance
TMC-P-V-X-442	IV & OU	Crowned Road. Modeled as IV and OU with half the width of road for each road type per WEPP Draft Guidance, Reduced road length from 1147 feet to 1000 feet per WEPP:road author guidance.
CPC-P-M-P-465	OR	Crowned Road. Modeled as OR with width of road only per WEPP Draft Guidance, Added Road gradient from photographs.
UDC-F-M-X-411	OR	Insloped, Rutted road - modeled as OR per WEPP guidance
NTC-P-M-X-387	OR	Insloped, Rutted road - modeled as OR per WEPP guidance. Added fill gradient from photographs.
LBM-P-F-X-185	IB	Crowned Road. Modeled as IB with width of road + ditches per WEPP Draft Guidance. Field sheets erroneous with Road Length. Modeled as 1000 ft.
LBM-P-V-X-198	IB	Crowned Road. Modeled as IB with width of road + ditch per WEPP Draft Guidance
LBH-P-M-X-134	IV	Crowned Road. Modeled as IB with width of road + ditch per WEPP Draft Guidance
TGC-F-M-X-130	OR	Insloped, Rutted road - modeled as OR per WEPP guidance
TGC-F-M-X-130	OR	
TGC-F-M-X-74	OR	Difficult to determine if the road was rutted due to snow. Assumed rutted and modeled as OR with veg. ditch (width of road only in claculation) per WEPP guidance.
TGC-F-M-X-48	IB	Crowned Road. Modeled as IB with width of road only per WEPP Draft Guidance. Rock content 50%.

Road crossings and parallel segments that are not listed above were not altered from the field worksheets when entered into the WEPP model.
Road Design options: OU = Outslope unrutted road, OR = Outslope rutted road, IV = Inslope road with vegetated or rocked ditch, IB = Inslope road with bare ditch

Elliston, MT (46.40°N 112.80°W; 5080 feet elevation) information for the last 34 years of record see **Table EB-3** and **EB-4**.

Table EB-3. Temperature and Precipitation for Elliston, MT

Month	Mean Maximum Temperature (°F)	Mean Minimum Temperature (°F)	Mean Precipitation (in)	Number of wet days
January	30.2	9.0	1.10	10.0
February	35.4	12.8	0.71	7.8
March	40.1	16.2	1.00	10.0
April	50.5	25.4	1.54	9.1
May	61.1	33.4	2.21	11.1
June	69.0	39.8	2.97	11.0
July	81.5	44.4	1.27	7.1
August	78.9	41.8	1.35	5.9
September	67.5	34.1	1.69	7.1
October	55.6	26.6	1.31	6.9
November	40.5	17.8	1.05	8.1
December	32.3	11.6	0.99	9.0
Annual			17.21	103.1

Tables EB-4. Interpolated Climate Data for Elliston, MT

Station	Weighting	Station	Weighting
Wind Stations		**Solar Radiation and Max .5 P Stations**	
DRUMMOND MT	43.4 %	HELENA, MONTANA	69.4 %
BUTTE MT	30.7 %	KALISPELL, MONTANA	18.9 %
HELENA MT	26 %	POCATELLO, IDAHO	11.7 %
Dewpoint Stations		**Time-to-Peak Stations**	
BUTTE MT	42 %	BOULDER ST SCHOOL M	36.5 %
HELENA MT	37.6 %	BUTTE 8 S MT	35.3 %
MISSOULA MT	20.4 %	OVANDO 1 SW MT	28.2 %

Modified by Rock:Clime on November 18, 2009 from DEER LODGE 3W MT 242275 0

Moulton, MT **(**46.40^{o}N 112.80^{o}W; 6700 feet elevation) information for the 34 years of record see **Table EB-5** and **EB-6**.

Table EB-5. Temperature and Precipitation for Moulton, MT

Month	Mean Maximum Temperature (^{o}F)	Mean Minimum Temperature (^{o}F)	Mean Precipitation (in)	Number of wet days
January	31.8	3.9	1.24	8.9
February	33.8	5.3	1.70	8.9
March	39.1	12.9	2.10	9.1
April	44.8	18.3	1.86	8.1
May	52.8	26.8	2.87	9.9
June	62.6	32.7	2.74	10.1
July	72.3	37.6	1.61	8.1
August	72.5	37.4	1.23	6.8
September	60.3	28.2	2.02	9.2
October	47.3	20.1	1.65	6.9
November	34.1	9.1	1.28	7.1
December	29.2	2.6	1.38	9.9
Annual			21.68	103.0

Table EB-6. Interpolated Climate Data for Moulton, MT

Station	Weighting	Station	Weighting
Wind Stations		**Solar Radiation and Max .5 P Stations**	
DRUMMOND MT	43.4 %	HELENA, MONTANA	69.4 %
BUTTE MT	30.7 %	KALISPELL, MONTANA	18.9 %
HELENA MT	26 %	POCATELLO, IDAHO	11.7 %
Dewpoint Stations		**Time-to-Peak Stations**	
BUTTE MT	42 %	BOULDER ST SCHOOL M	36.5 %
HELENA MT	37.6 %	BUTTE 8 S MT	35.3 %
MISSOULA MT	20.4 %	OVANDO 1 SW MT	28.2 %
Modified by Rock:Clime on November 18, 2009 from DEER LODGE 3W MT 242275 0			

3Mile-V-2 PRISM (46.67°N 112.60°E; 5248 feet elevation) information for the last 34 years of record see **Table EB-7** and **EB-8**.

Table EB-7. Temperature and Precipitation for 3Mile-V-2 PRISM

Month	Mean Maximum Temperature (°F)	Mean Minimum Temperature (°F)	Mean Precipitation (in)	Number of wet days
January	31.8	10.1	1.31	6.0
February	38.4	15.9	0.94	4.3
March	44.4	19.4	1.13	5.6
April	54.8	25.8	1.38	7.7
May	63.0	32.8	2.32	11.1
June	71.9	40.0	1.95	10.8
July	80.7	43.1	1.32	6.6
August	80.1	41.8	1.47	7.3
September	69.2	34.0	1.43	7.2
October	58.4	26.2	1.01	5.3
November	42.1	18.1	1.12	5.6
December	33.0	11.9	1.37	6.8
Annual			16.76	84.4

Table EB-8. Interpolated Climate Data for 3Mile-V-2 PRISM

Station	Weighting	Station	Weighting
Wind Stations		**Solar Radiation and Max .5 P Stations**	
DRUMMOND MT	43.4 %	HELENA, MONTANA	69.4 %
BUTTE MT	30.7 %	KALISPELL, MONTANA	18.9 %
HELENA MT	26 %	POCATELLO, IDAHO	11.7 %
Dewpoint Stations		**Time-to-Peak Stations**	
BUTTE MT	42 %	BOULDER ST SCHOOL M	36.5 %
HELENA MT	37.6 %	BUTTE 8 S MT	35.3 %
MISSOULA MT	20.4 %	OVANDO 1 SW MT	28.2 %

Modified by Rock:Clime on November 24, 2009 from DEER LODGE 3W MT 242275 0

Attachment EC - WEPP: Road Modeling Results for Field Assessed Sites

Table EC-1. WEPP: Road Modeling Results for Field Assessed Crossings

Comment	Elevation	Soil	Years	Design	Surface, traffic	Road grad (%)	Road length (ft)	Road width (ft)	Fill grad (%)	Fill length (ft)	Buff grad (%)	Buff length (ft)	Rock cont (%)	Average annual rain runoff (in)	Average annual snow runoff (in)	Average annual sediment leaving road (lb/yr)	Average annual sediment leaving buffer (lb/yr)
Valley Landscape																	
LBM-P-V-X-198	3MILE PRISM	Sandy Loam	50	Insloped, bare ditch	graveled high	0.5	176	18	27	7	0.3	1	25	0.2	0	21	19
TMC-P-V-X-442	3MILE PRISM	Silty Loam	50	Insloped, vegetated or rocked ditch	graveled high	1	1000	10	100	5	0.3	1	10	0.2	0	49	85
TMC-P-V-X-442	3MILE PRISM	Silty Loam	50	Outsloped, unrutted	graveled high	1	1000	10	145	5	0.3	1	10	0	0	217	Summed
																Mean	**0.03**
Valley Landscape (tons/year)							**588**							**25th**	**0.018**	**Median**	**0.03**
														75th	**0.03**	**Maximum**	**0.04**
																Minimum	**0.01**
Foothill Landscape																	
LBM-P-F-X-185	Elliston	Sand Loam	50	Insloped, bare ditch	graveled high	4	1000	26	0.3	1	0.3	1	10	0.4	0	1,032	947
TRC-P-F-X-237	Elliston	Sand Loam	50	Insloped, vegetated or rocked ditch	native low	3	305	9	9.5	8	0.3	1	15	0.2	0	9	10
TRC-P-F-X-237	Elliston	Sand Loam	50	Insloped, vegetated or rocked ditch	native low	5	45	9	5	8	0.3	1	15	0.1	0	2	Summed
SSC-P-F-X-347	Elliston	Sand Loam	50	Insloped, vegetated or rocked ditch	graveled high	5	310	14	100	7	0.3	1	35	0.3	0	95	113
LBM-S-F-X-270	Elliston	Sand Loam	50	Outsloped, rutted	graveled low	3	64.5	10.5	23	14	0.3	1	30	0.2	0	4	26
LBM-S-F-X-270	Elliston	Sand Loam	50	Outsloped, rutted	graveled low	13	110	10.5	23	14	0.3	1	30	0.3	0	33	Summed
NTC-P-F-X-348	Elliston	Sand Loam	50	Outsloped, unrutted	graveled high	0.5	135	16	35	11	0.3	1	50	0.1	0	26	13
																Mean	**0.11**
Foothill Landscape (tons/year)							**394**							**25th**	**0.007**	**Median**	**0.01**
														75th	**0.06**	**Maximum**	**0.47**
																Minimum	**0.01**
Mountain Landscape																	
LBH-P-M-X-134	Moulton	Clay Loam	30	Insloped, vegetated or rocked ditch	native high	1	100	26	23	4.75	0.3	1	45	1	1.9	33	20
TGC-F-M-X-74	Moulton	Clay Loam	30	Outsloped, rutted	native low	2	137	16	36	5	0.3	1	30	0.9	2	14	9
TGC-F-M-X-48	Moulton	Loam	30	Insloped, bare ditch	graveled low	3	144	9	70	12	0.3	1	50	0.2	0	12	26
TGC-F-M-X-48	Moulton	Loam	30	Insloped, bare ditch	graveled low	5	156	9	70	12	0.3	1	50	0.2	0	17	Summed
TGC-F-M-X-130	Moulton	Sand Loam	30	Outsloped, rutted	native low	8	123	15	46	10	0.3	1	30	0.2	0	22	30
TGC-F-M-X-130	Moulton	Sand Loam	30	Outsloped, rutted	native low	5	120	8	46	13	0.3	1	30	0.2	0	8	Summed
TGC-F-M-X-94	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	4	860	17	26	3	0.3	1	20	0.2	0.1	69	66
TRC-P-M-X-232	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	2.5	628	9	0.3	1	0.3	1	35	0.2	0.1	20	28
TRC-P-M-X-232	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	6	200	9	0.3	1	0.3	1	35	0.2	0.1	11	Summed
USD-F-M-X-96	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	graveled high	1	67	13	26	37	0.3	1	10	0.1	0	6	35
USD-F-M-X-96	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	graveled low	6	180	13	26	37	0.3	1	10	0.2	0	33	Summed
USD-P-M-X-116	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native high	4	416	22	58	13	0.3	1	25	0.2	0.1	164	202
USD-P-M-X-116	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native high	2	286	13	58	13	0.3	1	25	0.2	0	37	Summed
USD-P-M-X-116	Moulton	Sand Loam	30	Outsloped, rutted	native high	3	96	13	58	13	0.3	1	25	0.2	0	13	Summed
TGC-F-M-X-127	Moulton	Sand Loam	30	Outsloped, rutted	native low	6	275.5	11	85	14	0.3	1	45	0.4	0.1	81	112
TGC-F-M-X-127	Moulton	Sand Loam	30	Outsloped, rutted	native low	9	152	11	85	14	0.3	1	45	0.3	0.1	46	Summed
TRC-F-M-X-168	Moulton	Sand Loam	30	Outsloped, rutted	graveled high	4	276	15	58	17	0.3	1	35	0.2	0	94	434
TRC-F-M-X-168	Moulton	Sand Loam	30	Outsloped, rutted	graveled high	5	599	15	58	17	0.3	1	35	0.2	0	322	Summed
SSC-F-M-X-462	Moulton	Sand Loam	30	Outsloped, unrutted	native high	2	550	15	17	26	0.3	1	30	0	0	78	32
UDC-F-M-X-411	Moulton	Silt Loam	30	Outsloped, rutted	native low	7.5	700	10	0.3	1	0.3	1	30	1	1.8	760	585
NTC-P-M-X-387	Moulton	Silt Loam	30	Outsloped, rutted	native low	10.5	300	33	100	7	0.3	1	25	0.7	1.2	862	636
CPC-F-M-X-502	Moulton	Silt Loam	30	Outsloped, unrutted	native none	1	35	8	56	3	0.3	1	25	0.1	0	2	0
TGC-F-M-X-115	Moulton	Silt Loam	30	Outsloped, unrutted	native none	5	55	10	21	4	0.3	1	0	0.1	0	4	1

Table EC-1. WEPP: Road Modeling Results for Field Assessed Crossings

Comment	Elevation	Soil	Years	Design	Surface, traffic	Road grad (%)	Road length (ft)	Road width (ft)	Fill grad (%)	Fill length (ft)	Buff grad (%)	Buff length (ft)	Rock cont (%)	Average annual rain runoff (in)	Average annual snow runoff (in)	Average annual sediment leaving road (lb/yr)	Average annual sediment leaving buffer (lb/yr)
Mountain Landscape (tons/year)							**450**									**Mean**	**0.07**
														25th	**0.012**	**Median**	**0.02**
														75th	**0.08**	**Maximum**	**0.32**
																Minimum	**0.00**

Shaded cells in the Road Length column represent two upstream sections of the culvert. These cells were summed prior to calculating the average road length for each crossing within a watershed.
Shaded cells in the last column were summed either because the road was crowned and was modeled as two widths (inslope and outslope portion) or because of the two contributing upstream road sections.

Table EC-2. WEPP: Road Modeling Results for Field Assessed Parallel Segments

Comment	Elevation	Soil	Years	Design	Surface, traffic	Road grad (%)	Road length (ft)	Road width (ft)	Fill grad (%)	Fill length (ft)	Buff grad (%)	Buff length (ft)	Rock cont (%)	Average annual rain runoff (in)	Average annual snow runoff (in)	Average annual sediment leaving road (lb/yr)	Average annual sediment leaving buffer (lb/yr)
Fooothill Parallel Segments																	
LBM-P-F-P-316	Elliston	Silt Loam	50	Outsloped, rutted	native low	8	355	15	78	5	27.5	49.5	7.5	0.1	0	435	82
Mountain Parallel Segments																	
SSC-P-M-P-412	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	9	200	22	85	6	0.3	1	40	0.3	0.1	73	65
SSC-P-M-P-412	Moulton	Sand Loam	30	Outsloped, rutted	native high	7	304	10	42	6	20	60	15	0	0	117	24
CPC-P-M-P-465	Moulton	Silt Loam	30	Outsloped, rutted	native high	5	528	15	119	3	0.3	1	50	1.6	3.1	2,541	2,098
SSC-P-M-P-412	Moulton	Silt Loam	30	Insloped, vegetated or rocked ditch	graveled high	4	475	22	70	12	14	27	15	0.1	0	290	203
Mountain Landscape Parallel Segments Results (tons/year/mile)											Mean	22.3				**Mean**	**0.021**
											Median	14		**25th**	**0.002**	**Median**	**0.005**
														75th	**0.024**	**Maximum**	**0.075**
																Minimum	**0.001**

ATTACHMENT ED - WEPP: ROAD MODELING RESULTS FOR FIELD ASSESSED SITES WITH ROAD LENGTH REDUCTIONS

Table ED-1. WEPP: Road Modeling Results for Field Assessed Crossings: 200 feet maximum length

Comment	Elevation	Soil	Years	Design	Surface, traffic	Road grad (%)	Road length (ft)	Road width (ft)	Fill grad (%)	Fill length (ft)	Buff grad (%)	Buff length (ft)	Rock cont (%)	Average annual rain runoff (in)	Average annual snow runoff (in)	Average annual sediment leaving road (lb/yr)	Average annual sediment leaving buffer (lb/yr)
Valley Landscape																	
LBM-P-V-X-198	3MILE PRISM	Sandy Loam	50	Insloped, bare ditch	graveled high	0.5	176	18	27	7	0.3	1	25	0.2	0	21	19
TMC-P-V-X-442	3MILE PRISM	Silty Loam	50	Insloped, vegetated or rocked ditch	graveled high	1	200	10	100	5	0.3	1	10	0.2	0	23	29
TMC-P-V-X-442	3MILE PRISM	Silty Loam	50	Outsloped, unrutted	graveled high	1	200	10	145	5	0.3	1	10	0	0	43	Summed
Valley Landscape (tons/year)							**188**									**Mean**	**0.01**
														25th	**0.011**	**Median**	**0.01**
														75th	**0.01**	**Maximum**	**0.01**
																Minimum	**0.01**
Foothill Landscape																	
LBM-P-F-X-185	Elliston	Sand Loam	50	Insloped, bare ditch	graveled high	4	200	26	0.3	1	0.3	1	10	0.4	0	168	133
TRC-P-F-X-237	Elliston	Sand Loam	50	Insloped, vegetated or rocked ditch	native low	3	155	9	9.5	8	0.3	1	15	0.2	0	5	5
TRC-P-F-X-237	Elliston	Sand Loam	50	Insloped, vegetated or rocked ditch	native low	5	45	9	5	8	0.3	1	15	0.1	0	2	Summed
SSC-P-F-X-347	Elliston	Sand Loam	50	Insloped, vegetated or rocked ditch	graveled high	5	200	14	100	7	0.3	1	35	0.3	0	74	65
LBM-S-F-X-270	Elliston	Sand Loam	50	Outsloped, rutted	graveled low	3	64.5	10.5	23	14	0.3	1	30	0.2	0	4	26
LBM-S-F-X-270	Elliston	Sand Loam	50	Outsloped, rutted	graveled low	13	110	10.5	23	14	0.3	1	30	0.3	0	33	Summed
NTC-P-F-X-348	Elliston	Sand Loam	50	Outsloped, unrutted	graveled high	0.5	135	16	35	11	0.3	1	50	0.1	0	26	13
Foothill Landscape (tons/year)							**182**									**Mean**	**0.02**
														25th	**0.007**	**Median**	**0.01**
														75th	**0.03**	**Maximum**	**0.07**
																Minimum	**0.00**
Mountain Landscape																	
LBH-P-M-X-134	Moulton	Clay Loam	30	Insloped, vegetated or rocked ditch	native high	1	100	26	23	4.75	0.3	1	45	1	1.9	33	20
TGC-F-M-X-74	Moulton	Clay Loam	30	Outsloped, rutted	native low	2	137	16	36	5	0.3	1	30	0.9	2	14	9
TGC-F-M-X-48	Moulton	Loam	30	Insloped, bare ditch	graveled low	3	100	9	70	12	0.3	1	50	0.2	0	8	15
TGC-F-M-X-48	Moulton	Loam	30	Insloped, bare ditch	graveled low	5	100	9	70	12	0.3	1	50	0.2	0	10	Summed
TGC-F-M-X-130	Moulton	Sand Loam	30	Outsloped, rutted	native low	8	100	15	46	10	0.3	1	30	0.2	0	16	22
TGC-F-M-X-130	Moulton	Sand Loam	30	Outsloped, rutted	native low	5	100	8	46	13	0.3	1	30	0.2	0	6	
TGC-F-M-X-94	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	4	200	17	26	3	0.3	1	20	0.2	0	13	11
TRC-P-M-X-232	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	2.5	100	9	0.3	1	0.3	1	35	0.2	0.1	3	5
TRC-P-M-X-232	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	6	100	9	0.3	1	0.3	1	35	0.2	0.1	5	Summed
USD-F-M-X-96	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	graveled high	1	67	13	26	37	0.3	1	10	0.1	0	6	24
USD-F-M-X-96	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	graveled low	6	133	13	26	37	0.3	1	10	0.2	0	15	Summed
USD-P-M-X-116	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native high	4	104	22	58	13	0.3	1	25	0.2	0	26	40
USD-P-M-X-116	Moulton	Sand Loam	30	Outsloped, rutted	native high	3	96	13	58	13	0.3	1	25	0.2	0	13	Summed
USD-P-M-X-116	Moulton	Sand Loam	30	Outsloped, rutted	native high	SEGMENT NOT INCLUDED WITH BMP ROAD LENGTH REDUCTION											
TGC-F-M-X-127	Moulton	Sand Loam	30	Outsloped, rutted	native low	6	100	11	85	14	0.3	1	45	0.3	0.1	20	38
TGC-F-M-X-127	Moulton	Sand Loam	30	Outsloped, rutted	native low	9	100	11	85	14	0.3	1	45	0.3	0.1	19	Summed
TRC-F-M-X-168	Moulton	Sand Loam	30	Outsloped, rutted	graveled high	4	100	15	58	17	0.3	1	35	0.2	0	22	53
TRC-F-M-X-168	Moulton	Sand Loam	30	Outsloped, rutted	graveled high	5	100	15	58	17	0.3	1	35	0.2	0	27	Summed
SSC-F-M-X-462	Moulton	Sand Loam	30	Outsloped, unrutted	native high	2	200	15	17	26	0.3	1	30	0	0	28	12
UDC-F-M-X-411	Moulton	Silt Loam	30	Outsloped, rutted	native low	7.5	200	10	0.3	1	0.3	1	30	0.8	1.5	55	37
NTC-P-M-X-387	Moulton	Silt Loam	30	Outsloped, rutted	native low	10.5	200	33	100	7	0.3	1	25	0.6	0.9	386	272
CPC-F-M-X-502	Moulton	Silt Loam	30	Outsloped, unrutted	native none	1	35	8	56	3	0.3	1	25	0.1	0	2	0
TGC-F-M-X-115	Moulton	Silt Loam	30	Outsloped, unrutted	native none	5	55	10	21	4	0.3	1	0	0.1	0	4	1

Table ED-1. WEPP: Road Modeling Results for Field Assessed Crossings: 200 feet maximum length

Comment	Elevation	Soil	Years	Design	Surface, traffic	Road grad (%)	Road length (ft)	Road width (ft)	Fill grad (%)	Fill length (ft)	Buff grad (%)	Buff length (ft)	Rock cont (%)	Average annual rain runoff (in)	Average annual snow runoff (in)	Average annual sediment leaving road (lb/yr)	Average annual sediment leaving buffer (lb/yr)
Mountain Landscape (tons/year)							**177**									**Mean**	**0.02**
														25th	**0.005**	**Median**	**0.01**
														75th	**0.02**	**Maximum**	**0.14**
																Minimum	**0.00**

Table ED-2. WEPP: Road Modeling Results for Field Assessed Parallel Segments: 400 feet maximum length

Comment	Elevation	Soil	Years	Design	Surface, traffic	Road grad (%)	Road length (ft)	Road width (ft)	Fill grad (%)	Fill length (ft)	Buff grad (%)	Buff length (ft)	Rock cont (%)	Average annual rain runoff (in)	Average annual snow runoff (in)	Average annual sediment leaving road (lb/yr)	Average annual sediment leaving buffer (lb/yr)
Fooothill Parallel Segments																	
LBM-P-F-P-316	Elliston	Silt Loam	50	Outsloped, rutted	native low	8	355	15	78	5	27.5	49.5	7.5	0.1	0	435	82
Mountain Parallel Segments																	
SSC-P-M-P-412	Moulton	Sand Loam	30	Insloped, vegetated or rocked ditch	native low	9	200	22	85	6	0.3	1	40	0.3	0.1	73	65
SSC-P-M-P-412	Moulton	Sand Loam	30	Outsloped, rutted	native high	7	304	10	42	6	20	60	15	0	0	117	24
CPC-P-M-P-465	Moulton	Silt Loam	30	Outsloped, rutted	native high	5	400	15	119	3	0.3	1	50	1.5	2.9	1,365	1,111
SSC-P-M-P-412	Moulton	Silt Loam	30	Insloped, vegetated or rocked ditch	graveled high	4	400	22	70	12	14	27	15	0.1	0	225	146
Mountain Landscape Parallel Segments Results (tons/year/mile)											Mean	22.3				**Mean**	**0.010**
											Median	14		**25th**	**0.002**	**Median**	**0.003**
														75th	**0.012**	**Maximum**	**0.075**
																Minimum	**0.001**

Shaded cells in the Road length column represent two upstream sections of the culvert. These cells were summed prior to calculating the average road length for each crossing within a watershed.
Shaded cells in the last column were summed either because the road was crowned and was modeled as two widths (inslope and outslope portion) or because of the two contributing upstream road sections