

LTBMU Road BMP Retrofit Monitoring Program

Purpose:

Provide qualitative and quantitative data on the effects of large scale road BMP retrofit monitoring on forest roads (100 miles decommissioned, and 154 miles retrofitted between 1999 and 2004) to inform USFS managers, regulatory partners, and developers of Tahoe TMDL.

PROTOCOL used:

1) Region 5 Best Management Practices Evaluation Program (BMPEP) for stream crossings (qualitative visual assessment using uniform protocol) .

E08-Road surface, drainage and slope protection

E09-Stream crossings

E11-Control of side cast material

2)Water Quality Risk Assessment Protocols (WQRAP). Qualitative visual assessment of risk of road segment relative to erosion and sediment transport.

Road segments at stream crossings.

Road segments hydrologically connected to stream environmental zones (SEZ).

Road segments in non-stream environmental zones (Non-SEZ)

3)Modeling erosion and sediment yield with Water Erosion Protection Project (WEPP).

Ineffective



BMPEP Photos to accompany qualitative evaluation.

Effective



BMPEP Results:

93% (49 of 52) of road surface, drainage and slope protection upgrades were effective. Three ineffective sites, result of plugged cross-drains and ditches.

All 52 stream crossing upgrades were effective in preventing plugging and reducing diversion potential.

85% (44 of 52) of the sites were rated effective with regard to side cast material. Eight ineffective were the result of vegetative debris from downed trees placed into stream channels of SEZ's. *(note -recreational users likely responsible for disposing of the debris from wind-blown downed trees which were blocking the road, prior to planned removal by Forest personnel.)*

Table 3.1: Water Quality Risk Scores for Individual Road Features.

Connected Length	Score
not connected	0
<91 meters (100 yds)	5
91-275 meters (100-300 yds)	15
>275 meters (300 yds)	35
Road Grade	
<5%	0
6-10%	10
>10%	20
Surface Type	
Gravel or paved	0
Native	10
¹ Inlet Condition	
Good	0
Poor	10
¹ Diversion Distance	
No diversion potential	0
<23 meters	5
23-91 meters	10
>91 meters	25
² SEZ or NON-SEZ	
NON-SEZ	0
SEZ	20
² Chronic Erosion Feature	
None	0
Present	15

1. Applies to crossings only.

2. Applies to SEZ's and Non-SEZ's only.

WQRAP Protocol

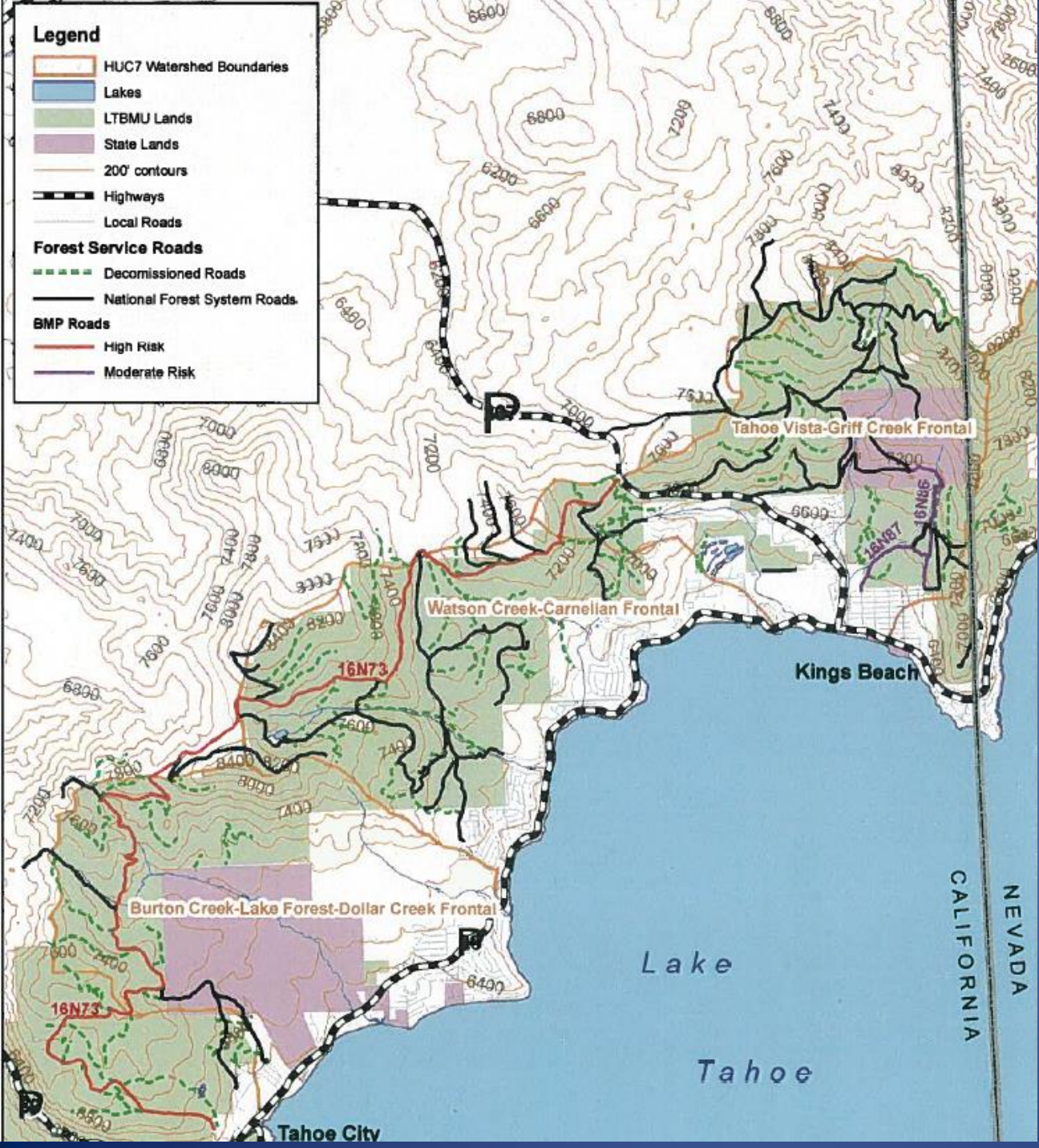
Table 3.2: Overall Water Quality Risk Score for Road Segments at crossings, in SEZ's, and Non-SEZ's.

Risk Category	Total Score (X)
High	X>60
Moderate	X=25-60
Low	X<25



Photo and description, part of WQRAP Assessment.

Site#067. There are over 300 ft of rills from either directions bringing to a total of over 900 feet of rills which converges into a gully at the bottom of the road (middle photo). The gully is approximately 8” deep and 12” wide which goes into the SEZ.



Map of Road Risk - LTBMU roads primarily follow contours, very few parallel stream courses.

WQRAP Results:

Within the 154 miles evaluated, BMP upgrades reduced the length of roads hydrologically connected to a surface waterbody from 17.4 to 10.7 miles. Remaining hydrologically connected road segments are considered to present some level of water quality risk.

The most common remaining causes of moderate to high risk evaluations are steep road gradients and close proximity of roads to SEZ's, even after connected length is reduced with BMPs. The only way to eliminate is to relocate roads.

Table 3.3: WEPP Parameters

	Input Variable	Notes
1	Climate	WEPP has many climate stations from which to choose but there is only one in the Lake Tahoe Basin. Therefore, representative climates were developed with Clignen for each watershed. Thirty years of climate were used to run the model.
2	Soil Texture	There are four options: clay loam, loam, sandy loam, and silt loam. Information for soil textures in the project area was compiled from the <i>Soil Survey Tahoe Basin Area California and Nevada</i>
3	Percent rock	Rock fragments in WEPP are considered rocks in the soil. To maintain comparability between treatments, percent rock remained at 0.
4	Road Design *	The model has four options: insloped, bare ditch (ib); insloped rocked ditch (iv); outsloped, unrutted (ou); and outsloped, rutted (or).
5	Road Surface *	WEPP options include: native, graveled, or paved.
6	Traffic Level	WEPP options for traffic level include: High, Low, and No Traffic. Roads with year-round traffic or logging roads with high use are considered High. Roads with low recreational use during dry conditions are modeled as Low (this setting is typical of most roads on the Lake Tahoe Basin Management Unit). Where vegetation has grown in one-half or more of the road, No Traffic is assigned. All roads were modeled as low traffic.
7	Road Gradient (%)	Refers to the slope of the road between drainage points. Gradient was measured in the field with a clinometer. WEPP has constraints between 0.1 and 40%.
8	Road horizontal length *(meter)	Refers to the length of road between drainage points. WEPP allows a range between 1 and 300 meters.
9	Road horizontal width (meter)	WEPP has three definitions for outsloped roads, rutted; outsloped roads, unrutted; and insloped roads. Road width is considered to be the width of the entire road. WEPP allows a range between 0.3 and 100 meters.
10	Fillslope slope (%)	WEPP requires a range between 0.1% and 150%.
11	Fillslope horizontal length (meter)	WEPP requires a range between 0.3 and 100 meters
12	Buffer gradient (%)	Refers to the gradient of the buffer, the area between the road and a stream, meadow, spring, or lake. WEPP allows a range between 0.1 and 100 percent.
13	Buffer Horizontal length (meter)	Refers to the horizontal length of the buffer, the area between the road and a stream, meadow, spring, or lake. WEPP allows a range between 0.3 and 300 meters.

* Input variables number 4 & 8 are most likely to change as a result of retrofits.

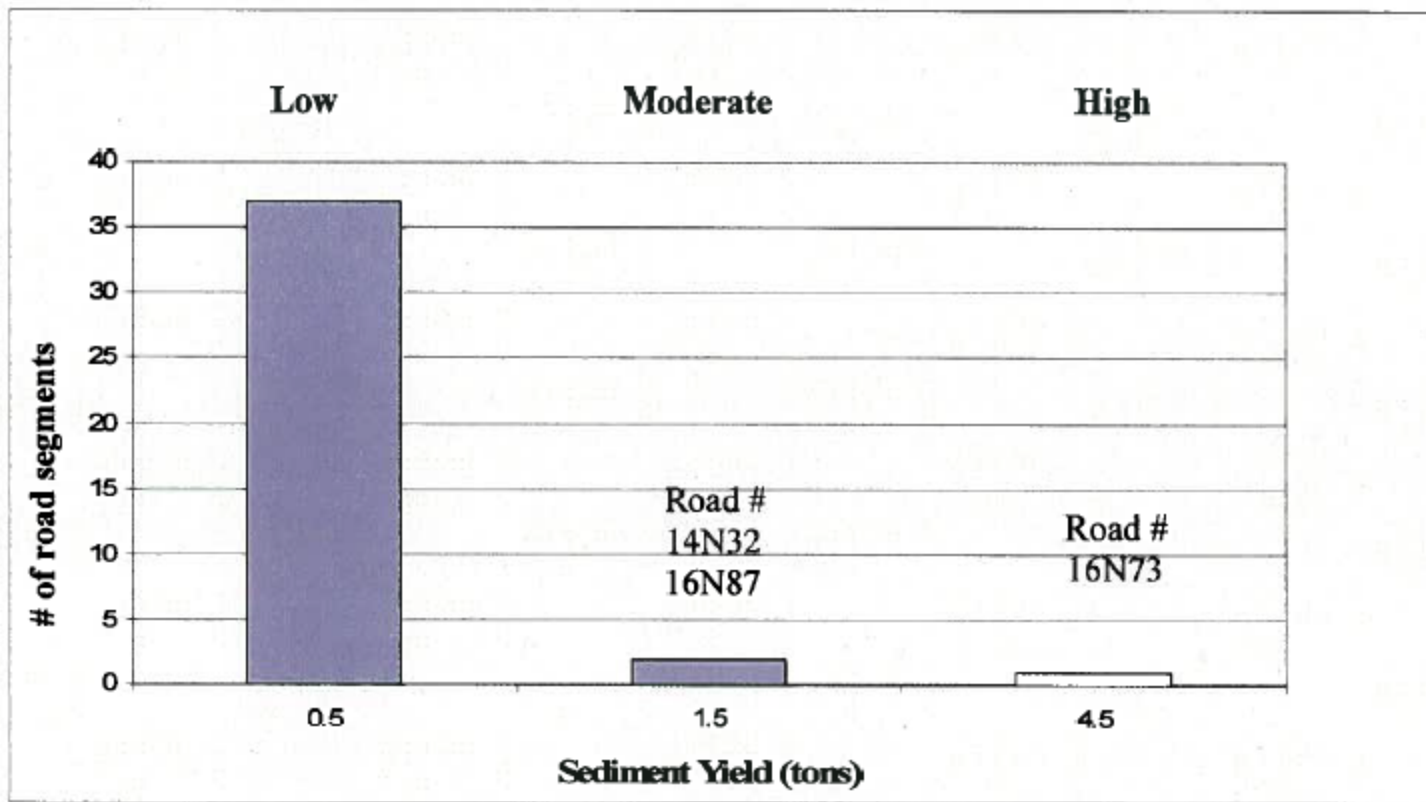


Figure 4.2: Histogram of sediment yield in estimated tons per year from roads. Low, moderate, and high delineate ranges of sediment yield rates used to prioritize more in depth evaluation.

WEPP Modeling Results:

- Overall sediment yield is predicted to decrease from 23.4 to 2.2 tons. Road improvements within Ward Creek and Watson Creek alone, accounted for 11.3 tons of the reduced sediment yield.
- WEPP did provide some anomalous results, which we addressed for above calculation. WEPP over predicted erosion from paved roads .

Future Monitoring ?

TMDL does not require estimates or reporting of load reduction from Forest Roads (which is required for paved roads in urban jurisdictions). For Forest Roads, TMDL requires annual tracking and reporting of miles of roads decommissioned or retrofitted, on an annual basis . Data from internal USFS reporting process, will be transferred to interagency Tahoe Basin EIP performance measure tracking and reporting system.

LTBMU will continue internal monitoring program as part of road maintenance. All roads are on a maintenance schedule with each road receiving visual assessment and maintenance at least once every five years. Higher use roads are visited more frequently.

WEPP : Road modeling has and will likely continue to be used for planning purposes, to estimate the relative effectiveness of alternative road treatments.

Road BMPs continued to be randomly monitored through Regional BMPEP on an annual basis. A National BMPEP protocol is currently being tested, and is expected to replace Regional protocols in a couple of years.

Roads Management

All Road Monitoring Info - 3.08 MB (BMPs_RoadManagement_Protocols.zip)

During Construction or Reconstruction of Road and Stream Crossings - Roads A

- [Protocol](#) - 238 KB (Road_A_Active_Road_and_Crossing_Construction_Reconstruction_Instructions_May2013.pdf)
- [Form](#) - 47.1 KB (NationalBMPform_draft_Road_A_Active_Road_and_Crossing_Construction_Reconstruction_May2013.pdf)

After Construction or Reconstruction of Road and Stream Crossing - Roads B

- [Protocol](#) - 383 KB (Road_B_Completed_Road_and_Crossing_Construction_Reconstruction_Instructions_May2013.pdf)
- [Form](#) - 50.4 KB (NationalBMPform_draft_Road_B_Completed_Road_and_Crossing_Construction_Reconstruction_May2013.pdf)

Road and Crossing Maintenance - Roads C

- [Protocol](#) - 585 KB (Road_C_Road_and_Crossing_Operation_Maintenance_Instructions_May2013.pdf)
- [Form](#) - 49 KB (NationalBMPform_draft_Road_C_Road_and_Crossing_Operation_Maintenance_May2013.pdf)

Road Storage - Roads D

- [Protocol](#) - 436 KB (Road_D_Road_Storage_Instructions_May2013.pdf)
- [Form](#) - 56.9 KB (NationalBMPform_draft_Road_D_Road_Storage_May2013.pdf)

During Road Decommissioning - Roads E

- [Protocol](#) - 455 KB (Road_E_Active_Road_Decommissioning_Instructions_Mar2013.pdf)
- [Form](#) - 38.4 KB (NationalBMPform_draft_Road_E_Active_Road_Decommissioning_Mar2013.pdf)

After Road Decommission - Roads F

- [Protocol](#) - 378 KB (Road_F_Completed_Road_Decommissioning_Instructions_Mar2013.pdf)
- [Form](#) - 47.4 KB (NationalBMPform_draft_Road_F_Completed_Road_Decommissioning_Mar2013.pdf)

Snow Removal and Storage - Roads G

- [Protocol](#) - 472 KB (Road_G_Snow_Removal_and_Storage_Instructions_May2013.pdf)
- [Form](#) - 47.3 KB (NationalBMPform_draft_Road_G_Snow_Removal_and_Storage_May2013.pdf)

Parking and Staging Areas - Roads H

- [Protocol](#) - 67.2 KB (Road_H_Parking_Staging_Areas_Instructions_Mar2013.pdf)
- [Form](#) - 47.2 KB (NationalBMPform_draft_Road_H_Parking_Staging_Areas_Mar2013.pdf)

Equipment Refueling Servicing - Roads I

- [Protocol](#) - 70.2 KB (Road_I_Equipment_Refueling_Servicing_Instructions_May2013.pdf)
- [Form](#) - 42 KB (NationalBMPform_draft_Road_I_Equipment_Refueling_Servicing_May2013.pdf)

National Road BMPEP
PROTOCOLS- currently
being tested.