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Agriculture

Forest  
Service

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# Amendment to the Hydrology Report

## Westside Fire Recovery Project

Happy Camp Oak Knoll and Salmon/Scott River Ranger Districts,  
Klamath National Forest  
Siskiyou County, California

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# I. Summary of Modifications between Draft and Final EIS

## Methodology

### Detailed Methodology

Cumulative watershed effects (CWE) modeling processes are the same as those used in the DEIS except that the modeling baseline is updated to the current year (2015) from 2014 when the fires occurred and project planning began. Additionally, the “low”, “moderate”, and “high” risk ratio inference points of < 1.0, 1.0 to 1.5, and > 1.5, respectively, are revised for the FEIS based on discussions with the Forest Hydrologist. In the FEIS, watersheds less than or equal to the threshold of concern (TOC) are interpreted to be at *low risk* (risk ratio ≤ 1.0) for adverse effects to hydrologic function and water quality. Watersheds that exceed the TOC (risk ratio > 1.0) are interpreted as having *elevated risk* of adverse effects to hydrologic function and water quality. Model results are reported to two decimal places in Appendices B and C; however, it is important to note that this is considered to be beyond the model resolution.

**Table 1: ERA model distribution of 7th field watersheds categorized by low, moderate, and high risk of adverse effects to hydrologic function in the DEIS compared with low and elevated risk in the FEIS**

| ERA Risk Ratios               | 2015     |       |       |       |       |          |          |
|-------------------------------|----------|-------|-------|-------|-------|----------|----------|
|                               | Baseline | DEIS  |       |       |       | Modified | Modified |
| 7th Field Watershed Count     | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| Low Risk (Ratio < 1.0)        | 66       | 65    | 65    | 65    | 65    | 65       | 65       |
| Moderate Risk (Ratio 1.0-1.5) | 9        | 10    | 10    | 10    | 10    | 10       | 10       |
| High Risk (Ratio > 1.5)       | 2        | 2     | 2     | 2     | 2     | 2        | 2        |

| ERA Risk Ratios             | 2015     |       |       |       |       |          |          |
|-----------------------------|----------|-------|-------|-------|-------|----------|----------|
|                             | Baseline | DEIS  |       |       |       | Modified | Modified |
| 7th Field Watershed Count   | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| Low Risk (Ratio ≤ 1.0)      | 69       | 65    | 65    | 65    | 66    | 65       | 65       |
| Elevated Risk (Ratio > 1.0) | 8        | 12    | 12    | 12    | 11    | 12       | 12       |

\*Table 1 results include past, present and reasonably foreseeable actions. If future actions are discounted one additional watershed (Jessups Gulch-North Fork Salmon River) moves from elevated risk (1.15) to low risk (0.83) under all action alternatives.

**Table 2: USLE model distribution of 7th field watersheds when categorized by low, moderate, and high risk of adverse effects to hydrologic function in the DEIS compared with low and elevated risk in the FEIS**

| USLE Risk Ratios              | 2015     |       |       |       |       |          |          |
|-------------------------------|----------|-------|-------|-------|-------|----------|----------|
|                               | Baseline | DEIS  |       |       |       | Modified | Modified |
| 7th Field Watershed Count     | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| Low Risk (Ratio < 1.0)        | 60       | 59    | 59    | 61    | 61    | 59       | 61       |
| Moderate Risk (Ratio 1.0-1.5) | 10       | 11    | 11    | 9     | 9     | 11       | 9        |
| High Risk (Ratio > 1.5)       | 7        | 7     | 7     | 7     | 7     | 7        | 7        |

| USLE Risk Ratios              | 2015     |       |       |       |       |          |          |
|-------------------------------|----------|-------|-------|-------|-------|----------|----------|
|                               | Baseline | DEIS  |       |       |       | Modified | Modified |
|                               | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| 7th Field Watershed Count     | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| Low Risk (Ratio $\leq 1.0$ )  | 60       | 61    | 61    | 61    | 61    | 61       | 61       |
| Elevated Risk (Ratio $>1.0$ ) | 17       | 16    | 16    | 16    | 16    | 16       | 16       |

**Table 3: Mass wasting model distribution of 7th field watersheds when categorized by low, moderate, and high risk of adverse effects to hydrologic function in the DEIS compared with low and elevated risk in the FEIS**

| Mass Wasting Risk Ratios      | 2015     |       |       |       |       |          |          |
|-------------------------------|----------|-------|-------|-------|-------|----------|----------|
|                               | Baseline | DEIS  |       |       |       | Modified | Modified |
|                               | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| 7th Field Watershed Count     | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| Low Risk (Ratio $< 1.0$ )     | 58       | 58    | 58    | 58    | 58    | 57       | 58       |
| Moderate Risk (Ratio 1.0-1.5) | 13       | 13    | 13    | 13    | 13    | 14       | 13       |
| High Risk (Ratio $> 1.5$ )    | 6        | 6     | 6     | 6     | 6     | 6        | 6        |

| Mass Wasting Risk Ratios      | 2015     |       |       |       |       |          |          |
|-------------------------------|----------|-------|-------|-------|-------|----------|----------|
|                               | Baseline | DEIS  |       |       |       | Modified | Modified |
|                               | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| 7th Field Watershed Count     | Alt 1    | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2    | Alt 3    |
| Low Risk (Ratio $\leq 1.0$ )  | 59       | 59    | 59    | 59    | 59    | 59       | 59       |
| Elevated Risk (Ratio $>1.0$ ) | 18       | 18    | 18    | 18    | 18    | 18       | 18       |

The duration of elevated risk is estimated based on CWE model recovery curves presented in the DEIS. Elevated risk of surface erosion as assessed by the Universal Soil Loss Equation (USLE) model is expected to reduce quickly, approaching the pre-fire levels after 2 years. Elevated risk as assessed by the ERA model is expected to remain constant for up to 10 years post-fire and then recover quickly over the next approximately 10 years. Elevated risk of mass wasting is expected to remain constant for 10 years post-fire and then recover gradually over the subsequent approximately 80 years. The geology report assesses all types of landsliding in the landslide risk assessment and the duration of elevated risk. In that analysis the Forest Geologist determined that the landslide risk will be elevated for more than 80 years in watersheds with more than 10% high and moderate vegetation severity. This can be mitigated by artificial regeneration. If 25% or more of the moderate and high severity areas are planted in a watershed the duration of elevated risk is expected to be about 30 years. Watersheds at elevated risk that are subject to project activities that increase risk ratios are interpreted as having negative cumulative effects.

**Analysis Indicators**

Hydrology analysis indicators were simplified from those in the DEIS based on the determination of dependence and/or redundancy between indicators. The final analysis indicators are *risk to channel morphology*, *risk of sediment regime alteration* and *trend of riparian reserve conditions*. The *risk of temperature regime alteration* analysis indicator was determined to be significantly dependent on the *trend of riparian condition indicator* and is thus not treated in a separate analysis and

discussion. Also, the *risk to channel function* indicator was determined to be redundant to the *risk to channel morphology* indicator and is thus removed from further discussion.

Additionally, results of the analysis of landslide likelihood from the project amendment to the geology report are included as a metric to assess the *risk to channel morphology* and *trend of riparian condition* indicators because landslides can produce debris flows that alter channel morphology and strip shade-producing streamside vegetation. For the *risk of sediment regime alteration* additional information from a Legacy Site Inventory and Treatment Plan that was not available for the DEIS is referenced in the FEIS. This plan has been submitted to the North Coast Regional Water Quality Control Board for review and, pending approval, will allow for enrollment of a potential WFR project action alternative in the waiver program.

**Spatial and Temporal Context**

The spatial context for the hydrologic analysis is expanded from the eight 5<sup>th</sup>-Field watersheds analyzed in the DEIS to ten 5<sup>th</sup> field watersheds in the FEIS to include the Ukonom Creek-Klamath River and South Fork Salmon River watersheds because these two watersheds were included in the project Aquatic Conservation Strategy Report. However, neither of these 5<sup>th</sup> field watersheds has any timber salvage acres or new temporary road miles proposed.

**Hydrologic Conditions**

Ten 5<sup>th</sup> field watersheds were analyzed for the Westside Fire Recovery (WFR) project by fire area. Three, five, and two 5<sup>th</sup> field watersheds were analyzed in the Beaver, Happy Camp Complex, and Whites Fire areas, respectively (Table 1).

**Table 4: Project 5th field watersheds sorted by fire area--Ten watersheds were analyzed at this scale**

| 5th-Field Watershed Name     | Watershed Area (Acres) | 2014 Wildfire      |
|------------------------------|------------------------|--------------------|
| Humbug Creek-Klamath River   | 68,023                 | Beaver             |
| Beaver Creek                 | 69,610                 | Beaver             |
| Horse Creek-Klamath River    | 98,625                 | Beaver             |
| Seiad Creek-Klamath River    | 81,706                 | Happy Camp Complex |
| Lower Scott River            | 98,016                 | Happy Camp Complex |
| Thompson Creek-Klamath River | 67,301                 | Happy Camp Complex |
| Elk Creek                    | 60,829                 | Happy Camp Complex |
| Ukonom Creek-Klamath River   | 87,884                 | Happy Camp Complex |
| South Fork Salmon River      | 185,597                | Whites             |
| North Fork Salmon River      | 130,545                | Whites             |

Seventy seven 7<sup>th</sup> field watersheds were analyzed for the WFR project by fire area (Table 2). Thirteen, forty five, and nineteen 7<sup>th</sup> field watersheds were analyzed in the Beaver, Happy Camp Complex, and Whites Fire area, respectively.

**Table 5: Project 7th field watersheds sorted by fire area--Seventy seven watersheds were analyzed at this scale**

| <b>7th-Field Watershed Name</b> | <b>Watershed Area (acres)</b> | <b>2014 Fire</b>   |
|---------------------------------|-------------------------------|--------------------|
| Doggett Creek                   | 7,701                         | Beaver             |
| Kohl Creek                      | 3,537                         | Beaver             |
| Dutch Creek                     | 3,827                         | Beaver             |
| Lower West Fork Beaver Creek    | 4,044                         | Beaver             |
| Jaynes Canyon                   | 7,009                         | Beaver             |
| Buckhorn Gulch-Beaver Creek     | 8,234                         | Beaver             |
| Soda Creek-Beaver Creek         | 7,370                         | Beaver             |
| Buckhorn Creek                  | 9,118                         | Beaver             |
| Dona Creek-Klamath River        | 4,380                         | Beaver             |
| Collins Creek-Klamath River     | 7,845                         | Beaver             |
| Lumgreys Creek                  | 5,496                         | Beaver             |
| Quigleys Cove-Klamath River     | 6,162                         | Beaver             |
| Miller Gulch-Klamath River      | 6,557                         | Beaver             |
| Middle Elk Creek                | 2,727                         | Happy Camp Complex |
| Big Ferry-Swanson               | 7,612                         | Happy Camp Complex |
| Walker Creek                    | 7,635                         | Happy Camp Complex |
| China Creek                     | 6,189                         | Happy Camp Complex |
| O'Neil Creek                    | 2,429                         | Happy Camp Complex |
| Rancheria Creek                 | 4,374                         | Happy Camp Complex |
| Horse Creek                     | 2,537                         | Happy Camp Complex |
| Middle Creek                    | 4,496                         | Happy Camp Complex |
| Lower Grider Creek              | 10,768                        | Happy Camp Complex |
| Bear Creek                      | 6,698                         | Happy Camp Complex |
| Fryingpan Creek-Klamath River   | 7,578                         | Happy Camp Complex |
| Upper Elk Creek                 | 3,025                         | Happy Camp Complex |
| Schutts Gulch-Klamath River     | 6,692                         | Happy Camp Complex |
| Tompkins Creek                  | 9,327                         | Happy Camp Complex |
| Caroline Creek-Klamath River    | 1,801                         | Happy Camp Complex |
| Granite Creek                   | 7,541                         | Happy Camp Complex |
| Bishop Creek-Elk Creek          | 9,253                         | Happy Camp Complex |
| Tom Martin Creek-Klamath River  | 10,690                        | Happy Camp Complex |
| Upper East Fork Elk Creek       | 3,873                         | Happy Camp Complex |
| Doolittle Creek                 | 4,050                         | Happy Camp Complex |
| Hoop&Devil-Elk Creek            | 3,075                         | Happy Camp Complex |
| McCarthy Creek-Scott River      | 11,611                        | Happy Camp Complex |
| Deep Creek-Scott River          | 3,798                         | Happy Camp Complex |
| Upper Grider Creek              | 8,467                         | Happy Camp Complex |
| West Grider Creek-Klamath River | 4,026                         | Happy Camp Complex |
| Headwaters Wooley Creek         | 5,832                         | Happy Camp Complex |

| <b>7th-Field Watershed Name</b>          | <b>Watershed Area (acres)</b> | <b>2014 Fire</b>   |
|--|-------------------------------|--------------------|
| Benjamin Creek-Klamath River             | 9,998                         | Happy Camp Complex |
| Cliff Valley Creek                       | 3,952                         | Happy Camp Complex |
| Lower East Fork Elk Creek                | 3,430                         | Happy Camp Complex |
| Cuddihy Fork                             | 6,452                         | Happy Camp Complex |
| Franklin Gulch-Scott River               | 6,450                         | Happy Camp Complex |
| Cougar Creek-Elk Creek                   | 6,918                         | Happy Camp Complex |
| Headwaters Elk Creek                     | 2,688                         | Happy Camp Complex |
| North Fork Kelsey Creek                  | 5,177                         | Happy Camp Complex |
| South Fork Kelsey Creek                  | 6,199                         | Happy Camp Complex |
| Toms Valley Creek-Elk Creek              | 4,564                         | Happy Camp Complex |
| Big Elk Fork                             | 3,594                         | Happy Camp Complex |
| Upper Shackelford Creek                  | 8,625                         | Happy Camp Complex |
| Upper North Fork Wooley Creek            | 4,318                         | Happy Camp Complex |
| Hell Hole Creek-Wooley Creek             | 6,178                         | Happy Camp Complex |
| Lower North Fork Wooley Creek            | 3,306                         | Happy Camp Complex |
| Rainy Valley Creek                       | 2,985                         | Happy Camp Complex |
| Upper Canyon Creek                       | 5,179                         | Happy Camp Complex |
| Red Rock Creek                           | 4,108                         | Happy Camp Complex |
| South Fork Wooley Creek                  | 6,031                         | Happy Camp Complex |
| Jessups Gulch-North Fork Salmon River    | 4,546                         | Whites             |
| Music Creek                              | 3,286                         | Whites             |
| Lower North Russian Creek                | 4,501                         | Whites             |
| Whites Gulch                             | 8,576                         | Whites             |
| Lower South Russian Creek                | 2,138                         | Whites             |
| Robinson Gulch-North Fork Salmon River   | 5,202                         | Whites             |
| Upper North Russian Creek                | 3,130                         | Whites             |
| Shadow Creek                             | 5,690                         | Whites             |
| Upper French Creek                       | 8,721                         | Whites             |
| Taylor Creek                             | 4,016                         | Whites             |
| Eddy Gulch                               | 4,425                         | Whites             |
| Upper South Russian Creek                | 6,396                         | Whites             |
| Jackson Creek                            | 4,348                         | Whites             |
| Specimen Creek                           | 5,009                         | Whites             |
| Yellow Dog Creek-North Fork Salmon River | 9,239                         | Whites             |
| Jackass Gulch                            | 2,807                         | Whites             |
| Sugar Creek                              | 8,760                         | Whites             |
| Sixmile Creek                            | 4,049                         | Whites             |
| Big Creek                                | 2,735                         | Whites             |

Existing conditions are modified to include winter 2014-15 precipitation and streamflow data for the project area. Although northern California has been in a persistent drought winter 2014-15 storms did

produce some runoff events. Figures 1-3 display streamflow data for USGS gauge sites on the Scott River, Salmon River, and Indian Creek for the period 8/1/14 through 5/15/15.

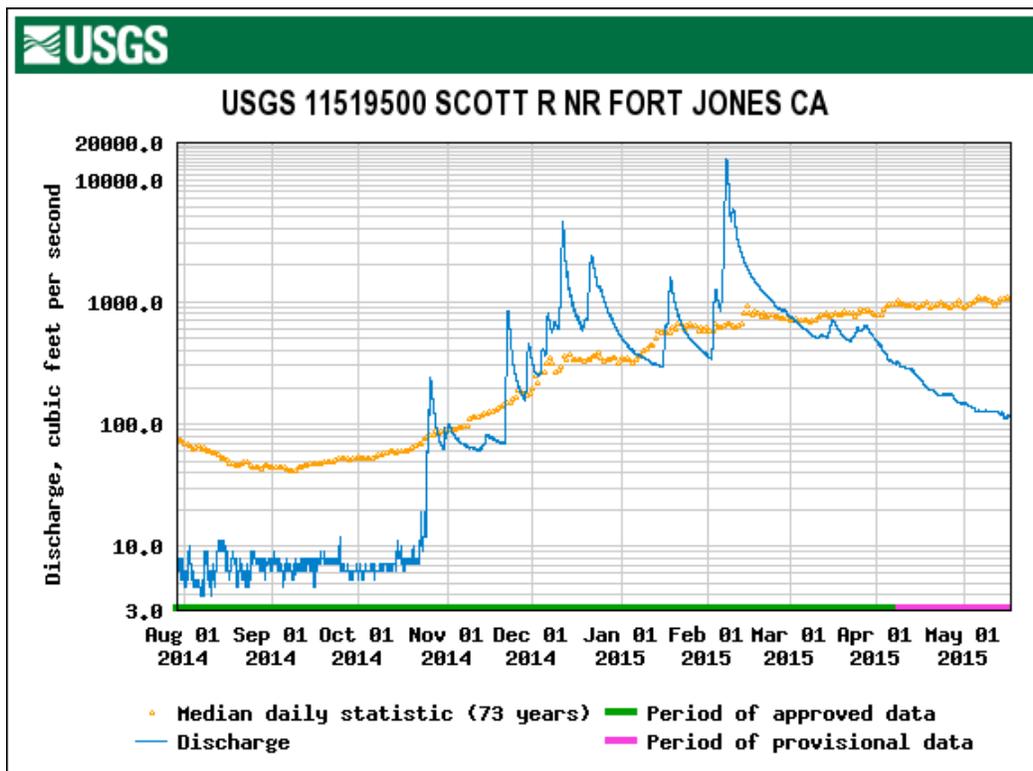


Figure 1: US Geological Survey streamflow data for the Scott River near Fort Jones CA gauge station

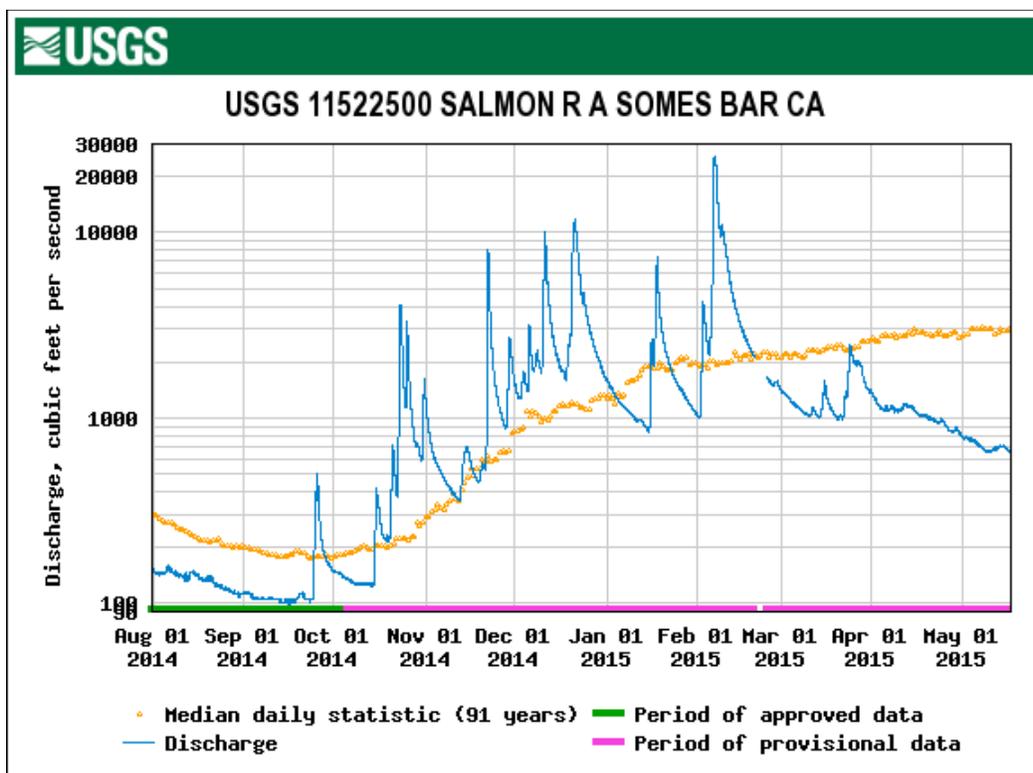


Figure 2: US Geological Survey streamflow data for the Salmon River near Somes Bar CA gauge station

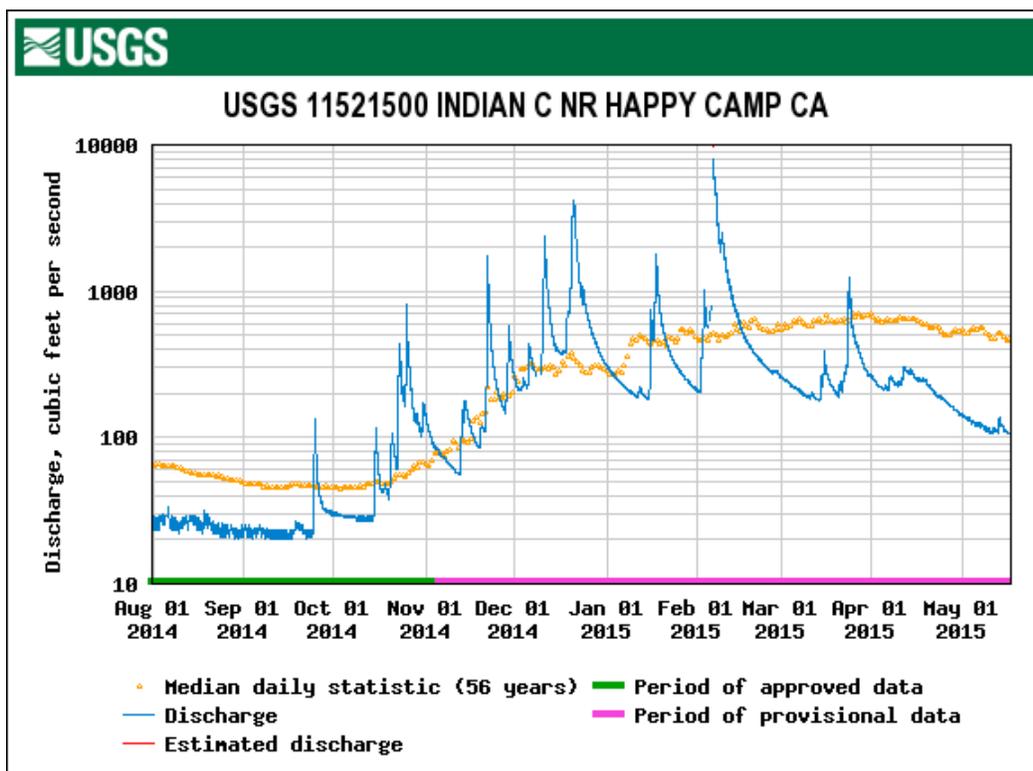


Figure 3: US Geological Survey streamflow data for the Indian Creek near Happy Camp CA gauge station

Streamflow since the 2014 fires peaked in early February 2015 (Table 1). However, at the scale of these large gauged watersheds the runoff events were on the order of 2-year return flows, or less as in the case of the Salmon River. Nonetheless, post-fire surface erosion and sedimentation were observed in the project area.

Table 6: Peak streamflow at three US Geological Survey gauge stations in or adjacent to the project area

| Gauge Site   | Drainage Area (miles <sup>2</sup> ) | Date of Peak | Streamflow (cfs) | Unit Streamflow (cfs/mile <sup>2</sup> ) | Q <sub>2</sub> , 2-Year Return Flow (cfs) |
|--------------|-------------------------------------|--------------|------------------|--|---|
| Scott River  | 653                                 | 2/7/15       | 14,600           | 22                                       | 15,000                                    |
| Salmon River | 751                                 | 2/7/15       | 14,500           | 19                                       | 29,700                                    |
| Indian Creek | 120                                 | 2/6/15       | 9,770            | 81                                       | 7,250                                     |

Precipitation data for the area was available from the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) website. Table 2 displays daily precipitation totals reported by community users in Etna, Forks of Salmon, and Yreka.

**Table 7: February 2015 precipitation data for Etna, Forks of Salmon, and Yreka from the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) website**

|                  | Etna        | Forks of Salmon | Yreka       |
|------------------|-------------|-----------------|-------------|
|                  | CA-SK-4     | CA-SK-9         | CA-SK-5     |
| Date             | Precip (in) | Precip (in)     | Precip (in) |
| 2/1/2015         | --          | 0               | 0           |
| 2/2/2015         | 0.71        | 0.91            | 0.65        |
| 2/3/2015         | 0.82        | 0               | 0.51        |
| 2/4/2015         | --          | 0               | 0           |
| 2/5/2015         | 0.14        | 0.45            | 0.01        |
| 2/6/2015         | 1.99        | 2.25            | 1.06        |
| 2/7/2015         | 3.20        | 2.30            | 2.03        |
| 2/8/2015         | --          | 0.04            | 0.02        |
| 2/9/2015         | 0.5         | 1.08            | 0.27        |
| 2/10/2015        | --          | 0.16            | 0.02        |
| 2/11/2015        | --          | 0               | 0           |
| 2/12/2015        | --          | 0               | 0           |
| 2/13/2015        | --          | 0               | 0           |
| 2/14/2015        | --          | 0               | 0           |
| 2/15/2015        | --          | 0               | 0           |
| 2/16/2015        | --          | 0               | 0           |
| 2/17/2015        | --          | 0               | 0           |
| 2/18/2015        | --          | 0               | 0           |
| 2/19/2015        | --          | 0               | 0           |
| 2/20/2015        | --          | 0               | 0           |
| 2/21/2015        | --          | 0               | 0           |
| 2/22/2015        | --          | 0               | 0           |
| 2/23/2015        | --          | 0               | 0           |
| 2/24/2015        | --          | 0               | 0           |
| 2/25/2015        | --          | 0               | 0           |
| 2/26/2015        | --          | 0               | 0           |
| 2/27/2015        | --          | 0.13            | 0.09        |
| 2/28/2015        | --          | 0.06            | 0.06        |
| <b>Feb Total</b> | <b>7.36</b> | <b>7.38</b>     | <b>4.72</b> |

While the daily and monthly precipitation totals displayed in Table 2 are relatively modest, post-fire surface erosion and sedimentation were observed in the project area. Surface erosion resulted due to fire effects on vegetation and soil infiltration properties. In light of observed year-1 surface erosion it is expected that year-2 surface erosion will be less for a storm with similar duration and intensity. Field observations of hillslope surface erosion in areas such as Tompkins, Walker, and Grider Creeks are in keeping with predictions from the USLE watershed model. This model assumes sediment yield in the first winter post-disturbance (wildfire) resulting from a 2-year, 6-hour magnitude storm. The 3.20" of precipitation observed in Etna, CA during the 24 hours prior to 2/7/15 (Table 7) is estimated to be a 2-year storm event based on the NOAA Precipitation Frequency Data Server (PFDS).

## II. Environmental Consequences of Modified Alternatives

### Modified Alternative 2

The potential consequences to hydrologic function and water quality of implementing modified alternative 2 are very similar to those anticipated from implementation of alternative 2. At the 5<sup>th</sup> field watershed scale modified alternative 2 does not increase CWE model risk ratios beyond 2014 fire effects (alternative 1 model results), and only the Beaver Creek watershed is interpreted as having elevated risk of adverse effects to hydrologic function and water quality as USLE and mass wasting model risk ratios are 1.2 and 1.1, respectively. These results are interpreted to indicate that cumulative watershed effects of modified alternative 2 on hydrologic function and water quality will likely not be detectable at the 5<sup>th</sup> field watershed scale.

ERA model results at the 7<sup>th</sup> field watershed scale are similar to those for 5<sup>th</sup> field watersheds in that modified alternative 2 does not increase risk ratios beyond fire effects (alternative 1) for most watersheds with the exception of Jessups Gulch-North Fork Salmon River (+ 0.8), Whites Gulch (+ 0.3), and Upper North Russian Creek (+ 0.3). Eleven of seventy seven (14%) of the 7<sup>th</sup> field watersheds analyzed have ERA model risk ratio in excess of 1.0 and thus are at elevated risk of adverse effects to hydrologic function and water quality. However only two watersheds were moved in to elevated risk due to modified alternative 2 activities (Walker Creek to 1.1 and Jessups Gulch-North Fork Salmon River to 1.2). These results are interpreted to indicate that adverse cumulative watershed effects are already present in a number of 7<sup>th</sup> field watersheds but additional effects of modified alternative 2 will likely only be detectable in a small number of 7<sup>th</sup> field watersheds.

While model analyses suggest that adverse cumulative watershed effects of the modified alternative 2 will be mostly undetectable beyond 2014 fire effects at the watershed scale, *sediment regime alteration* may be detectable at the site-scale. These effects are anticipated to be mostly the result of road (new temporary segments, segments on existing roadbeds, and reopened decommissioned segments) and landing construction. Modified alternative 2 reduces the estimated length of temporary roads from alternative 2 in the Beaver (2.8 to 1.1 miles) and Happy Camp Complex (18.4 to 14.4 miles) Fires. Site-scale impacts of sediment regime alteration are expected to be manifest in roadbed and crossing erosion and sedimentation and turbidity in downstream channel reaches. However, Project Design Features (PDFs) and Water Quality Best Management Practices (BMPs) are designed and implemented to limit the spatial and temporal extent of these impacts. The complete detail of PDFs is found in the FEIS.

### **Methods**

Methods are revised as described in Section I of this report.

### **Environmental Consequences**

#### **Project Area A: Beaver Fire**

##### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) as determined by the three CWE models are the same as alternative 2 (see Tables 1-3 this report). Only the Buckhorn Gulch-Beaver Creek 7<sup>th</sup> field watershed is pushed in to the elevated risk category (ERA) under modified alternative 2.

##### *Cumulative Effects*

In the Beaver Fire area the only project analyzed as future or on-going is McCollins. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area B: Happy Camp Complex**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) as determined by CWE models are the same as alternative 2 (Tables 1-3). Only the Walker Creek (ERA) is pushed in to the elevated risk category while Lower East Fork Elk Creek moves to the low risk category (USLE model) due to legacy sediment site treatments.

#### *Cumulative Effects*

Lovers Canyon and Scott Bar Fuels Reduction are the only projects considered as present or future activities in the Happy Camp Complex Fire area for this analysis. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area C: Whites Fire**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) as determined by the CWE models are the same as alternative 2. Music Creek and Jessups Gulch-North Fork Salmon River 7<sup>th</sup> field watersheds are pushed in to the elevated risk category (ERA) under modified alternative 2.

#### *Cumulative Effects*

The only project modeled for cumulative effects in the Whites Fire area was the Jess project. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### ***Compliant with Law, Policy and the Forest Plan***

Modified alternative 2 complies with applicable law, regulation, and policy. The project will be enrolled in the North Coast Regional Water Quality Control Board waiver program prior to implementation of the selected alternative.

## **Modified Alternative 3**

### ***Methods***

Methods are revised as described in Section I of this report.

## **Environmental Consequences**

### **Project Area A: Beaver Fire**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2 (Tables 1-3). Only the Buckhorn Gulch-Beaver Creek 7<sup>th</sup> field watershed is pushed in to the elevated risk category (ERA) under modified alternative 3. Under modified alternative 3 twenty eight 7<sup>th</sup> field watersheds exceed the model threshold of concern and of those thirteen have risk ratios that are increased by this alternative's activities.

Site-scale effects are anticipated to be different than alternative 2. Appendix C demonstrates that fewer miles of temporary roads and associated stream crossings and landings (none in the Beaver Fire area) in Riparian Reserves are proposed anticipated under modified alternative 3. This reduced ground disturbance will result in reduced risk of sediment regime alteration, and thus reduced the risk to water quality. In addition, reduced disturbance may be expected to have less effect on the trend of post-fire riparian conditions.

#### *Cumulative Effects*

In the Beaver Fire area the only project analyzed as future or on-going is McCollins. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area B: Happy Camp Complex**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2 (Tables 1-3). Only the Walker Creek (ERA) is pushed in to the elevated risk category while Lower East Fork Elk Creek moves to the low risk category (USLE model) due to legacy sediment site treatments.

Site-scale effects are anticipated to be different than alternative 2. Appendix C demonstrates that fewer miles of temporary roads and associated stream crossings and landings in Riparian Reserves are proposed anticipated under modified alternative 3. This reduced ground disturbance will result in reduced risk of sediment regime alteration, and thus reduced the risk to water quality. In addition, reduced disturbance may be expected to have less effect on the trend of post-fire riparian conditions.

#### *Cumulative Effects*

Lovers Canyon and Scott Bar Fuels Reduction are the only projects considered as present or future activities in the Happy Camp Complex Fire area for this analysis. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

## **Project Area C: Whites Fire**

### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2 (Tables 1-3). Music Creek and Jessups Gulch-North Fork Salmon River 7<sup>th</sup> field watersheds are pushed in to the elevated risk category (ERA) in modified alternative 3.

Site-scale effects are anticipated to be different than alternative 2. Appendix C demonstrates that fewer miles of temporary roads and associated stream crossings and landings (none in the Whites Fire area) in Riparian Reserves are proposed anticipated under modified alternative 3. This reduced ground disturbance will result in reduced risk of sediment regime alteration, and thus reduced the risk to water quality. In addition, reduced disturbance may be expected to have less effect on the trend of post-fire riparian conditions.

### *Cumulative Effects*

The only project modeled for cumulative effects in the Whites Fire area was the Jess project. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### ***Compliant with Law, Policy and the Forest Plan***

Modified alternative 2 complies with applicable law, regulation, and policy. The project will be enrolled in the North Coast Regional Water Quality Control Board waiver program prior to implementation of the selected alternative.

## **III. Modification of Environmental Consequences by Fire Area since the Draft EIS**

### ***Affected Environment***

The analysis of the Affected Environment for the CWE models includes the Eddy Late Successional Reserve, Elk Thin, Fish Meadows, Glassups Timber Sale, Happy Camp Fire Protection Phase 2, Johnny O'Neil Late Successional Reserve Habitat Restoration and Fuels Reduction, Lake Mountain Foxtail Pine, Lower Scott Roads, North Fork Roads Storm-proofing, Oak Flat Thin, Singleton, Thom Seider Vegetation Management and Fuels Reduction, and Two Bit Vegetation Management projects. Work done under the Burned Area Emergency Response (BAER), grazing allotments, Private Timber Harvest Plans since 2005, and Private Land Salvage (Emergency Timber Harvest Plans) are on-going activities and the CWE models include them in the "current" portion of the results.

For the entire project area, under alternative 2 there are fifty 7<sup>th</sup> field watersheds at low risk for sediment regime alteration for all three CWE models. Twenty seven 7<sup>th</sup> field watersheds exceed the threshold of concern for at least one CWE model. Eight 7<sup>th</sup> field watersheds are in exceedance for two CWE models, and six that are in exceedance for all three CWE models.

**Project Area A: Beaver Fire**

*Risk to Channel Morphology*

The debris flow likelihood is elevated due to the 2014 fire effects. There is a likelihood of highly likely for Lumgrey Creek, Soda Creek, Lower West Fork Beaver Creek, Dutch Creek, Buckhorn Gulch, Doggett Creek, Dona Creek and Kohl Creek. This means that a debris flow will probably occur during an average storm event.

**Table 8: Beaver Fire 7<sup>th</sup> field watersheds with the greatest likelihood of experiencing debris flows as inferred from landslide likelihood**

| 7th-Field Watershed Name     | 2014 Fire | Alt 2<br>Landslide<br>Likelihood | Inferred Debris Flow<br>Likelihood |
|------------------------------|-----------|----------------------------------|------------------------------------|
| Lumgrey Creek                | Beaver    | Highly Likely                    | Likely                             |
| Soda Creek-Beaver Creek      | Beaver    | Highly Likely                    | Likely                             |
| Lower West Fork Beaver Creek | Beaver    | Highly Likely                    | Likely                             |
| Dutch Creek                  | Beaver    | Highly Likely                    | Likely                             |
| Buckhorn Gulch-Beaver Creek  | Beaver    | Highly Likely                    | Likely                             |
| Doggett Creek                | Beaver    | Highly Likely                    | Likely                             |
| Dona Creek-Klamath River     | Beaver    | Highly Likely                    | Likely                             |
| Kohl Creek                   | Beaver    | Highly Likely                    | Likely                             |

*Risk to Sediment Regime*

Lumgrey Creek, Soda Creek, Lower West Fork Beaver Creek, Buckhorn Gulch, Doggett Creek, Dona Creek and Kohl Creek are over the threshold of concern for the mass wasting model. These watersheds have an elevated risk to channel geomorphology for about 10 years and will be back to pre-fire risk in about 30 years. Jaynes Creek and Dutch Creek have a risk ratio over the threshold of concern which means they will have an elevated risk for about 10 years before it recovers to pre-fire risk.

*Trend of Riparian Reserve Condition*

In Riparian Reserves that had high or moderate vegetation burn severity there is on average little to no shade from large over story conifers as is the desired condition described in the Forest Plan (4-106). The deciduous understory will likely resprout and provide some shade on stream channels over the next two to five years. The 2014 wildfire have increased the risk to channel geomorphology or sediment regime alteration nine watersheds in the Beaver fire area. These watersheds will recover slowly over the next 10 to 30 years to pre-fire conditions.

**Project Area B: Happy Camp Complex**

*Risk to Channel Morphology*

The landslide likelihood is elevated due to the 2014 fire effects. There is a likelihood of almost certain in Lower Grider, O’Neil, Walker, Caroline, Granite and Middle Elk Creek. These watersheds have a probability of debris flow even in a below average storm event. Rancheria Creek, Tom Martin Creek, Schutts Gulch, Middle Creek, Deep Creek, Big Ferry Swanson, Bear Creek, Bishop Creek and Doolittle Creek have a likely probability of a debris flow event. This means that there is a probability of debris flow events in an average storm event.

**Table 9: Happy Camp Complex Fire 7<sup>th</sup> field watersheds with the greatest likelihood of experiencing debris flows as inferred from landslide likelihood**

| 7th-Field Watershed Name       | 2014 Fire  | Alt 2                |                                 |
|--------------------------------|------------|----------------------|---------------------------------|
|                                |            | Landslide Likelihood | Inferred Debris Flow Likelihood |
| Lower Grider Creek             | Happy Camp | Almost Certain       | Highly Likely                   |
| O'Neil Creek                   | Happy Camp | Almost Certain       | Highly Likely                   |
| Walker Creek                   | Happy Camp | Almost Certain       | Highly Likely                   |
| Caroline Creek-Klamath River   | Happy Camp | Almost Certain       | Highly Likely                   |
| Granite Creek                  | Happy Camp | Almost Certain       | Highly Likely                   |
| Middle Elk Creek               | Happy Camp | Almost Certain       | Highly Likely                   |
| Rancheria Creek                | Happy Camp | Highly Likely        | Likely                          |
| Tom Martin Creek-Klamath River | Happy Camp | Highly Likely        | Likely                          |
| Schutts Gulch-Klamath River    | Happy Camp | Highly Likely        | Likely                          |
| Middle Creek                   | Happy Camp | Highly Likely        | Likely                          |
| Deep Creek-Scott River         | Happy Camp | Highly Likely        | Likely                          |
| Big Ferry-Swanson              | Happy Camp | Highly Likely        | Likely                          |
| Bear Creek                     | Happy Camp | Highly Likely        | Likely                          |
| Bishop Creek-Elk Creek         | Happy Camp | Highly Likely        | Likely                          |
| Doolittle Creek                | Happy Camp | Highly Likely        | Likely                          |

*Risk to Sediment Regime*

Lower Grider Creek, O'Neil Creek, Schutts Creek, Walker Creek, Caroline Creek, Middle Creek, Deep Creek, Granite Creek, Middle Creek, Bear Creek, and Bishop Creek all have risk ratios over the threshold of concern for mass wasting model. These watersheds will have an elevated risk to sediment regime alteration for 10 years and slowly recovery to pre-fire conditions in about 30 years. Big Ferry-Swanson Creek has a risk ratio over the threshold of concern for the ERA model and will recovery to pre-fire conditions in about 10 years. Horse Creek, Fryingpan creek, and Upper Elk Creek are over the threshold of concern for the USLE model and will have an elevated risk to sediment regime alteration for about 2 years and will quickly recover to per-fire conditions.

*Trend of Riparian Reserve Condition*

In Riparian Reserves that had high or moderate vegetation burn severity there is on average little to no shade from large over story conifers as is the desired condition described in the Forest Plan (4-106). The deciduous understory will likely resprout and provide some shade on stream channels over the next two to five years. The 2014 wildfire has increased the risk to channel geomorphology or sediment regime alteration 15 watersheds in the Happy Camp Complex area. These watersheds will recover slowly over the next 10 to 30 years to pre-fire conditions.

**Project Area C: Whites Fire**

*Risk to Channel Morphology*

The landslide likelihood is elevated due to the 2014 fire effects. Music Creek, Upper North Russian Creek, Lower North Russian Creek, Whites Gulch, and Robinson Gulch have a likely probability of a debris flow event. This means that there is a probability of debris flow events in an average storm event.

**Table 10: Whites Fire 7<sup>th</sup> field watersheds with the greatest likelihood of experiencing debris flows as inferred from landslide likelihood**

| 7th-Field Watershed Name               | 2014 Fire | Alt 2 Landslide Likelihood | Inferred Debris Flow Likelihood |
|--|-----------|----------------------------|---------------------------------|
| Music Creek                            | Whites    | Highly Likely              | Likely                          |
| Upper North Russian Creek              | Whites    | Highly Likely              | Likely                          |
| Lower North Russian Creek              | Whites    | Highly Likely              | Likely                          |
| Whites Gulch                           | Whites    | Highly Likely              | Likely                          |
| Robinson Gulch-North Fork Salmon River | Whites    | Highly Likely              | Likely                          |

*Risk to Sediment Regime*

Music Creek has risk ratios over the threshold of concern for mass wasting model. These watersheds will have an elevated risk to sediment regime alteration for 10 years and slowly recovery to pre-fire conditions in about 30 years. Lower North Russian Creek and Whites Gulch are over the threshold of concern for the USLE model and will have an elevated risk to sediment regime alteration for about 2 years and will quickly recover to per-fire conditions.

*Trend of Riparian Reserve Condition*

In Riparian Reserves that had high or moderate vegetation burn severity there is on average little to no shade from large over story conifers as is the desired condition described in the Forest Plan (4-106). The deciduous understory will likely resprout and provide some shade on stream channels over the next two to five years. The 2014 wildfire has increased the risk to channel geomorphology or sediment regime alteration five watersheds in the Happy Camp Complex area. These watersheds will recover slowly over the next 10 to 30 years to pre-fire conditions.

**Environmental Consequences**

**Alternative 1 – No Action**

**Project Area A: Beaver Fire**

*Direct Effects and Indirect Effects*

Effects of alternative 1 in the Beaver Fire area are the same as those described in the Hydrology report for all indicators.

*Cumulative Effects*

McCollins Late Successional Reserve Enhancement project is the only action considered for cumulative effects that is not included in the affected environment. This project does not increase the risk ratio for any model above 1.0 or increase the landslide likelihood in the fire area.

**Project Area B: Happy Camp Complex**

*Direct Effects and Indirect Effects*

Effects of alternative 1 in the Happy Camp Complex Fire area are the same as those described in the Hydrology report for all indicators.

### *Cumulative Effects*

Lovers Canyon and Scott Mountain Fuels Reduction projects are the only actions considered for cumulative effects that are not already assessed in the affected environment. These projects do not increase the risk ratio for any of the models beyond the Threshold of Concern (TOC) or increase the landslide likelihood in the fire area.

### **Project Area C: Whites Fire**

#### *Direct Effects and Indirect Effects*

Effects of alternative 1 in the Happy Camp Complex Fire area are the same as those described in the Hydrology report for all indicators.

#### *Cumulative Effects*

The Jess project is the only project considered for cumulative effects that is not already assessed in the affected environment. This project does increase the risk ratio in the Jessups Gulch watershed over 1.0 leading to an elevated risk of sediment regime alteration. The landslide risk is not increased, so the risk to channel morphology remains the same as in the affected environment for Jessups Gulch. The Jess project is expected to improve Riparian Reserve conditions through treatments intended to increase the number of large trees and decrease fuels loading in Riparian Reserves. The trend in Riparian Reserve condition in this watershed will be a slow upward trend as a result of the Jess project.

### **Alternative 2**

### **Project Area A: Beaver Fire**

#### *Direct Effects and Indirect Effects*

#### *Risk to Channel Morphology*

Based on results from the 2014 BAER analysis, post-fire unit peak stream flows (cubic feet per second/square mile) are not expected to increase sufficiently to increase risk to existing channel morphology via non-bulked flows. This is because project area streams are predominantly steep with channel beds and banks armored by coarse substrate (cobble, boulder, bedrock). Based on ERA model results none of the 5<sup>th</sup> field watersheds are at elevated risk for adverse hydrologic effects under alternative 2 (Appendix A). For 7<sup>th</sup> field watersheds alternative 2 increases the number of watersheds at elevated risk from eight to twelve out of seventy seven watersheds for all fires (Table 1). Only Buckhorn Gulch-Beaver Creek moves in to the elevated risk category (ERA model) in the Beaver Fire area as a result of alternative 2.

Mass wasting and potential associated debris flows are and have been (pre-settlement) fundamental mechanisms of channel change in the Klamath Mountains. The landslide likelihood derived for the amendment to the project geology report is employed here to infer likelihood of debris flows and potential effects to the *risk to channel morphology* indicator. Analysis in the project geology report indicates that landslides are *likely* in five and *highly likely* in eight Beaver Fire area 7<sup>th</sup> field watersheds due to fire effects (Table 8). There are no 7<sup>th</sup> field watersheds in the Beaver Fire area with almost certain likelihood of landslides. Neither alternative 2 nor any other action alternative increases the landslide likelihood in the fire area (see geology report for details), and thus there is no effect on the likelihood of debris flows or risk to channel morphology. These

results are interpreted to indicate that debris flow alteration of channel morphology and effects to hydrologic function and water quality is likely along at least some reaches of the channel network in the Lumgreys, Soda, Lower West Fork Beaver, Dutch, Buckhorn Gulch, Doggett, Dona, and Kohl Creek 7<sup>th</sup> field watersheds. This likelihood is not increased by alternative 2. Effects on channel morphology from debris flow alteration, should a debris flow occur in a channel, are expected to persist for at least a decade as riparian vegetation recovers along debris flow tracks.

#### *Risk of Sediment Regime Alteration*

Risk of sediment regime alteration is assessed with all three CWE models. Nearly all 5<sup>th</sup> field watershed risk ratios are unchanged under alternative 2 for each model (Appendix A). The exception is that Humburg Creek-Klamath River, Seiad Creek-Klamath River, and North Fork Salmon ERA risk ratios increase nominally with the largest increase (0.06) still considered to be essentially within the model margin of error. For 7<sup>th</sup> field watersheds alternative 2 increases the number of watersheds at elevated risk from eight to twelve for the ERA model while no change is detected by the USLE and mass wasting models. The four watersheds moved in to elevated risk as determined by the ERA model are Buckhorn Gulch-Beaver Creek, Walker Creek, Music Creek, and Jessups Gulch-North Fork Salmon River. However, it is important to note that this elevated risk can be unrealized such as where elevated mass wasting risk has not actually produced landslides because of the lack of a triggering storm event. Additionally, watershed PDFs such as watershed-4, which precludes mechanical equipment in hydrologic Riparian Reserves will reduce the risk of sediment regime alteration and sediment production to water bodies.

While risk of sediment regime alteration is undetectable to minor at 5<sup>th</sup> and 7<sup>th</sup> field watershed scales, some project activities are expected to produce site scale effects. Appendix C displays ground disturbing activities in hydrologic and geologic Riparian Reserves under alternatives 2 and 3 modified. The use of reopened decommissioned roads and temporary roads (these segments sum to 2.6 miles under alternative 2) has potential to alter site-scale sediment regimes over the short-term, particularly where stream crossings and new landings would be constructed. Alternative 2 proposes eleven stream crossings along reopened decommissioned roads or temporary roads in Riparian Reserves and 22 new landings. However PDF watershed-5 and watershed-23 will reduce risk of sediment production to water courses from these activities.

The treatment of legacy sediment sites under alternative 2 (and any action alternative) will reduce the risk of sediment regime alteration resulting from road-related erosion and sedimentation. Table 11 displays legacy sediment site repairs proposed within hydrologic and geologic Riparian Reserves as part of the application to the North Coast Regional Water Quality Control Board for enrollment of the WFR project in the waiver program. Please note that some of these sites have already been analyzed under previous National Environmental Policy Act (NEPA) projects. Approximately seventy road-related legacy sediment sites are identified for treatment in the Beaver Fire area for the waiver application.

**Table 11: Road-related legacy sediment site repairs proposed for hydrologic and geologic Riparian Reserves as part of the application to the North Coast Regional Water Quality Control Board for waiver coverage-- Talled sites do not include work done under 2014 BAER assessments**

| <b>Alternative 2<br/>Road Legacy Sediment Sites</b> | <b>Beaver Fire</b> | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> |
|---|--------------------|---------------------------|--------------------|--------------|
| Highly Risk Stream Crossings                        | 4                  | 85                        | 13                 | 102          |
| Stream Diversion Potential                          | 37                 | 160                       | 63                 | 260          |
| Diversion Potential, Undersized Culvert             | 21                 | 80                        | 21                 | 122          |
| Undersized Culvert                                  | 12                 | 90                        | 44                 | 146          |
| Total   | 74                 | 415                       | 141                | 630          |

*Trend of Riparian Condition*

For Beaver Fire 5<sup>th</sup> field watersheds post-fire increased peak flow is not expected to negatively affect channel morphology. Alternative 2 has no effect on the debris flow likelihood (see geology report for details) at the 7<sup>th</sup> field scale and there is no change from the existing condition for risk to channel morphology in this alternative. The indirect effects to shade not related to debris flow events as a result of alternative 2 will be small in the Beaver Fire area because no planting will occur in the Riparian Reserves. However, recruitment of large wood to stream channels in the first decade post-fire may produce increases in stream shading where mature Riparian Reserve conifers were fire killed and fall across channels. Reforestation outside of the Riparian Reserves will have a small indirect effect on stream shading, but not enough to improve the trend of riparian conditions in any watershed overall.

*Cumulative Effects*

In the Beaver Fire area the only project analyzed as future or on-going is McCollins. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

**Project Area B: Happy Camp Complex**

*Direct Effects and Indirect Effects*

*Risk to Channel Morphology*

Alternative 2 does not increase the landslide likelihood in the fire area (see geology report for details). These results are interpreted to indicate that the risk of debris flow alteration of channel morphology is highly likely along at least some reaches of the Lower Grider, O’Neil, Walker, Caroline, Granite, Middle Elk Creek 7<sup>th</sup> field watersheds (Table 9). Proposed reforestation reduces the duration of elevated landslide risk to approximately 30 years for Upper Grider, Cliff Valley, Lower Grider, O’Neil, Walker, Caroline, Middle, Tompkins, Horse, Upper East Fork Elk, Upper Elk and Lower East Fork Elk Creeks (See Table 1 in the Amendment to the Geology report for details).

*Risk of Sediment Regime Alteration*

None of the 5<sup>th</sup> field watersheds in the Happy Camp Complex Fire area are at elevated risk for adverse effects to hydrologic function and water quality by any of the three CWE models under alternative 2. As a result of alternative 2 the Walker Creek 7<sup>th</sup> field watershed is moved from low to elevated risk (ERA model) in the Happy Camp Complex Fire area. This elevated risk will persist for approximately a decade before declining.

Surface erosion (USLE) and mass wasting risk categories are not changed by the alternative for any of the 7<sup>th</sup> field watersheds in the fire area with the exception of Lower East Fork Elk Creek which is reduced from elevated to low risk (USLE model) as a result of proposed road-related legacy sediment site treatments. Legacy site treatments in the Elk Creek watershed will reduce road-related erosion and sedimentation potential long term. Proposed legacy site repairs in Elk Creek will remove an estimated approximately 140,000 yards<sup>3</sup> of sediment from risk of impacting water quality in the Elk Creek watershed (G. Bousefield, personal communication).

The hand treatments and planting in the Riparian Reserves will increase their ability to buffer sediment delivery to the stream channel by increasing ground cover and encouraging vegetation in the short term.

#### *Trend of Riparian Condition*

Alternative 2 does not increase the debris flow likelihood (see geology report for details) at the 7<sup>th</sup> field scale and there is a reduction in the duration of elevated landslide likelihood in 12 watersheds as a result of reforestation from planting. Reforestation from planting in Riparian Reserves will decrease the time needed to regain effective shade on intermittent and perennial channels. Areas where the decrease in duration of landslide risk is juxtaposed with Riparian Reserve treatments will have a steeper positive trend when compared with areas where just one or the other will occur.

#### *Cumulative Effects*

Lovers Canyon and Scott Bar Fuels Reduction are the only projects considered as present or future activities in the Happy Camp Complex Fire area for this analysis. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area C: Whites Fire**

#### *Direct Effects and Indirect Effects*

##### *Risk to Channel Morphology*

Alternative 2 has no effect on landslide likelihood in the fire area (see geology report for details). The risk to channel morphology is similar in magnitude and scale as that described for the Beaver Fire area. Music Creek, Upper North Russian Creek, Lower North Russian Creek, Whites Gulch, and Robinson Gulch 7<sup>th</sup> field watersheds are likely to experience debris flows along at least some reaches of their channel networks.

##### *Risk of Sediment Regime Alteration*

Four 7<sup>th</sup> field watersheds in the Whites Fire area are over the TOC (risk ratio  $\geq 1.0$ ) for at least one of the three CWE models under alternative 2: Music Creek (ERA and mass wasting), Jessups Gulch (ERA), Lower North Russian Creek (USLE), and Whites Gulch (USLE). This elevated risk will persist from about 2 years for surface erosion (USLE) rate recovery to at least three decades for recovery of mass wasting erosion rates. Music Creek and Whites Gulch were pushed in to the elevated risk category by alternative 2 while Jessups Gulch and Lower North Russian Creek were at elevated risk under alternative 1.

The treatment of legacy sediment sites under alternative 2 will reduce the risk of sediment regime alteration resulting from road-related erosion and sedimentation. Approximately one hundred and forty road-related legacy sediment sites are identified for treatment in the Whites Fire area as part of the waiver application (Table 11) required for any action alternative. Please note that these sites have already been analyzed under previous NEPA projects.

The hand treatments and planting in the Riparian Reserves will increase the Riparian Reserves ability to buffer sediment delivery to the stream channel by increasing ground cover and encouraging vegetation on the short term.

#### *Trend of Riparian Condition*

Debris flows are considered likely in the Music, Upper North Russian, Lower North Russian, Whites Gulch, and Robinson Gulch 7<sup>th</sup> field watersheds in the Whites Fire Area. Alternative 2 does not increase the debris flow likelihood (see geology report for details) at the 7<sup>th</sup> field scale and there is no change from the existing condition for risk to channel morphology in this alternative. The reforestation in Riparian Reserves will increase the time needed to regain effective shade on intermittent and perennial channels. The trend in Riparian Reserves receiving treatment will be steeper compared to the areas where no treatment will occur.

#### *Cumulative Effects*

The only project modeled for cumulative effects in the Whites Fire area was the Jess project. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Alternative 3**

#### **Project Area A: Beaver Fire**

##### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Only the Buckhorn Gulch-Beaver Creek 7<sup>th</sup> field watershed is pushed in to the elevated risk category (ERA) under alternative 3. There is no effect to the debris flow likelihood for the Beaver Fire area from alternative 3, and no fire salvage in the Beaver Fire area in this alternative.

##### *Cumulative Effects*

In the Beaver Fire area the only project analyzed as future or on-going is McCollins. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

#### **Project Area B: Happy Camp Complex**

##### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Only the Walker Creek (ERA) is pushed in to the elevated risk category while Lower East Fork Elk Creek moves to the low risk category (USLE model) due to legacy sediment site treatments. There is no effect to the debris flow likelihood and the duration of elevated risk will not be reduced for Lower Grider Creek in this alternative. There is less salvage in the Happy Camp Complex Fire area under alternative 3 than alternative 2, so there may be a decreased risk of sediment regime alteration. However, CWE models were not sensitive to these fewer salvage acres at 5<sup>th</sup> and 7<sup>th</sup> field watershed scales. There is no hand treatment in Riparian Reserves so the benefit of increased shade and sediment buffering due to production of ground cover will not occur.

#### ***Cumulative Effects***

Lovers Canyon and Scott Bar Fuels Reduction are the only projects considered as present or future activities in the Happy Camp Complex Fire area for this analysis. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area C: Whites Fire**

#### ***Direct Effects and Indirect Effects***

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Music Creek and Jessups Gulch-North Fork Salmon River 7<sup>th</sup> field watersheds are pushed in to the elevated risk category (ERA) under alternative 3. There is no effect to debris flow likelihood or duration of elevated landslide risk in this alternative. There is less salvage in the Whites Fire area under alternative 3 than alternative 2, so there may be a decreased risk of sediment regime alteration. However, CWE models were not sensitive to these fewer salvage acres at 5<sup>th</sup> and 7<sup>th</sup> field watershed scales. There is no hand treatment in Riparian Reserves proposed so the benefit of increased shade and sediment buffering due to increase ground cover will not occur.

#### ***Cumulative Effects***

The only project modeled for cumulative effects in the Whites Fire area was the Jess project. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Alternative 4**

### **Project Area A: Beaver Fire**

#### ***Direct Effects and Indirect Effects***

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Only the Buckhorn Gulch-Beaver Creek 7<sup>th</sup> field watershed

is pushed in to the elevated risk category (ERA) under alternative 4. There is no effect to the debris flow likelihood for the Beaver Fire area from alternative 4.

#### *Cumulative Effects*

In the Beaver Fire area the only project analyzed as future or on-going is McCollins. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area B: Happy Camp Complex**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Only the Walker Creek (ERA) is pushed in to the elevated risk category while Lower East Fork Elk Creek moves to the low risk category (USLE model) due to legacy sediment site treatments. There is no effect to the debris flow likelihood and the duration of elevated risk will not be reduced for Lower Grider Creek in this alternative. There is less salvage in the Happy Camp Complex Fire area under alternative 4 than alternative 2, so there may be a decreased risk of sediment regime alteration. However, CWE models were not sensitive to these fewer salvage acres at 5<sup>th</sup> and 7<sup>th</sup> field watershed scales.

#### *Cumulative Effects*

Lovers Canyon and Scott Bar Fuels Reduction are the only projects considered as present or future activities in the Happy Camp Complex Fire area for this analysis. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area C: Whites Fire**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are similar to alternative 2 with the exception being that the Music Creek 7<sup>th</sup> field watershed is not pushed in to the elevated risk category (ERA) under alternative 4. There is no effect to debris flow likelihood or duration of elevated landslide risk in this alternative.

#### *Cumulative Effects*

The only project modeled for cumulative effects in the Whites Fire area was the Jess project. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

## **Alternative 5**

### **Project Area A: Beaver Fire**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Only the Buckhorn Gulch-Beaver Creek 7<sup>th</sup> field watershed is pushed in to the elevated risk category (ERA) under alternative 5.

#### *Cumulative Effects*

In the Beaver Fire area the only project analyzed as future or on-going is McCollins. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area B: Happy Camp Complex**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Only the Walker Creek (ERA) is pushed in to the elevated risk category while Lower East Fork Elk Creek moves to the low risk category (USLE model) due to legacy sediment site treatments.

#### *Cumulative Effects*

Lovers Canyon and Scott Bar Fuels Reduction are the only projects considered as present or future activities in the Happy Camp Complex Fire area for this analysis. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

### **Project Area C: Whites Fire**

#### *Direct Effects and Indirect Effects*

Potential effects to hydrologic function and water quality at the watershed scale (5<sup>th</sup> and 7<sup>th</sup> fields) are the same as alternative 2. Music Creek and Jessups Gulch-North Fork Salmon River 7<sup>th</sup> field watersheds are pushed in to the elevated risk category (ERA) under alternative 5.

#### *Cumulative Effects*

The only project modeled for cumulative effects in the Whites Fire area was the Jess project. Watershed risk ratios displayed in Appendices B and C account for these projects. Livestock grazing is not included in the CWE model assessments but grazing effects are assumed to be minor in the context of the 2014 wildfires.

***Compliance with law, regulation, policy, and the Forest Plan***

Project alternative comply with applicable law, regulation, and policy. The project will be enrolled in the North Coast Regional Water Quality Control Board waiver program prior to implementation of the selected alternative.

## Appendix A: Cumulative Watershed Effects Model Results for 5<sup>th</sup> Field Watersheds by Fire Area

**Table 12: Equivalent roaded area (ERA) model results for the seven project alternatives across ten 5<sup>th</sup> field watersheds, sorted by 2014 wildfire--Percent ERA can be computed by multiplying risk ratio by TOC--Results are inclusive of past, present, and future foreseeable project actions**

| Equivalent Roaded Area (ERA) Model<br>5th Field Watershed | Drainage Area | Watershed Threshold<br>of Concern (TOC) | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|---------------|---|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |               |   |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Humbug Creek-Klamath River                                | 68,023        | 11%                                     | Beaver             | 0.31              | 0.37          | 0.37  | 0.37  | 0.37  | 0.37              | 0.37              |
| Beaver Creek  | 69,610        | 8%                                      | Beaver             | 1.00              | 1.02          | 1.02  | 1.02  | 1.02  | 1.02              | 1.02              |
| Horse Creek-Klamath River                                 | 98,625        | 9%                                      | Beaver             | 0.71              | 0.74          | 0.73  | 0.74  | 0.73  | 0.73              | 0.73              |
| Seiad Creek-Klamath River                                 | 81,706        | 8%                                      | Happy Camp Complex | 0.54              | 0.59          | 0.58  | 0.59  | 0.57  | 0.58              | 0.59              |
| Lower Scott River   | 99,858        | 9%                                      | Happy Camp Complex | 0.55              | 0.59          | 0.58  | 0.59  | 0.58  | 0.58              | 0.58              |
| Thompson Creek-Klamath River                              | 61,233        | 9%                                      | Happy Camp Complex | 0.42              | 0.44          | 0.43  | 0.44  | 0.43  | 0.43              | 0.43              |
| Elk Creek   | 71,359        | 8%                                      | Happy Camp Complex | 0.51              | 0.53          | 0.52  | 0.53  | 0.52  | 0.52              | 0.52              |
| Ukonom Creek-Klamath River                                | 81,192        | 8%                                      | Happy Camp Complex | 0.39              | 0.39          | 0.39  | 0.39  | 0.39  | 0.39              | 0.39              |
| South Fork Salmon River                                   | 185,284       | 9%                                      | Whites             | 0.31              | 0.32          | 0.31  | 0.32  | 0.32  | 0.31              | 0.32              |
| North Fork Salmon River                                   | 134,520       | 9%                                      | Whites             | 0.35              | 0.41          | 0.40  | 0.41  | 0.40  | 0.40              | 0.41              |

**Table 13: Universal Soil Loss Equation (USLE) model results for the seven project alternatives across ten 5<sup>th</sup> field watersheds, sorted by 2014 wildfire--Results are inclusive of past, present, and future foreseeable project actions**

| Universal Soil Loss Equation (USLE) Model<br>5th Field Watershed | Drainage Area | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|--|---------------|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|  |               |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Humbug Creek-Klamath River                                       | 68,023        | Beaver             | 0.50              | 0.54          | 0.54  | 0.54  | 0.54  | 0.54              | 0.54              |
| Beaver Creek   | 69,610        | Beaver             | 1.17              | 1.17          | 1.17  | 1.17  | 1.17  | 1.17              | 1.17              |
| Horse Creek-Klamath River  | 98,625        | Beaver             | 0.82              | 0.82          | 0.82  | 0.82  | 0.82  | 0.82              | 0.82              |
| Seiad Creek-Klamath River  | 81,706        | Happy Camp Complex | 0.78              | 0.79          | 0.79  | 0.78  | 0.78  | 0.79              | 0.79              |
| Lower Scott River  | 98,016        | Happy Camp Complex | 0.50              | 0.51          | 0.51  | 0.51  | 0.51  | 0.51              | 0.51              |
| Thompson Creek-Klamath River                                     | 67,301        | Happy Camp Complex | 0.31              | 0.32          | 0.32  | 0.32  | 0.31  | 0.32              | 0.31              |
| Elk Creek  | 60,829        | Happy Camp Complex | 0.32              | 0.31          | 0.31  | 0.31  | 0.31  | 0.31              | 0.31              |

Appendix A: Cumulative Watershed Effects Model Results for 5th Field Watersheds by Fire Area

| Universal Soil Loss Equation (USLE) Model<br>5th Field Watershed | Drainage Area | 2014 Wildfire      | 2015              | DEIS  |       |       |       |       | Modified | Modified |
|--|---------------|--------------------|-------------------|-------|-------|-------|-------|-------|----------|----------|
|  |               |                    | Baseline<br>Alt 1 | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2 | Alt 3    |          |
| Ukonom Creek-Klamath River                                       | 87,884        | Happy Camp Complex | 0.19              | 0.19  | 0.19  | 0.19  | 0.19  | 0.19  | 0.19     |          |
| South Fork Salmon River  | 185,597       | Whites             | 0.26              | 0.26  | 0.26  | 0.26  | 0.26  | 0.26  | 0.26     |          |
| North Fork Salmon River  | 130,545       | Whites             | 0.37              | 0.38  | 0.38  | 0.38  | 0.38  | 0.38  | 0.38     |          |

Table 14: Mass wasting model results for the seven project alternatives across ten 5<sup>th</sup> field watersheds, sorted by 2014 wildfire--Results are inclusive of past, present, and future foreseeable project actions

| Mass Wasting Model<br>5th Field Watershed | Drainage Area | 2014 Wildfire      | 2015              | DEIS  |       |       |       |       | Modified | Modified |
|---|---------------|--------------------|-------------------|-------|-------|-------|-------|-------|----------|----------|
|   |               |                    | Baseline<br>Alt 1 | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2 | Alt 3    |          |
| Humbug Creek-Klamath River                | 68,023        | Beaver             | 0.84              | 0.84  | 0.84  | 0.84  | 0.84  | 0.84  | 0.84     |          |
| Beaver Creek                              | 69,610        | Beaver             | 1.07              | 1.08  | 1.08  | 1.08  | 1.08  | 1.08  | 1.07     |          |
| Horse Creek-Klamath River                 | 98,625        | Beaver             | 0.87              | 0.88  | 0.88  | 0.88  | 0.87  | 0.88  | 0.87     |          |
| Seiad Creek-Klamath River                 | 81,706        | Happy Camp Complex | 0.83              | 0.85  | 0.84  | 0.84  | 0.83  | 0.84  | 0.84     |          |
| Lower Scott River                         | 98,016        | Happy Camp Complex | 0.57              | 0.58  | 0.59  | 0.58  | 0.57  | 0.59  | 0.58     |          |
| Thompson Creek-Klamath River              | 67,301        | Happy Camp Complex | 0.49              | 0.50  | 0.49  | 0.50  | 0.49  | 0.49  | 0.49     |          |
| Elk Creek                                 | 60,829        | Happy Camp Complex | 0.98              | 0.97  | 0.97  | 0.97  | 0.97  | 0.97  | 0.97     |          |
| Ukonom Creek-Klamath River                | 87,884        | Happy Camp Complex | 0.56              | 0.56  | 0.56  | 0.56  | 0.56  | 0.56  | 0.56     |          |
| South Fork Salmon River                   | 185,597       | Whites             | 0.40              | 0.40  | 0.40  | 0.40  | 0.40  | 0.40  | 0.40     |          |
| North Fork Salmon River                   | 130,545       | Whites             | 0.73              | 0.73  | 0.73  | 0.73  | 0.73  | 0.73  | 0.73     |          |

## Appendix B: Cumulative Watershed Effects Model Results for 7<sup>th</sup> Field Watersheds by Fire Area

Table 15: Equivalent roaded area (ERA) model results for the seven project alternatives--Risk ratios greater than 1.0 are highlighted and indicate ERA exceeds the threshold of concern (from 8-12 watersheds depending on alternative)--Percent ERA can be computed by multiplying risk ratio by TOC

| Equivalent Roaded Area (ERA) Model<br>7th Field Watershed | Watershed Threshold<br>of Concern (TOC) | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|---|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |   |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Lumgreycreek  | 8.5%                                    | Beaver             | 0.45              | 0.45          | 0.45  | 0.45  | 0.46  | 0.45              | 0.46              |
| Miller Gulch-Klamath River                                | 11.5%                                   | Beaver             | 0.31              | 0.34          | 0.34  | 0.34  | 0.35  | 0.33              | 0.34              |
| Soda Creek-Beaver Creek                                   | 8.0%                                    | Beaver             | 1.06              | 1.06          | 1.06  | 1.06  | 1.06  | 1.06              | 1.06              |
| Jaynes Canyon   | 7.5%                                    | Beaver             | 1.16              | 1.17          | 1.17  | 1.17  | 1.17  | 1.17              | 1.17              |
| Lower West Fork Beaver Creek                              | 7.5%                                    | Beaver             | 1.31              | 1.31          | 1.31  | 1.31  | 1.32  | 1.31              | 1.31              |
| Dutch Creek   | 8.5%                                    | Beaver             | 1.33              | 1.38          | 1.41  | 1.41  | 1.40  | 1.40              | 1.40              |
| Buckhorn Gulch-Beaver Creek                               | 8.5%                                    | Beaver             | 1.04              | 1.09          | 1.09  | 1.08  | 1.09  | 1.07              | 1.08              |
| Quigleys Cove-Klamath River                               | 12.0%                                   | Beaver             | 0.42              | 0.50          | 0.50  | 0.50  | 0.49  | 0.47              | 0.48              |
| Doggett Creek   | 7.5%                                    | Beaver             | 1.99              | 2.08          | 2.05  | 2.07  | 2.06  | 2.02              | 2.03              |
| Dona Creek-Klamath River                                  | 9.5%                                    | Beaver             | 0.82              | 0.87          | 0.85  | 0.87  | 0.84  | 0.84              | 0.83              |
| Buckhorn Creek  | 7.0%                                    | Beaver             | 0.96              | 0.99          | 0.99  | 0.99  | 0.99  | 0.98              | 0.98              |
| Kohl Creek  | 8.5%                                    | Beaver             | 1.51              | 1.56          | 1.56  | 1.55  | 1.55  | 1.55              | 1.54              |
| Collins Creek-Klamath River                               | 11.5%                                   | Beaver             | 0.44              | 0.49          | 0.49  | 0.49  | 0.49  | 0.48              | 0.49              |
| Upper Grider Creek  | 7.5%                                    | Happy Camp Complex | 0.42              | 0.48          | 0.47  | 0.46  | 0.43  | 0.46              | 0.48              |
| Cliff Valley Creek  | 7.0%                                    | Happy Camp Complex | 0.35              | 0.44          | 0.43  | 0.40  | 0.39  | 0.41              | 0.41              |
| Rancheria Creek   | 7.0%                                    | Happy Camp Complex | 0.88              | 0.92          | 0.92  | 0.92  | 0.92  | 0.91              | 0.92              |
| Lower Grider Creek  | 7.0%                                    | Happy Camp Complex | 0.69              | 0.80          | 0.79  | 0.78  | 0.73  | 0.76              | 0.78              |
| Tom Martin Creek-Klamath River                            | 9.0%                                    | Happy Camp Complex | 0.51              | 0.57          | 0.57  | 0.58  | 0.55  | 0.55              | 0.56              |
| O'Neil Creek  | 8.0%                                    | Happy Camp Complex | 0.77              | 0.93          | 0.93  | 0.92  | 0.90  | 0.86              | 0.88              |
| Schutts Gulch-Klamath River                               | 9.0%                                    | Happy Camp Complex | 0.59              | 0.60          | 0.60  | 0.60  | 0.60  | 0.60              | 0.60              |
| Walker Creek  | 6.5%                                    | Happy Camp Complex | 1.00              | 1.09          | 1.08  | 1.12  | 1.05  | 1.07              | 1.08              |
| Caroline Creek-Klamath River                              | 9.5%                                    | Happy Camp Complex | 0.48              | 0.57          | 0.57  | 0.58  | 0.50  | 0.54              | 0.55              |
| West Grider Creek-Klamath River                           | 10.0%                                   | Happy Camp Complex | 0.41              | 0.45          | 0.45  | 0.45  | 0.45  | 0.43              | 0.45              |

## Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Equivalent Roaded Area (ERA) Model<br>7th Field Watershed | Watershed Threshold<br>of Concern (TOC) | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|---|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |   |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Upper Shackelford Creek                                   |   | Happy Camp Complex | 0.20              | 0.20          | 0.20  | 0.20  | 0.20  | 0.20              | 0.20              |
| Upper Canyon Creek  | 8.0%                                    | Happy Camp Complex | 0.08              | 0.08          | 0.08  | 0.08  | 0.08  | 0.08              | 0.08              |
| Red Rock Creek  | 8.0%                                    | Happy Camp Complex | 0.08              | 0.08          | 0.08  | 0.08  | 0.08  | 0.08              | 0.08              |
| North Fork Kelsey Creek                                   | 8.0%                                    | Happy Camp Complex | 0.28              | 0.28          | 0.28  | 0.28  | 0.28  | 0.28              | 0.28              |
| South Fork Kelsey Creek                                   | 7.5%                                    | Happy Camp Complex | 0.21              | 0.25          | 0.25  | 0.25  | 0.25  | 0.25              | 0.25              |
| Middle Creek  | 8.5%                                    | Happy Camp Complex | 0.57              | 0.72          | 0.71  | 0.75  | 0.67  | 0.68              | 0.65              |
| Deep Creek-Scott River                                    | 9.0%                                    | Happy Camp Complex | 0.46              | 0.52          | 0.52  | 0.52  | 0.51  | 0.52              | 0.51              |
| Tompkins Creek  | 7.5%                                    | Happy Camp Complex | 0.53              | 0.65          | 0.65  | 0.64  | 0.59  | 0.60              | 0.60              |
| McCarthy Creek-Scott River                                | 9.5%                                    | Happy Camp Complex | 0.51              | 0.53          | 0.53  | 0.53  | 0.52  | 0.53              | 0.52              |
| Big Ferry-Swanson   | 9.0%                                    | Happy Camp Complex | 1.15              | 1.18          | 1.18  | 1.17  | 1.16  | 1.17              | 1.17              |
| Franklin Gulch-Scott River                                | 9.0%                                    | Happy Camp Complex | 0.37              | 0.39          | 0.39  | 0.39  | 0.39  | 0.38              | 0.38              |
| China Creek   | 7.5%                                    | Happy Camp Complex | 0.74              | 0.89          | 0.88  | 0.91  | 0.81  | 0.83              | 0.82              |
| Horse Creek   | 10.0%                                   | Happy Camp Complex | 0.64              | 0.73          | 0.73  | 0.79  | 0.67  | 0.73              | 0.65              |
| Fryingpan Creek-Klamath River                             | 11.0%                                   | Happy Camp Complex | 0.57              | 0.64          | 0.64  | 0.64  | 0.62  | 0.62              | 0.63              |
| Headwaters Elk Creek                                      | 7.5%                                    | Happy Camp Complex | 0.32              | 0.32          | 0.32  | 0.32  | 0.32  | 0.32              | 0.32              |
| Rainy Valley Creek  | 6.5%                                    | Happy Camp Complex | 0.11              | 0.11          | 0.11  | 0.11  | 0.11  | 0.11              | 0.11              |
| Toms Valley Creek-Elk Creek                               | 7.5%                                    | Happy Camp Complex | 0.23              | 0.23          | 0.23  | 0.23  | 0.23  | 0.23              | 0.23              |
| Granite Creek   | 7.5%                                    | Happy Camp Complex | 0.59              | 0.59          | 0.59  | 0.59  | 0.59  | 0.59              | 0.59              |
| Middle Elk Creek  | 6.5%                                    | Happy Camp Complex | 1.40              | 1.40          | 1.40  | 1.40  | 1.40  | 1.40              | 1.40              |
| Upper East Fork Elk Creek                                 | 8.0%                                    | Happy Camp Complex | 0.58              | 0.59          | 0.59  | 0.58  | 0.58  | 0.57              | 0.57              |
| Upper Elk Creek   | 7.5%                                    | Happy Camp Complex | 0.54              | 0.67          | 0.67  | 0.58  | 0.59  | 0.63              | 0.58              |
| Lower East Fork Elk Creek                                 | 9.5%                                    | Happy Camp Complex | 0.43              | 0.42          | 0.42  | 0.41  | 0.41  | 0.41              | 0.41              |
| Bear Creek  | 7.0%                                    | Happy Camp Complex | 0.66              | 0.66          | 0.66  | 0.66  | 0.66  | 0.66              | 0.66              |
| Bishop Creek-Elk Creek                                    | 8.0%                                    | Happy Camp Complex | 0.57              | 0.59          | 0.59  | 0.59  | 0.59  | 0.57              | 0.59              |
| Doolittle Creek   | 8.0%                                    | Happy Camp Complex | 0.56              | 0.61          | 0.61  | 0.60  | 0.61  | 0.57              | 0.60              |
| Cougar Creek-Elk Creek                                    | 8.5%                                    | Happy Camp Complex | 0.38              | 0.37          | 0.37  | 0.37  | 0.36  | 0.37              | 0.35              |
| Hoop&Devil-Elk Creek                                      | 10.0%                                   | Happy Camp Complex | 0.35              | 0.53          | 0.52  | 0.53  | 0.50  | 0.51              | 0.52              |
| Benjamin Creek-Klamath River                              | 9.5%                                    | Happy Camp Complex | 0.41              | 0.42          | 0.42  | 0.42  | 0.41  | 0.41              | 0.41              |
| Cuddihy Fork  | 7.5%                                    | Happy Camp Complex | 0.39              | 0.39          | 0.39  | 0.39  | 0.39  | 0.39              | 0.39              |

Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Equivalent Roaded Area (ERA) Model<br>7th Field Watershed | Watershed Threshold<br>of Concern (TOC) | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|---|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |   |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Upper North Fork Wooley Creek                             | 7.5%                                    | Happy Camp Complex | 0.20              | 0.20          | 0.20  | 0.20  | 0.20  | 0.20              | 0.20              |
| Lower North Fork Wooley Creek                             | 7.0%                                    | Happy Camp Complex | 0.12              | 0.12          | 0.12  | 0.12  | 0.12  | 0.12              | 0.12              |
| Headwaters Wooley Creek                                   | 6.5%                                    | Happy Camp Complex | 0.42              | 0.42          | 0.42  | 0.42  | 0.42  | 0.42              | 0.42              |
| Big Elk Fork  | 6.5%                                    | Happy Camp Complex | 0.22              | 0.22          | 0.22  | 0.22  | 0.22  | 0.22              | 0.22              |
| South Fork Wooley Creek                                   | 7.5%                                    | Happy Camp Complex | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Hell Hole Creek-Wooley Creek                              | 9.0%                                    | Happy Camp Complex | 0.15              | 0.15          | 0.15  | 0.15  | 0.15  | 0.15              | 0.15              |
| Jackson Creek   | 8.5%                                    | Whites             | 0.30              | 0.30          | 0.30  | 0.30  | 0.30  | 0.30              | 0.30              |
| Upper French Creek  | 8.0%                                    | Whites             | 0.58              | 0.58          | 0.58  | 0.58  | 0.58  | 0.58              | 0.58              |
| Sugar Creek   | 9.5%                                    | Whites             | 0.21              | 0.21          | 0.21  | 0.21  | 0.21  | 0.21              | 0.21              |
| Sixmile Creek   | 9.5%                                    | Whites             | 0.18              | 0.21          | 0.21  | 0.20  | 0.21  | 0.19              | 0.21              |
| Shadow Creek  | 10.5%                                   | Whites             | 0.52              | 0.59          | 0.60  | 0.59  | 0.58  | 0.56              | 0.58              |
| Upper South Russian Creek                                 | 7.0%                                    | Whites             | 0.38              | 0.39          | 0.39  | 0.39  | 0.39  | 0.39              | 0.39              |
| Music Creek   | 6.0%                                    | Whites             | 1.03              | 1.07          | 1.07  | 1.06  | 1.04  | 1.05              | 1.04              |
| Lower South Russian Creek                                 | 6.0%                                    | Whites             | 0.83              | 0.88          | 0.88  | 0.88  | 0.88  | 0.87              | 0.86              |
| Upper North Russian Creek                                 | 7.5%                                    | Whites             | 0.37              | 0.68          | 0.68  | 0.65  | 0.62  | 0.68              | 0.67              |
| Taylor Creek  | 7.5%                                    | Whites             | 0.53              | 0.54          | 0.54  | 0.55  | 0.54  | 0.54              | 0.54              |
| Lower North Russian Creek                                 | 8.0%                                    | Whites             | 0.74              | 0.96          | 0.96  | 0.97  | 0.95  | 0.96              | 0.96              |
| Big Creek   | 9.0%                                    | Whites             | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Yellow Dog Creek-North Fork Salmon River                  | 9.5%                                    | Whites             | 0.20              | 0.28          | 0.28  | 0.28  | 0.28  | 0.28              | 0.28              |
| Specimen Creek  | 10.5%                                   | Whites             | 0.30              | 0.30          | 0.30  | 0.30  | 0.30  | 0.30              | 0.30              |
| Whites Gulch  | 8.0%                                    | Whites             | 0.68              | 0.98          | 0.99  | 0.97  | 0.92  | 0.95              | 0.97              |
| Robinson Gulch-North Fork Salmon River                    | 9.0%                                    | Whites             | 0.74              | 0.86          | 0.86  | 0.86  | 0.86  | 0.85              | 0.86              |
| Eddy Gulch  | 8.5%                                    | Whites             | 0.53              | 0.55          | 0.55  | 0.55  | 0.55  | 0.54              | 0.55              |
| Jessups Gulch-North Fork Salmon River                     | 7.0%                                    | Whites             | 0.83              | 1.15          | 1.15  | 1.15  | 1.15  | 1.15              | 1.15              |
| Jackass Gulch   | 9.0%                                    | Whites             | 0.26              | 0.26          | 0.26  | 0.26  | 0.26  | 0.26              | 0.26              |

Table 16: Universal soil loss equation (USLE) model results for the seven project alternatives--Risk ratios greater than 1.0 are highlighted and interpreted as elevated risk of adverse effects to hydrologic function and water quality (16 watersheds for all action alternatives)

| Universal Soil Loss Equation (USLE) Model<br>7th Field Watershed | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|--|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|  |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Lumgreys Creek   | Beaver             | 1.38              | 1.38          | 1.38  | 1.38  | 1.38  | 1.38              | 1.38              |
| Miller Gulch-Klamath River                                       | Beaver             | 0.49              | 0.49          | 0.49  | 0.49  | 0.49  | 0.49              | 0.49              |
| Soda Creek-Beaver Creek  | Beaver             | 1.60              | 1.60          | 1.60  | 1.60  | 1.60  | 1.60              | 1.60              |
| Jaynes Canyon  | Beaver             | 1.68              | 1.68          | 1.68  | 1.68  | 1.68  | 1.68              | 1.68              |
| Lower West Fork Beaver Creek                                     | Beaver             | 1.65              | 1.65          | 1.65  | 1.65  | 1.65  | 1.65              | 1.65              |
| Dutch Creek  | Beaver             | 1.72              | 1.74          | 1.74  | 1.73  | 1.72  | 1.74              | 1.72              |
| Buckhorn Gulch-Beaver Creek                                      | Beaver             | 1.40              | 1.41          | 1.41  | 1.41  | 1.40  | 1.41              | 1.40              |
| Quigleys Cove-Klamath River                                      | Beaver             | 0.76              | 0.76          | 0.76  | 0.76  | 0.76  | 0.76              | 0.76              |
| Doggett Creek  | Beaver             | 1.58              | 1.61          | 1.61  | 1.60  | 1.59  | 1.59              | 1.58              |
| Dona Creek-Klamath River   | Beaver             | 1.17              | 1.19          | 1.19  | 1.19  | 1.17  | 1.18              | 1.17              |
| Buckhorn Creek   | Beaver             | 0.87              | 0.87          | 0.87  | 0.87  | 0.87  | 0.87              | 0.87              |
| Kohl Creek   | Beaver             | 1.58              | 1.60          | 1.60  | 1.60  | 1.58  | 1.60              | 1.58              |
| Collins Creek-Klamath River                                      | Beaver             | 0.90              | 0.92          | 0.92  | 0.92  | 0.92  | 0.92              | 0.92              |
| Upper Grider Creek   | Happy Camp Complex | 0.62              | 0.64          | 0.64  | 0.63  | 0.62  | 0.64              | 0.64              |
| Cliff Valley Creek   | Happy Camp Complex | 0.67              | 0.70          | 0.69  | 0.68  | 0.67  | 0.69              | 0.69              |
| Rancheria Creek  | Happy Camp Complex | 1.23              | 1.23          | 1.23  | 1.23  | 1.23  | 1.23              | 1.23              |
| Lower Grider Creek   | Happy Camp Complex | 0.91              | 0.93          | 0.93  | 0.93  | 0.91  | 0.93              | 0.93              |
| Tom Martin Creek-Klamath River                                   | Happy Camp Complex | 0.81              | 0.82          | 0.82  | 0.82  | 0.81  | 0.82              | 0.82              |
| O'Neil Creek   | Happy Camp Complex | 1.80              | 1.83          | 1.83  | 1.82  | 1.81  | 1.83              | 1.82              |
| Schutts Gulch-Klamath River                                      | Happy Camp Complex | 0.79              | 0.80          | 0.80  | 0.80  | 0.79  | 0.80              | 0.80              |
| Walker Creek   | Happy Camp Complex | 1.18              | 1.20          | 1.20  | 1.20  | 1.18  | 1.20              | 1.20              |
| Caroline Creek-Klamath River                                     | Happy Camp Complex | 0.71              | 0.79          | 0.80  | 0.74  | 0.74  | 0.75              | 0.75              |
| West Grider Creek-Klamath River                                  | Happy Camp Complex | 0.88              | 0.88          | 0.88  | 0.88  | 0.88  | 0.88              | 0.88              |
| Upper Shackleford Creek  | Happy Camp Complex | 0.14              | 0.14          | 0.14  | 0.14  | 0.14  | 0.14              | 0.14              |
| Upper Canyon Creek   | Happy Camp Complex | 0.01              | 0.01          | 0.01  | 0.01  | 0.01  | 0.01              | 0.01              |
| Red Rock Creek   | Happy Camp Complex | 0.01              | 0.01          | 0.01  | 0.01  | 0.01  | 0.01              | 0.01              |
| North Fork Kelsey Creek  | Happy Camp Complex | 0.50              | 0.50          | 0.50  | 0.50  | 0.50  | 0.50              | 0.50              |

Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Universal Soil Loss Equation (USLE) Model<br>7th Field Watershed | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|--|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|  |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| South Fork Kelsey Creek  | Happy Camp Complex | 0.18              | 0.20          | 0.20  | 0.20  | 0.20  | 0.20              | 0.20              |
| Middle Creek   | Happy Camp Complex | 0.98              | 1.01          | 1.01  | 0.99  | 0.99  | 1.00              | 1.00              |
| Deep Creek-Scott River   | Happy Camp Complex | 0.57              | 0.59          | 0.59  | 0.59  | 0.59  | 0.59              | 0.59              |
| Tompkins Creek   | Happy Camp Complex | 0.90              | 0.91          | 0.91  | 0.91  | 0.90  | 0.91              | 0.90              |
| McCarthy Creek-Scott River                                       | Happy Camp Complex | 0.52              | 0.53          | 0.53  | 0.52  | 0.52  | 0.53              | 0.52              |
| Big Ferry-Swanson  | Happy Camp Complex | 0.74              | 0.75          | 0.75  | 0.75  | 0.74  | 0.75              | 0.74              |
| Franklin Gulch-Scott River                                       | Happy Camp Complex | 0.40              | 0.41          | 0.41  | 0.41  | 0.41  | 0.40              | 0.41              |
| China Creek  | Happy Camp Complex | 0.83              | 0.86          | 0.86  | 0.84  | 0.83  | 0.85              | 0.85              |
| Horse Creek  | Happy Camp Complex | 1.08              | 1.12          | 1.11  | 1.11  | 1.08  | 1.11              | 1.09              |
| Fryingpan Creek-Klamath River                                    | Happy Camp Complex | 1.12              | 1.13          | 1.13  | 1.13  | 1.13  | 1.13              | 1.13              |
| Headwaters Elk Creek   | Happy Camp Complex | 0.42              | 0.42          | 0.42  | 0.42  | 0.42  | 0.42              | 0.42              |
| Rainy Valley Creek   | Happy Camp Complex | 0.17              | 0.17          | 0.17  | 0.17  | 0.17  | 0.17              | 0.17              |
| Toms Valley Creek-Elk Creek                                      | Happy Camp Complex | 0.32              | 0.32          | 0.32  | 0.32  | 0.32  | 0.32              | 0.32              |
| Granite Creek  | Happy Camp Complex | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Middle Elk Creek   | Happy Camp Complex | 0.12              | 0.12          | 0.12  | 0.12  | 0.12  | 0.12              | 0.12              |
| Upper East Fork Elk Creek  | Happy Camp Complex | 0.87              | 0.79          | 0.79  | 0.79  | 0.79  | 0.79              | 0.79              |
| Upper Elk Creek  | Happy Camp Complex | 0.99              | 1.03          | 1.02  | 0.99  | 0.98  | 1.03              | 0.98              |
| Lower East Fork Elk Creek  | Happy Camp Complex | 1.05              | 0.97          | 0.97  | 0.96  | 0.96  | 0.97              | 0.97              |
| Bear Creek   | Happy Camp Complex | 0.28              | 0.28          | 0.28  | 0.28  | 0.28  | 0.28              | 0.28              |
| Bishop Creek-Elk Creek   | Happy Camp Complex | 0.10              | 0.09          | 0.09  | 0.09  | 0.09  | 0.09              | 0.09              |
| Doolittle Creek  | Happy Camp Complex | 0.43              | 0.42          | 0.42  | 0.42  | 0.41  | 0.42              | 0.41              |
| Cougar Creek-Elk Creek   | Happy Camp Complex | 0.52              | 0.47          | 0.47  | 0.47  | 0.47  | 0.47              | 0.47              |
| Hoop&Devil-Elk Creek   | Happy Camp Complex | 0.73              | 0.67          | 0.67  | 0.67  | 0.67  | 0.67              | 0.67              |
| Benjamin Creek-Klamath River                                     | Happy Camp Complex | 0.34              | 0.34          | 0.34  | 0.34  | 0.34  | 0.34              | 0.34              |
| Cuddihy Fork   | Happy Camp Complex | 0.02              | 0.02          | 0.02  | 0.02  | 0.02  | 0.02              | 0.02              |
| Upper North Fork Wooley Creek                                    | Happy Camp Complex | 0.43              | 0.43          | 0.43  | 0.43  | 0.43  | 0.43              | 0.43              |
| Lower North Fork Wooley Creek                                    | Happy Camp Complex | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Headwaters Wooley Creek  | Happy Camp Complex | 0.41              | 0.41          | 0.41  | 0.41  | 0.41  | 0.41              | 0.41              |
| Big Elk Fork   | Happy Camp Complex | 0.38              | 0.38          | 0.38  | 0.38  | 0.38  | 0.38              | 0.38              |

Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Universal Soil Loss Equation (USLE) Model<br>7th Field Watershed | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|--|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|  |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| South Fork Wooley Creek  | Happy Camp Complex | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Hell Hole Creek-Wooley Creek                                     | Happy Camp Complex | 0.10              | 0.10          | 0.10  | 0.10  | 0.10  | 0.10              | 0.10              |
| Jackson Creek  | Whites             | 0.38              | 0.38          | 0.38  | 0.38  | 0.38  | 0.38              | 0.38              |
| Upper French Creek   | Whites             | 0.33              | 0.33          | 0.33  | 0.33  | 0.33  | 0.33              | 0.33              |
| Sugar Creek  | Whites             | 0.25              | 0.25          | 0.25  | 0.25  | 0.25  | 0.25              | 0.25              |
| Sixmile Creek  | Whites             | 0.57              | 0.57          | 0.57  | 0.57  | 0.57  | 0.57              | 0.57              |
| Shadow Creek   | Whites             | 0.99              | 1.00          | 1.00  | 1.00  | 0.99  | 1.00              | 1.00              |
| Upper South Russian Creek  | Whites             | 0.47              | 0.48          | 0.48  | 0.48  | 0.47  | 0.48              | 0.48              |
| Music Creek  | Whites             | 0.97              | 0.98          | 0.98  | 0.97  | 0.97  | 0.97              | 0.97              |
| Lower South Russian Creek  | Whites             | 0.82              | 0.82          | 0.82  | 0.82  | 0.82  | 0.82              | 0.82              |
| Upper North Russian Creek  | Whites             | 0.48              | 0.55          | 0.55  | 0.55  | 0.55  | 0.55              | 0.55              |
| Taylor Creek   | Whites             | 0.56              | 0.56          | 0.56  | 0.56  | 0.56  | 0.56              | 0.56              |
| Lower North Russian Creek  | Whites             | 1.15              | 1.16          | 1.16  | 1.16  | 1.16  | 1.16              | 1.16              |
| Big Creek  | Whites             | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Yellow Dog Creek-North Fork Salmon River                         | Whites             | 0.34              | 0.34          | 0.34  | 0.34  | 0.34  | 0.34              | 0.34              |
| Specimen Creek   | Whites             | 0.09              | 0.09          | 0.09  | 0.09  | 0.09  | 0.09              | 0.09              |
| Whites Gulch   | Whites             | 1.30              | 1.12          | 1.12  | 1.12  | 1.11  | 1.12              | 1.12              |
| Robinson Gulch-North Fork Salmon River                           | Whites             | 0.88              | 0.92          | 0.92  | 0.92  | 0.92  | 0.92              | 0.92              |
| Eddy Gulch   | Whites             | 0.98              | 0.98          | 0.98  | 0.98  | 0.98  | 0.98              | 0.98              |
| Jessups Gulch-North Fork Salmon River                            | Whites             | 0.46              | 0.61          | 0.61  | 0.61  | 0.61  | 0.61              | 0.61              |
| Jackass Gulch  | Whites             | 0.27              | 0.27          | 0.27  | 0.27  | 0.27  | 0.27              | 0.27              |

Table 17: Mass wasting model results for the seven project alternatives--Risk ratios greater than 1.0 are highlighted and interpreted as elevated risk of adverse effects to hydrologic function and water quality (18 watersheds for all alternatives)

| Mass Wasting Model<br>7th Field Watershed | 2014 Wildfire | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|---------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |               | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Lumgreys Creek                            | Beaver        | 1.04              | 1.04          | 1.04  | 1.04  | 1.04  | 1.04              | 1.04              |
| Miller Gulch-Klamath River                | Beaver        | 0.75              | 0.75          | 0.75  | 0.75  | 0.75  | 0.75              | 0.75              |

Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Mass Wasting Model<br>7th Field Watershed | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| Soda Creek-Beaver Creek                   | Beaver             | 1.47              | 1.47          | 1.47  | 1.47  | 1.47  | 1.47              | 1.47              |
| Jaynes Canyon                             | Beaver             | 0.85              | 0.85          | 0.85  | 0.85  | 0.85  | 0.85              | 0.85              |
| Lower West Fork Beaver Creek              | Beaver             | 1.05              | 1.05          | 1.05  | 1.05  | 1.05  | 1.05              | 1.05              |
| Dutch Creek                               | Beaver             | 0.94              | 0.99          | 0.99  | 0.98  | 0.95  | 1.00              | 0.94              |
| Buckhorn Gulch-Beaver Creek               | Beaver             | 1.19              | 1.22          | 1.22  | 1.21  | 1.19  | 1.22              | 1.19              |
| Quigleys Cove-Klamath River               | Beaver             | 0.77              | 0.82          | 0.82  | 0.82  | 0.77  | 0.82              | 0.77              |
| Doggett Creek                             | Beaver             | 1.12              | 1.16          | 1.15  | 1.15  | 1.12  | 1.13              | 1.12              |
| Dona Creek-Klamath River                  | Beaver             | 1.19              | 1.24          | 1.23  | 1.23  | 1.19  | 1.21              | 1.19              |
| Buckhorn Creek                            | Beaver             | 0.68              | 0.69          | 0.69  | 0.69  | 0.68  | 0.69              | 0.68              |
| Kohl Creek                                | Beaver             | 1.20              | 1.24          | 1.24  | 1.23  | 1.20  | 1.23              | 1.20              |
| Collins Creek-Klamath River               | Beaver             | 0.79              | 0.80          | 0.80  | 0.80  | 0.79  | 0.80              | 0.79              |
| Upper Grider Creek                        | Happy Camp Complex | 0.32              | 0.37          | 0.37  | 0.35  | 0.32  | 0.37              | 0.37              |
| Cliff Valley Creek                        | Happy Camp Complex | 0.32              | 0.35          | 0.35  | 0.33  | 0.32  | 0.35              | 0.34              |
| Rancheria Creek                           | Happy Camp Complex | 0.68              | 0.68          | 0.68  | 0.68  | 0.68  | 0.68              | 0.68              |
| Lower Grider Creek                        | Happy Camp Complex | 1.09              | 1.14          | 1.13  | 1.11  | 1.09  | 1.12              | 1.12              |
| Tom Martin Creek-Klamath River            | Happy Camp Complex | 0.44              | 0.46          | 0.46  | 0.46  | 0.45  | 0.46              | 0.46              |
| O'Neil Creek                              | Happy Camp Complex | 1.53              | 1.55          | 1.54  | 1.54  | 1.53  | 1.54              | 1.54              |
| Schutts Gulch-Klamath River               | Happy Camp Complex | 1.16              | 1.16          | 1.16  | 1.16  | 1.16  | 1.16              | 1.16              |
| Walker Creek                              | Happy Camp Complex | 1.92              | 1.96          | 1.96  | 1.94  | 1.93  | 1.96              | 1.96              |
| Caroline Creek-Klamath River              | Happy Camp Complex | 1.64              | 1.72          | 1.74  | 1.65  | 1.70  | 1.66              | 1.66              |
| West Grider Creek-Klamath River           | Happy Camp Complex | 0.59              | 0.59          | 0.59  | 0.59  | 0.59  | 0.59              | 0.59              |
| Upper Shackleford Creek                   | Happy Camp Complex | 0.09              | 0.09          | 0.09  | 0.09  | 0.09  | 0.09              | 0.09              |
| Upper Canyon Creek                        | Happy Camp Complex | 0.07              | 0.07          | 0.07  | 0.07  | 0.07  | 0.07              | 0.07              |
| Red Rock Creek                            | Happy Camp Complex | 0.03              | 0.03          | 0.03  | 0.03  | 0.03  | 0.03              | 0.03              |
| North Fork Kelsey Creek                   | Happy Camp Complex | 0.46              | 0.46          | 0.46  | 0.46  | 0.46  | 0.46              | 0.46              |
| South Fork Kelsey Creek                   | Happy Camp Complex | 0.35              | 0.38          | 0.38  | 0.38  | 0.38  | 0.38              | 0.38              |
| Middle Creek                              | Happy Camp Complex | 1.09              | 1.20          | 1.20  | 1.17  | 1.10  | 1.19              | 1.15              |
| Deep Creek-Scott River                    | Happy Camp Complex | 1.39              | 1.41          | 1.41  | 1.41  | 1.41  | 1.41              | 1.41              |
| Tompkins Creek                            | Happy Camp Complex | 0.82              | 0.85          | 0.85  | 0.85  | 0.82  | 0.85              | 0.83              |

Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Mass Wasting Model<br>7th Field Watershed | 2014 Wildfire      | 2015              |               |       |       |       | Modified<br>Alt 2 | Modified<br>Alt 3 |
|---|--------------------|-------------------|---------------|-------|-------|-------|-------------------|-------------------|
|   |                    | Baseline<br>Alt 1 | DEIS<br>Alt 2 | Alt 3 | Alt 4 | Alt 5 |                   |                   |
| McCarthy Creek-Scott River                | Happy Camp Complex | 0.43              | 0.43          | 0.43  | 0.43  | 0.43  | 0.43              | 0.43              |
| Big Ferry-Swanson                         | Happy Camp Complex | 0.62              | 0.62          | 0.62  | 0.62  | 0.62  | 0.62              | 0.62              |
| Franklin Gulch-Scott River                | Happy Camp Complex | 0.39              | 0.39          | 0.39  | 0.39  | 0.39  | 0.39              | 0.39              |
| China Creek                               | Happy Camp Complex | 0.76              | 0.80          | 0.80  | 0.78  | 0.76  | 0.78              | 0.78              |
| Horse Creek                               | Happy Camp Complex | 0.81              | 0.92          | 0.91  | 0.91  | 0.81  | 0.91              | 0.83              |
| Fryingpan Creek-Klamath River             | Happy Camp Complex | 0.76              | 0.76          | 0.76  | 0.76  | 0.76  | 0.76              | 0.76              |
| Headwaters Elk Creek                      | Happy Camp Complex | 0.15              | 0.15          | 0.15  | 0.15  | 0.15  | 0.15              | 0.15              |
| Rainy Valley Creek                        | Happy Camp Complex | 0.02              | 0.02          | 0.02  | 0.02  | 0.02  | 0.02              | 0.02              |
| Toms Valley Creek-Elk Creek               | Happy Camp Complex | 0.60              | 0.60          | 0.60  | 0.60  | 0.60  | 0.60              | 0.60              |
| Granite Creek                             | Happy Camp Complex | 1.52              | 1.52          | 1.52  | 1.52  | 1.52  | 1.52              | 1.52              |
| Middle Elk Creek                          | Happy Camp Complex | 2.85              | 2.85          | 2.85  | 2.85  | 2.85  | 2.85              | 2.85              |
| Upper East Fork Elk Creek                 | Happy Camp Complex | 0.54              | 0.50          | 0.50  | 0.50  | 0.50  | 0.50              | 0.50              |
| Upper Elk Creek                           | Happy Camp Complex | 0.44              | 0.45          | 0.45  | 0.43  | 0.42  | 0.45              | 0.43              |
| Lower East Fork Elk Creek                 | Happy Camp Complex | 0.49              | 0.44          | 0.44  | 0.44  | 0.42  | 0.42              | 0.44              |
| Bear Creek                                | Happy Camp Complex | 1.01              | 1.01          | 1.01  | 1.01  | 1.01  | 1.01              | 1.01              |
| Bishop Creek-Elk Creek                    | Happy Camp Complex | 1.76              | 1.76          | 1.76  | 1.76  | 1.76  | 1.76              | 1.76              |
| Doolittle Creek                           | Happy Camp Complex | 0.46              | 0.44          | 0.44  | 0.44  | 0.44  | 0.44              | 0.44              |
| Cougar Creek-Elk Creek                    | Happy Camp Complex | 0.64              | 0.60          | 0.60  | 0.60  | 0.60  | 0.60              | 0.60              |
| Hoop&Devil-Elk Creek                      | Happy Camp Complex | 0.61              | 0.57          | 0.57  | 0.57  | 0.57  | 0.57              | 0.57              |
| Benjamin Creek-Klamath River              | Happy Camp Complex | 0.63              | 0.63          | 0.63  | 0.63  | 0.63  | 0.63              | 0.63              |
| Cuddihy Fork                              | Happy Camp Complex | 0.65              | 0.65          | 0.65  | 0.65  | 0.65  | 0.65              | 0.65              |
| Upper North Fork Wooley Creek             | Happy Camp Complex | 0.11              | 0.11          | 0.11  | 0.11  | 0.11  | 0.11              | 0.11              |
| Lower North Fork Wooley Creek             | Happy Camp Complex | 0.10              | 0.10          | 0.10  | 0.10  | 0.10  | 0.10              | 0.10              |
| Headwaters Wooley Creek                   | Happy Camp Complex | 0.23              | 0.23          | 0.23  | 0.23  | 0.23  | 0.23              | 0.23              |
| Big Elk Fork                              | Happy Camp Complex | 0.06              | 0.06          | 0.06  | 0.06  | 0.06  | 0.06              | 0.06              |
| South Fork Wooley Creek                   | Happy Camp Complex | 0.00              | 0.00          | 0.00  | 0.00  | 0.00  | 0.00              | 0.00              |
| Hell Hole Creek-Wooley Creek              | Happy Camp Complex | 0.18              | 0.18          | 0.18  | 0.18  | 0.18  | 0.18              | 0.18              |
| Jackson Creek                             | Whites             | 0.42              | 0.42          | 0.42  | 0.42  | 0.42  | 0.42              | 0.42              |
| Upper French Creek                        | Whites             | 0.78              | 0.78          | 0.78  | 0.78  | 0.78  | 0.78              | 0.78              |

Appendix B: Cumulative Watershed Effects Model Results for 7th Field Watersheds by Fire Area

| Mass Wasting Model<br>7th Field Watershed | 2014 Wildfire | 2015              | DEIS  |       |       |       |       | Modified | Modified |
|---|---------------|-------------------|-------|-------|-------|-------|-------|----------|----------|
|   |               | Baseline<br>Alt 1 | Alt 2 | Alt 3 | Alt 4 | Alt 5 | Alt 2 | Alt 3    |          |
| Sugar Creek                               | Whites        | 0.45              | 0.45  | 0.45  | 0.45  | 0.45  | 0.45  | 0.45     |          |
| Sixmile Creek                             | Whites        | 0.38              | 0.38  | 0.38  | 0.38  | 0.38  | 0.38  | 0.38     |          |
| Shadow Creek                              | Whites        | 0.45              | 0.45  | 0.45  | 0.45  | 0.45  | 0.45  | 0.45     |          |
| Upper South Russian Creek                 | Whites        | 0.77              | 0.77  | 0.77  | 0.77  | 0.77  | 0.77  | 0.77     |          |
| Music Creek                               | Whites        | 1.17              | 1.17  | 1.17  | 1.17  | 1.17  | 1.17  | 1.17     |          |
| Lower South Russian Creek                 | Whites        | 0.63              | 0.63  | 0.63  | 0.63  | 0.63  | 0.63  | 0.63     |          |
| Upper North Russian Creek                 | Whites        | 0.98              | 0.98  | 0.98  | 0.98  | 0.98  | 0.98  | 0.98     |          |
| Taylor Creek                              | Whites        | 0.54              | 0.54  | 0.54  | 0.54  | 0.54  | 0.54  | 0.54     |          |
| Lower North Russian Creek                 | Whites        | 0.84              | 0.85  | 0.85  | 0.85  | 0.84  | 0.85  | 0.85     |          |
| Big Creek                                 | Whites        | 0.00              | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00     |          |
| Yellow Dog Creek-North Fork Salmon River  | Whites        | 0.28              | 0.28  | 0.28  | 0.28  | 0.28  | 0.28  | 0.28     |          |
| Specimen Creek                            | Whites        | 0.65              | 0.65  | 0.65  | 0.65  | 0.65  | 0.65  | 0.65     |          |
| Whites Gulch                              | Whites        | 0.66              | 0.62  | 0.62  | 0.62  | 0.61  | 0.62  | 0.62     |          |
| Robinson Gulch-North Fork Salmon River    | Whites        | 0.79              | 0.80  | 0.80  | 0.80  | 0.79  | 0.80  | 0.80     |          |
| Eddy Gulch                                | Whites        | 0.77              | 0.77  | 0.77  | 0.77  | 0.77  | 0.77  | 0.77     |          |
| Jessups Gulch-North Fork Salmon River     | Whites        | 0.65              | 0.65  | 0.65  | 0.65  | 0.65  | 0.65  | 0.65     |          |
| Jackass Gulch                             | Whites        | 0.19              | 0.19  | 0.19  | 0.19  | 0.19  | 0.19  | 0.19     |          |

## Appendix C: Activities in Hydrologic and Geologic Riparian Reserves Under Alternatives 2 and 3-Modified by Fire Area

|                                    | <b>Alt 2</b>       |                           |                    |              | <b>Alt 3 Modified</b> |                           |                    |              |
|------------------------------------|--------------------|---------------------------|--------------------|--------------|-----------------------|---------------------------|--------------------|--------------|
|                                    | <b>Beaver Fire</b> | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> | <b>Beaver Fire</b>    | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> |
| <b>Temporary Roads in RR</b>       |                    |                           |                    |              |                       |                           |                    |              |
| Maintenance Level 1 roads reopened | 5                  | 5.7                       | 0.9                | 11.6         | 2                     | 2.7                       | 0.1                | 4.8          |
| Reopen Decommissioned Roads        | 0                  | 1.4                       | 0                  | 1.4          | 0                     | 0.4                       | 0                  | 1.2          |
| Existing Temporary Road Reopened   | 0.7                | 0.4                       | 0                  | 1.1          | 0                     | 0.3                       | 0                  | 0.1          |
| New Temporary Road                 | 0                  | 0.1                       | 0                  | 0.1          | 0                     | 0.1                       | 0                  | 0.1          |
| Total Miles                        | 5.7                | 7.6                       | 0.9                | 14.2         | 2                     | 4.1                       | 0.1                | 6.2          |

|                                    | <b>Alt 2</b>       |                           |                    |              | <b>Alt 3 Modified</b> |                           |                    |              |
|------------------------------------|--------------------|---------------------------|--------------------|--------------|-----------------------|---------------------------|--------------------|--------------|
|                                    | <b>Beaver Fire</b> | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> | <b>Beaver Fire</b>    | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> |
| <b>Stream Crossings in RR</b>      |                    |                           |                    |              |                       |                           |                    |              |
| Maintenance Level 1 roads reopened | 39                 | 33                        | 5                  | 77           | 15                    | 19                        | 1                  | 35           |
| Reopen Decommissioned Roads        | 0                  | 8                         | 0                  | 8            | 0                     | 4                         | 0                  | 4            |
| Existing Temporary Road Reopened   | 3                  | 0                         | 0                  | 3            | 0                     | 0                         | 0                  | 0            |
| New Temporary Road                 | 0                  | 0                         | 0                  | 0            | 0                     | 0                         | 0                  | 0            |
| Total                              | 42                 | 41                        | 5                  | 88           | 15                    | 23                        | 1                  | 39           |

|                           | <b>Alt 2</b>       |                           |                    |              | <b>Alt 3 Modified</b> |                           |                    |              |
|---------------------------|--------------------|---------------------------|--------------------|--------------|-----------------------|---------------------------|--------------------|--------------|
|                           | <b>Beaver Fire</b> | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> | <b>Beaver Fire</b>    | <b>Happy Camp Complex</b> | <b>Whites Fire</b> | <b>Total</b> |
| <b>New Landings in RR</b> |                    |                           |                    |              |                       |                           |                    |              |
| Ground Based              | 5                  | 1                         | 0                  | 6            | 0                     | 0                         | 0                  | 0            |
| Helicopter                | 0                  | 11                        | 4                  | 15           | 0                     | 6                         | 0                  | 6            |
| Skyline                   | 0                  | 1                         | 0                  | 1            | 0                     | 0                         | 0                  | 0            |
| Total                     | 5                  | 13                        | 4                  | 22           | 0                     | 6                         | 0                  | 6            |

### Literature Cited

Community Collaborative Rain, Hail and Snow Network website <http://www.cocorahs.org/state.aspx?state=ca>

NOAA Precipitation Frequency Data Server (PFDS) <http://hdsc.nws.noaa.gov/hdsc/pfds/>