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LANDSLIDE INVENTORY FOR THE 2003, 2006, AND 2010 STORM SEASONS, STITZ CREEK, HUMBOLDT COUNTY, CA

Prepared for:

North Coast Regional Water Quality Control Board
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INTRODUCTION

Project Description

This report presents the results of a landslide inventory for the Stitz Creek watershed for the 2003, 2006, and 2010 Water Year (WY) conducted by Humboldt Redwood Company (HRC). Aerial photographs were used to identify landslides, estimate sediment production, and delivery to watercourses for each WY. Landslide attributes were recorded for each landslide and were subsequently analyzed to quantify associations with potential geomorphic and/or management related influences.

Rainfall during the 2003 and 2006 WY represents the first two major storm events since the implementation of HRC's Habitat Conservation Plan (HCP). Precipitation during the 2010 WY was above average but less intense than 2003 and 2006. Landsliding was widespread throughout the region during these storm seasons and are considered landslide-triggering events.

Study Area

Stitz Creek is located in the Lower Eel River Watershed in northern California. The watershed contains approximately 2,575 acres and drains to the Eel River about 3 miles east of the town of Scotia, California. The deeply incised watercourses of Stitz Creek form a dendritic drainage pattern on slopes ranging from 1,680 feet in elevation along the ridge forming the southeastern boundary of the watershed to approximately 80 feet in elevation at the confluence with the Eel River. Pertinent location information is listed in Table 1.

Table 1: Pertinent Location Information	
Legal Description	Section 2, 10, 11, 12, 13, 14, and 15 Township 1N, Range 1E, HB&M.
USGS Quadrangle	Scotia 7.5-minute quadrangle.
Cal Watershed	Jordan Creek 1111.120202

Methods

High-angle, stereo paired, aerial photographs scaled at 1:12,000 were reviewed to identify landslides that occurred in response precipitation associated with 2003, 2006, and 2010 WY. Our scope of work included identification of mass wasting features on aerial imagery taken in the summer of 2003, 2006, and 2010; plotting features on 10-foot DEM topographic maps produced from LiDAR; and recording pertinent landslide attributes. Slide attributes such as type of failure, dimensions, geomorphic associations, land use association, percent delivery, and discharge volumes for individual events was documented in spread sheet data forms.

In the absence of field data, landslide dimensional attributes were recorded from aerial photographs using a 20/inch engineering scale (resolution of ~25 feet). Landslide depths were modeled between 3 to 5 feet for shallow events (S) and 10 to 12 feet for deep events (D). The area-volume relationships developed by Cruden and Varnes (1996) were used to calculate the landslide displacement volumes with the half ellipsoid equation: $1/6\,\pi\,LWD$. L = length, W = width, D = depth.

Landslide classification was used in general accordance with California Geologic Survey Note 50 (1997) and Cruden and Varnes (1996).

Mass wasting mapping was restricted to those areas that exhibited evidence of recent movement (raw or sparsely vegetated with brush/ grass). A small portion of the landslides were evaluated in the field to acquire true dimensional attributes. Surface erosion was not evaluated. Road and watercourse GIS layers were used to identify road and watercourse associations relative to landslide locations.

STRUCTURAL/GEOLOGIC SETTING

Regional Structural Setting

The Stitz Creek watershed is located within the Northern Coast Ranges Province of California, which is characterized by north-northwest oriented ranges that reflect the dominant regional structural trend. In the northern most part of the province, the structural trend is dominated by northwest striking, northeast dipping thrust faults and northwest trending fold axes that accommodate northeast directed shortening. Shortening is in response to convergence of the North American and Gorda Plates across the Cascadia subduction zone. In the southern part of the province, the local structural grain is dominated by north-northwest trending strike-slip faults associated with the San Andreas transform margin between the North American and Pacific Plates. Between the northern and southern portions of the province, the northwest trending structure is overprinted with west-northwesterly trending folds and thrust faults. The superimposed west-northwest trending structures are generally accepted to be a result of the northward migration of the Mendocino Triple Junction (Kelsey and Carver, 1988; Aalto et al., 1995). The Mendocino Triple Junction (MTJ) marks the location where the Cascadia subduction zone to the north transitions to the San Andreas transform margin to the south.

Seismotectonic Setting

Stitz Creek is located within a seismically active area. Because of the seismotectonic setting there are numerous sources for potentially large earthquakes. In general, the seismic sources are a manifestation of the interaction between the North American, Gorda, and Pacific Plates. There is an estimated ten percent chance of 0.6-0.9 g (60 to 90 percent of the acceleration due to gravity) being exceeded in fifty years (Petersen et al., 1996). The estimated ground accelerations are approximate and not intended for use in site-specific investigations (Petersen et al., 1996).

No active faults are mapped passing through the project area, and no part of the plan lies within and/or adjacent to an Alquist-Priolo Earthquake Fault Zone. The nearest known fault that is "zoned" as active is the Little Salmon fault (Hart and Bryant, 1997) (3.5 mile north). This particular structure is a northwest-trending, northeast-dipping thrust fault zone that dissects slopes along the northern valley wall of the Van Duzen River basin. It is part of a broad, 15-mile wide fold and thrust belt that accommodates onshore deformation associated with the Cascadia Subduction Zone.

Ground motion affiliated with a large seismic event in this semi-mountainous/steep terrain would likely trigger or reactivate landslides within the project area. It is well documented that earthquake-induced landslides often occur at localities where slopes are naturally unstable under nonseismic conditions (Keefer, 1984). Consequently, there is the potential that some landslides could be triggered on slopes within the Stitz Creek area following a significant seismic event. Site response during strong ground motion will depend on a complex interaction between site-specific conditions of earth materials, topography, lithology, hydrology, earthquake wave travel path and distance to source.

Geologic Setting

Published literature and geologic maps of the region (Ogle, 1953; Spittler, 1982; Kilbourne, 1985; McLaughlin and others, 2000) indicate the study area is predominantly underlain by bedrock associated with Middle Miocene to Late Pleistocene age Wildcat Group sediments, specifically the Pullen, Scotia Bluffs, and Carlotta formations as well as the Undifferentiated Wildcat Group. Approximately 130 acres at the mouth of the basin is mapped as underlain by the Tertiary to Cretaceous age Yager terrane of the Coastal Belt of the Franciscan Complex.

The Wildcat Group consists of five sedimentary formations that were unconformably deposited onto Coastal Belt bedrock of Franciscan Complex in the ancestral Eel River Basin. These formations represent an upward-coarsening sequence ranging from inner-shelf, fine-grain sandstone, siltstone, and mudstone to nearshore sands and gravels (marine and non-marine). This upward coarsening of lithologies demonstrates the transition (regression) from a deep-water offshore environment (Pullen formation) to a near-shore marine or terrestrial alluvial environment (Carlotta formation).

The Pullen formation is the oldest unit of the Wildcat Group and extends into the southwestern portion of the study area overlying the Yager terrane in angular unconformity. The section is thickest and most complete along the Eel River near Scotia and thins in all directions. No exposures have been identified north of the Little Salmon Fault. The lithology varies greatly within the unit but is generally comprised of dark-blue gray mudstones and cream colored diatomaceous mudstones and siltstones low in the section and transitioning to greenish brown sandstones.

In the early 1950s Ogle (1953) classified Wildcat Group sediments northeast of the Little Salmon fault as undifferentiated, because of the poor exposures and general lack of distinctive lithologies and indicator fossils. Undifferentiated Wildcat underlies approximately half the Stitz Creek basin, as mapped by Ogle (1953). Regional compilation mapping by Spittler (1982) identifies similar lithologies and contact locations as the previous mapping by Ogle (1953). Sediments associated with the Undifferentiated Wildcat Group are commonly described as moderately indurated, fine- to medium-grained sandstone, siltstone, and claystone with minor pebble- and cobble-bearing conglomerate. Shell hash observed in portions of the study area suggests that some of the Undifferentiated Wildcat Group sediments could possibly be re-categorized as Rio Dell Formation.

The Scotia Bluffs Formation, which unconformably overlies the Rio Dell Formation is comprised of near-shore, fine-grained, massive sandstone intermixed with minor amounts of siltstone, mudstone, and conglomerate. Sandstone affiliated with the Scotia Bluffs Formation is moderately- to well- consolidated and weathers to a grayish or light brown color. Conglomerates in the Scotia Bluffs Formation are generally made up of well-rounded, pebble-sized clasts of sandstone, chert, schist, and quartz. These sediments are derived from Franciscan Complex Coastal and Central belt lithologies that are commonly located to the south of the basin. Narrow ridges with near-vertical bluff faces are also commonly affiliated with this formation.

The Carlotta Formation is atop and interlaid with the Scotia Bluffs sandstone forming a gradational contact. Deposition of the Carlotta likely occurred in near shore and non-marine environments based on massive coarse conglomerates, poorly sorted sandstones, bedded and massive siltstones and mudstones, and the occurrence of redwood logs found in some deposits. The massive conglomerate beds often grade up from coarse to fine sand, which grades to fine gray silt and claystone. The massive sandstone beds are generally dirtier and coarser than the typical sandstone of the Scotia Bluffs formation, and weathers to a brown color. The thickest and most complete section of the unit occurs within the Eel River syncline and thins to the north and west.

The Yager terrane is a 5,000 foot thick section representing the uppermost limits of the Franciscan Complex likely dating to the Eocene, but could extend into the Oligocene and/or the Paleocene. The rocks include argillite, sandstone, and conglomerate forming thin-beds of turbidity mudstone interbedded with sandstone bearing organics resulting in carbonate concretions and carbonate layers in the mudstone (McLaughlin and others, 2000). The turbidity beds indicate that this terrane was formed near the continental margin, likely near a delta. Rocks of the Yager terrane are less sheared than the older Franciscan formation and much more consolidated than the overlying Wildcat Group resulting in greater relief due to differential erosion.

Geomorphic Setting
The bedrock contacts within the drainage are reflected in the topographic expression which is distinctly different in the northern, upslope, portion of the drainage underlain by Scotia Bluffs and Carlotta formations. These northerly dipping beds exhibit differential weathering resulting in pronounced cuesta morphology. Asymmetric, east-west trending ridgelines consist of moderately inclined north-facing dip-slopes and precipitously steep, south-facing end-slopes (bluffs) that do not support robust timber stands. Where present, intersecting fracture planes produce wedge failures, also rock topple events occur on the more prominent end-slope bluffs resulting in deposition of colluvial aprons at their base. Dip-slopes, ranging from 20 to 35 degrees, are prone to debris slides and flows especially within watercourses and on streamside slopes. Watercourses underlain by Scotia Bluffs have a tendency to follow the bluff alignments due to the northward dipping beds and south-facing bluffs.

Slopes underlain by the Undifferentiated Wildcat sediments are void of distinct bluffs with moderate to steep slopes regularly transitioning from concave to convex in response to the dense stream network. Tributaries within this bedrock unit typically extend upslope to steep headwalls. Alluvium within the main stem of Stitz Creek form low gradient terraces. The active channel has incised the alluvium forming steep, easily erodible banks which expose poorly graded silts and sands. Deposition and formation of the stream terraces predate the initial harvest entry (circa 1900-1920) based on the terrace surfaces being used for the construction of a railroad grade. Historic aggradations of the terrace surfaces due to overbank flooding is evidenced by the partial burial of remaining old growth stumps and saw cut timbers associated with railroad trestles. Generally, watercourse morphology within the basin displays a deeply entrenched dendritic pattern characteristic of initial incision into a region of gentle slope with secondary structural control (Bloom, 1978). This is consistent with uplift, deformation, and erosion of a regionally gently inclined coastal plain and entrenchment of an antecedent drainage network.

As expected, the entrenched drainage network, coupled with underlying geologic formations, strongly correlates with landslide distribution and frequency of both shallow and deep-seated landslides; with shallow landslides concentrated in steeply inclined streamside slopes and deep-seated landslides often encompassing the entirety of tributary drainages. Where the watercourses have eroded into the end-slopes of the Scotia Bluffs and Carlotta formations, shallow landsliding appears increasingly frequent while slopes underlain by Undifferentiated Wildcat appear more prone to deep-seated landsliding. Geomorphic mapping conducted for watershed analysis and the HCP used eight sets of aerial photographs, spanning a 50 year period following the initial harvest entry. The mapping for watershed analysis did not identify landforms, such as inner gorges, headwall swales, and debris slide slopes, however, the areas identified as shallow landslides strongly correlate with previous mapping of these landforms compiled by the California Geologic Survey (1999). This correlation is reinforced by the conclusions of watershed analysis that inner gorge slopes, steep streamside slopes, and headwall swales present the highest hazard of failure and delivery of sediment to a watercourse under management conditions and formulated prescriptions to address the hazard (PALCO, 2004). The landslide inventory previously developed for watershed analysis is an essential tool for determining if observed landslides are reactivations of previous mapping.

HYDROLOGIC DATA

Oswald Geologic (2008a and 2008b) compiled annual, monthly, and daily precipitation data for 2003, 2006, and 2010 WY for the Reports of Waste Discharge (ROWD) for Bear Creek and Jordan Creek Watershed Landslide Inventories. Rainfall data present in the landslide inventory reports (Oswald Geologic, 2008a; 2008b) was measured at the NOAA weather stations in Scotia and on Woodley Island, California.

The function of the precipitation data presented by Oswald Geologic (2008a and 2008b) is to highlight the relation between precipitation and landslide frequency. The climate data analysis presented in the Bear and Jordan Creek Landslide Inventories is complete and accurate; this report builds upon those studies and draws additional conclusions observed in the data recorded since 2008.

The proximity of the study area to Jordan Creek (1.8 miles) and Bear Creek (4.3 miles) suggests the data, as previously presented, is applicable and at least as accurate based on the location of Stitz Creek in relation to the Scotia gauging station, which was used for the annual and monthly climate data presented in the previous Landslide Inventories (REF.).

Regional Climate

The climate of the study area is strongly influenced by the proximity to coastal mountains. Coastal influence provides a temperate climate with high humidity and steep terrain creating orographic effects that focus precipitation onto upland slopes. Winter storms created by offshore low-pressure systems bring moisture-laden air from the east Pacific focusing intense and prolonged periods of precipitation on the region. The storm season lasts from October to April and generally accounts for approximately 90% of the annual precipitation.

Annual Precipitation

Average annual rainfall in Scotia California, through 2016 WY, is 47.07 inches. This average is 1.63 inches less than the average reported by Oswald Geologic (2008a and 2008b). Two factors contribute to this discrepancy: the four year drought occurring between 2011 and 2015, and this record begins in 1926 rather than 1932. The 2003 and 2006 WY brought above average rainfall and rank 9th and 5th respectively for wettest on record. The 2010 WY was also above average (ranking 16th wettest on record) but was only 9.4 inches above average while 2003 and 2006 were 17.91 inches and 23.73 inches above average respectively. Figure 1 shows annual precipitation totals recorded at the Scotia weather station from 1926 to 2016 with the 2003, 2006, and 2010 WY totals labeled, as well as the average annual rainfall for reference.

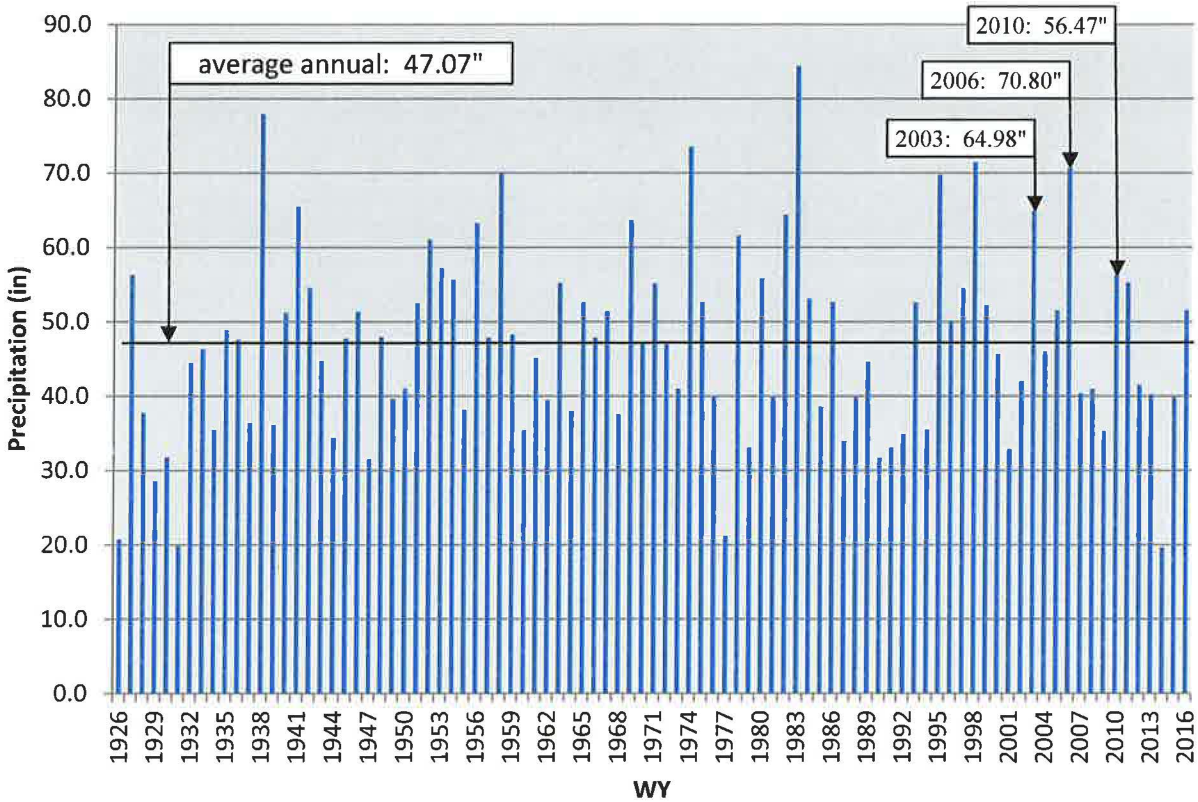


Figure 1: Annual Precipitation at the Scotia CA, NOAA Weather Station from 1926 to 2016.

Monthly Precipitation

Oswald Geologic (2008a and 2008b) attributes landsliding from 1997 to be influenced by strong ground accelerations generated from the M>6.5 earthquakes on the Cape Mendocino fault between 1992 and 1994. Other research has demonstrated that ground shaking can weaken resisting forces inherent to hillslopes and create conditions prone to landslides during ensuing rain events (Dadson et al., 2004; Keefer, 1984). While annual totals for 1997 WY were only slightly above average, rainfall between December, 1996 and January, 1997 had well above average rainfall. The 2003 and 2006 storm seasons were not preceeded by earthquakes large enough to influence regional landsliding but did receive significantly above average rainfall, especially later in the season (i.e. March and April) when antecedent soil-moisture levels were elevated and could provide a mechanism for regional precipitation-driven landsliding.

The 2010 HY produced above average annual precipitation. The monthly totals, presented in Figure 2, show January and April made the two larges departures above monthly averages. May and June also had above average totals but less than 4 inches of rain fell during each of those months. The months of October through December each received 4 to 5 inches of rain and February and March recorded 5 to 6 inches. Although the annual total was above average, there were not consecutive months of percistent, torrential rainfall that lead to saturated soil conditions.

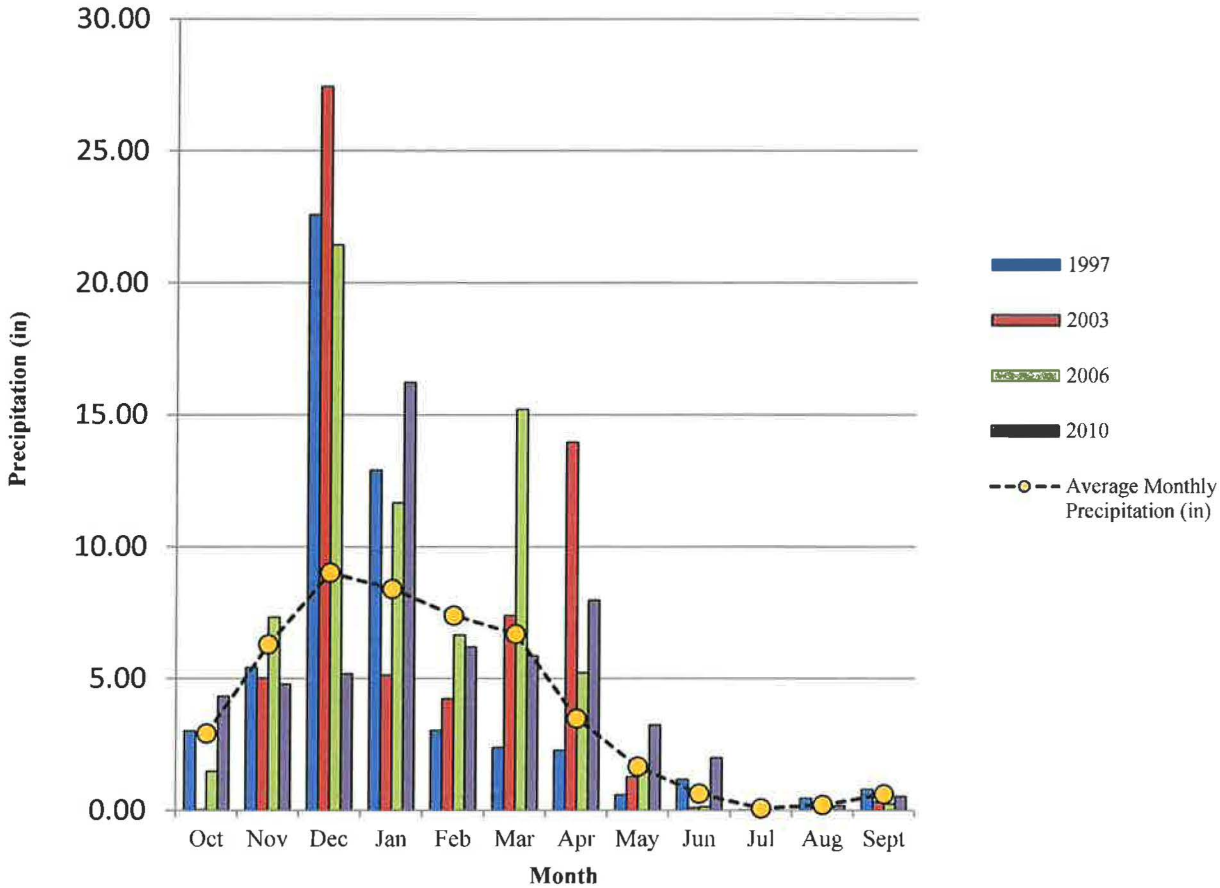


Figure 2: Monthly rainfall totals for 1997, 2003, 2006, and 2010 HY with 90 year average.

Daily Precipitation

This section contains a brief summary of daily precipitation for 2003, 2006 and 2010 WY. The 2003 WY experienced nine rainfall records (Table 2) including 4.68 inches in a 12-hour period in late December. While significant rain events occurred throughout the 2003 WY, late season rainfall in early April produced an array of landslides reported throughout the county.

Table 2: Climate Records for Eureka CA, 1887-2014		
12 Hour Maximum	4.68	Dec 27, 2002
24 Hour Maximum	6.85	Dec 27-28, 2002
1 Calendar Day Maximum	6.79	Dec 27, 2002
2 Calendar Day Maximum	8.82	Dec 27-28, 2002
3 Calendar Day Maximum	9.04	Dec 27-29, 2002
4 Calendar Day Maximum	10.49	Dec 27-30, 2002
5 Calendar Day Maximum	11.11	Dec 27-31, 2002
15 Calendar Day Maximum	18.39	Dec 14-28, 2002
Greatest in Calendar Month	23.31	Dec 2002

Precipitation data for the 2006 WY (Figure 3) indicates one inch of rainfall in a 24 hour period was exceeded 6 times, and between late December and early February over ½ inch of rain per day occurred for most of that time period. On December 31, 2005 the Eel River recorded a historic crest of 53.13 feet which ranks the 6th highest for the period of record. The series of storms that generated the crest caused widespread flooding and landsliding so severe that Humboldt County was declared a State disaster area.

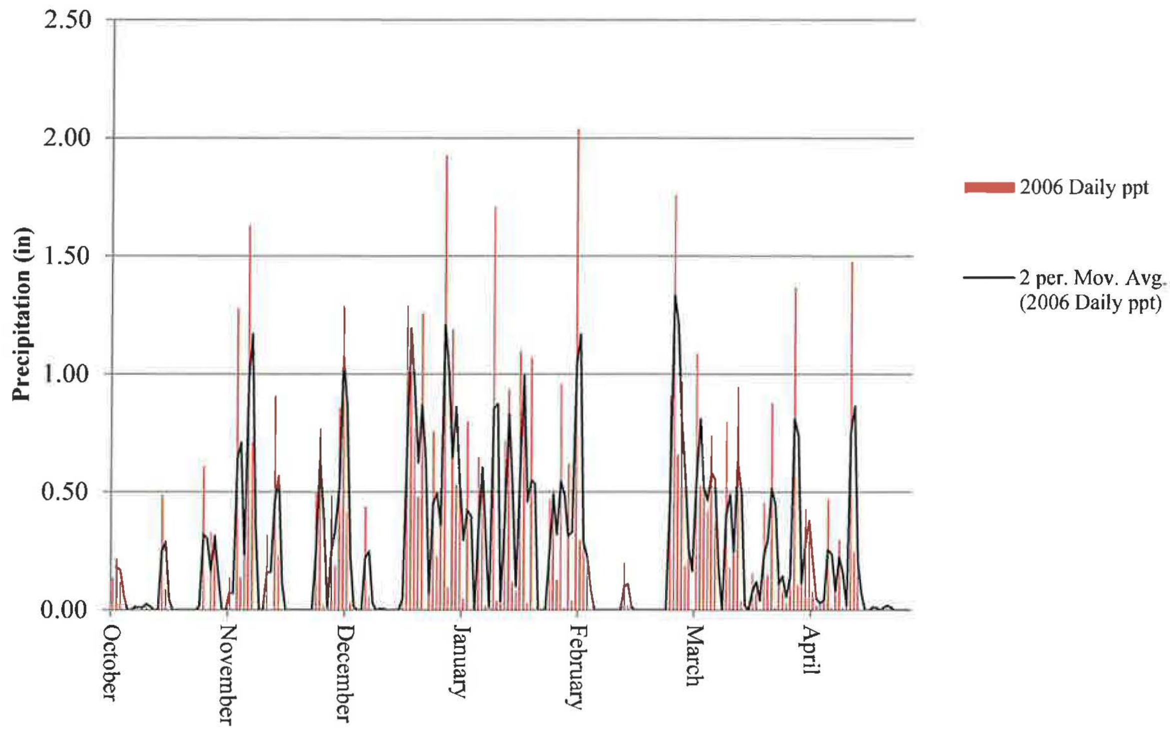


Figure 3: Daily precipitation totals measured at the NOAA weather station in Eureka for the 2006 WY with 2-day moving average.

The daily precipitation data compiled for 2010 WY are displayed in Figure 4. The 2-day moving average shows that one inch of precipitation in a 24 hour period was exceeded 3 times; twice as many occurrences took place in 2006. Although several daily precipitation totals exceeded one inch during 2010, the temporal distribution of these events appears relatively evenly spaced throughout the wet season. The sustained precipitation between late December and early February noted in the 2006 record is absent in 2010, and no time-period in 2010 had significant sustained precipitation between large storms comparable to the 2006 wet season. The total annual rainfall in 2006 WY was 14.33 inches greater than in 2010 WY.

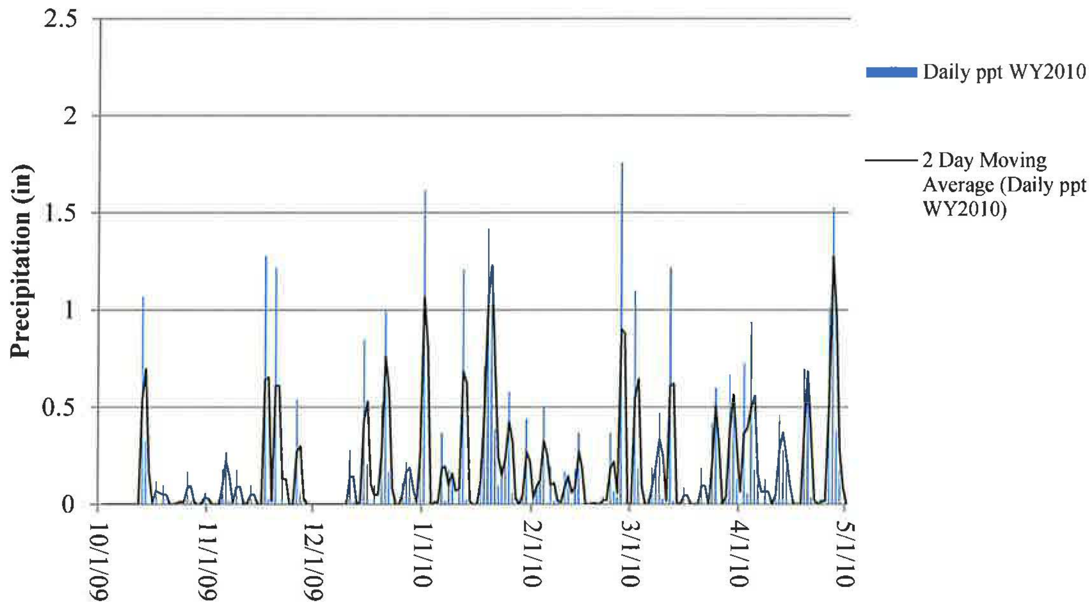


Figure 4: Daily precipitation totals mesured at the NOAA weather station in Eureka for the 2010 WY with a 2-day moving average.

Analysis of the precipitation data for the 2003 and 2006 WY show above average annual rainfall totals and above average selected monthly totals. Both of these storm seasons received significant precipitation volumes late in the season when antecedent soil-moisture levels were elevated and hillslopes were likely saturated from large December rainfall totals. Although the 2010 storm season was above average by comparison to 2003 and 2006, 2010 received substantially less rainfall with reduced duration and intensity of individual precipitation events. The climatic setting leading to the 2003 and 2006 precipitation-driven landslides were not present during the 2010 storm season as evidenced by the annual, monthly, and daily precipitation totals and reinforced by the number of landslides observed in during the respective years of study.

LANDSLIDE INVENTORY

Area-Frequency Relationships

Landslide frequency and magnitude in the Stitz Creek drainage-area dramatically decreased from 2003 to 2010. Mapping of the aerial photographic identified landslides is presented in Appendices A, B, and C for each year of review with the corresponding attribute tables presented in Appendices D, E, and F. Figure 5 plots the frequency against the estimated area of each landslide for each year of study. The distribution of landslide sizes is heavily skewed towards smaller landslides with few outliers of larger landslides. This skewed distribution is a characteristic of landslide inventories worldwide (Guzzetti et al., 2002; Malamud et al., 2004; Oswald, 2008a and 2008b). The largest landslide observed in 2003 was approximately $^4/_5$ of an acre and the largest in 2006 was $^9/_{10}$ of an acre. The largest landslide in 2010 was ½ of an acre. These larger slides also tend to be the largest contributors to the landslide sediment budget.

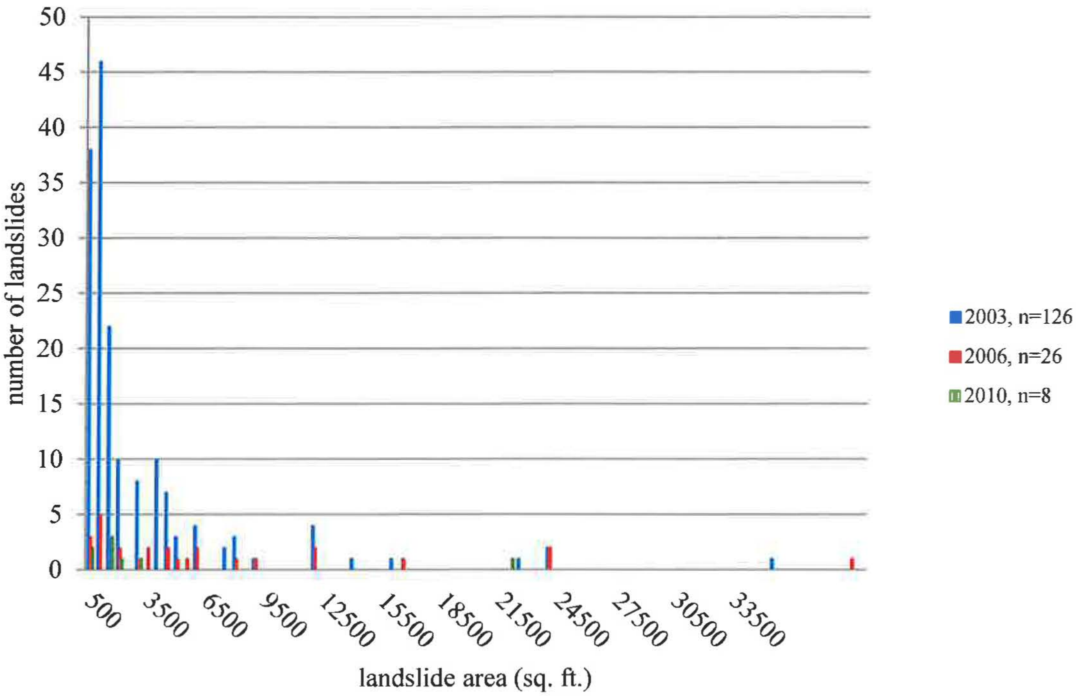


Figure 5: Number of landslides per area of displacement for 2003, 2006, and 2010.

Figures 6-8 show the landslide area-frequency distribution plotted on a log-log graph and, demonstrate completeness of the inventory. The cumulative area-frequency curve for the 2003 season follows a straight line over the larger area landslides. A straight line on a log-log graph can be referred to as a log-transformed power law curve. This is advantageous for 2 reasons: it is easier to visualize the data, and it is easier to work with a linear function when doing statistical analysis. The deviation from the log-transformed power law correlation at the smaller landslide size is a result of the physical lower limit of landslide size before surface erosion processes dominate, and to some extent the ability to detect small landslides in a forested landscape, and also in part to limitations in observing small landslides in aerial photography (Malamud et al., 2004). A fall off of values from the power law at the larger sized landslides would indicate an incomplete catalog or under sampling in the mid-size range. Large earthflows/compound failures can be difficult to observe in aerial photography when rotational movement occurs with minimal translational displacement. This is not observed for the 2003 and 2006 inventory years. Due to the small sample size of landslides observed for the 2010 inventory the cumulative area-frequency graph is not well developed relevant to the power law correlation. It should be noted that significantly more small landslides were observed in 2003, with approximately 50% being less than 1,000 ft^2. Approximately 30% of 2006 landslide areas and 25% of the 2010 landslide areas were under 1,000 ft^2.

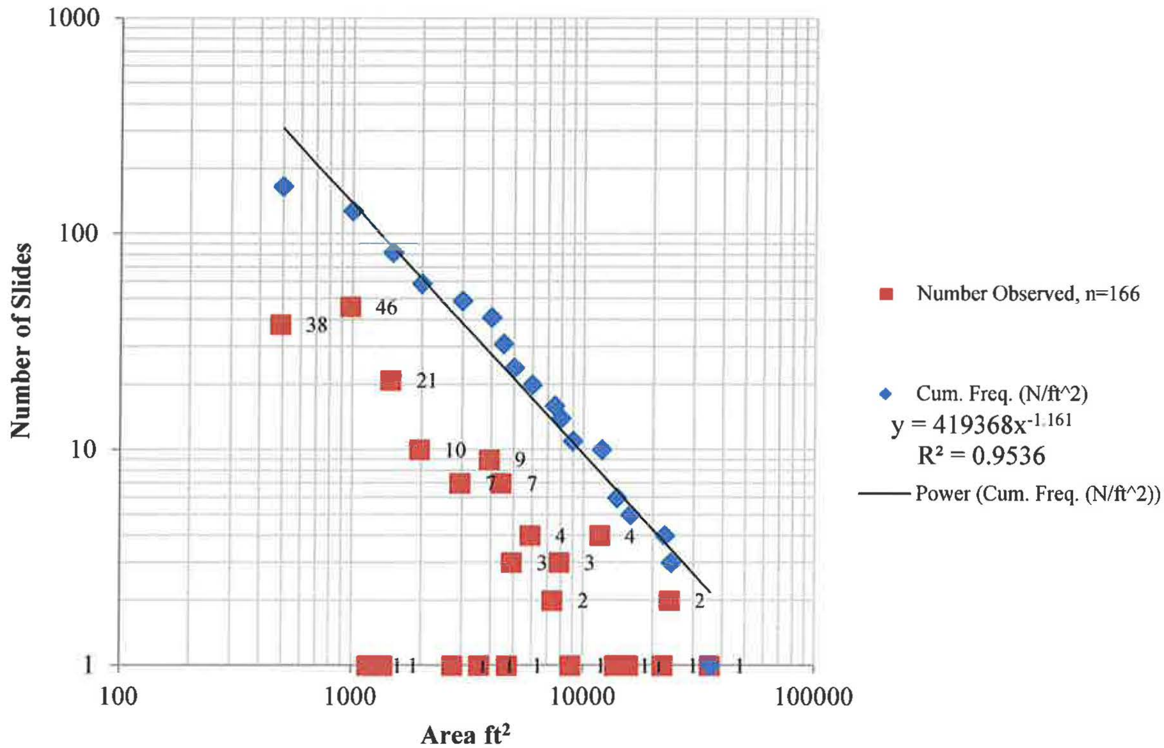


Figure 6: Log-log area-frequency distribution for 2003 landslide inventory. Trend line is a log transformed power function.

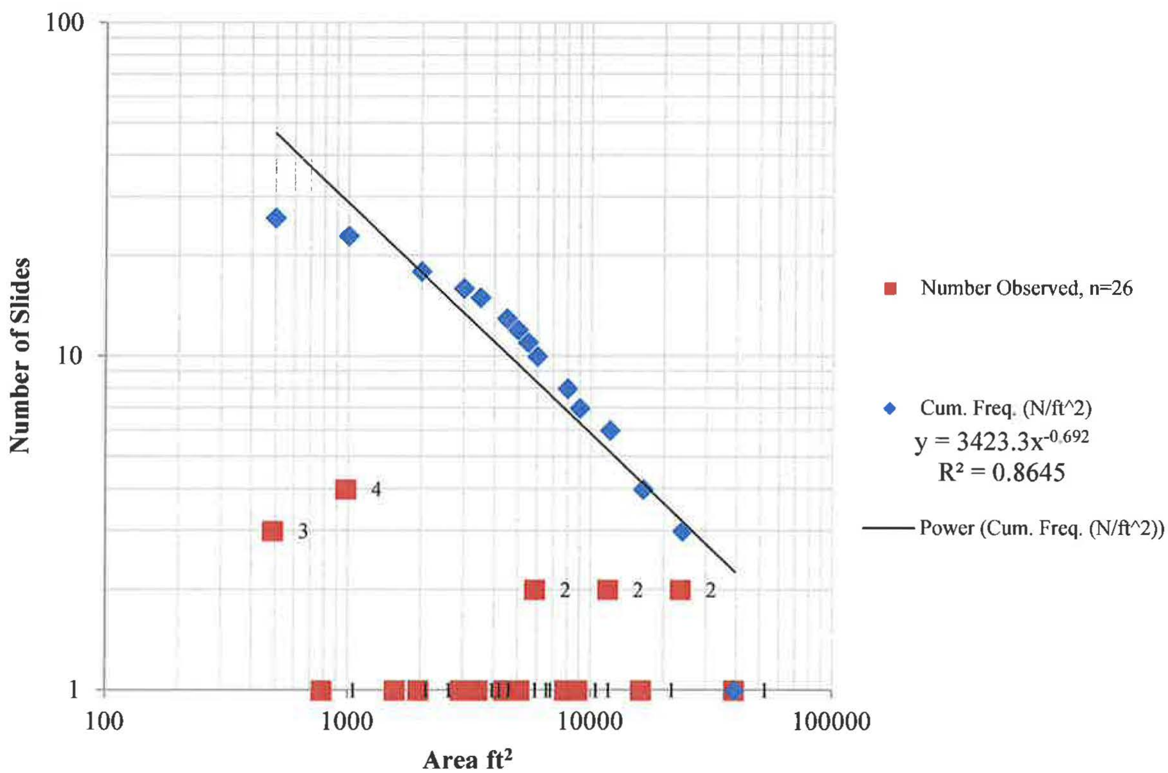


Figure 7: Log-log area-frequency distribution for 2006 landslide inventory. Trend line is a log transformed power function

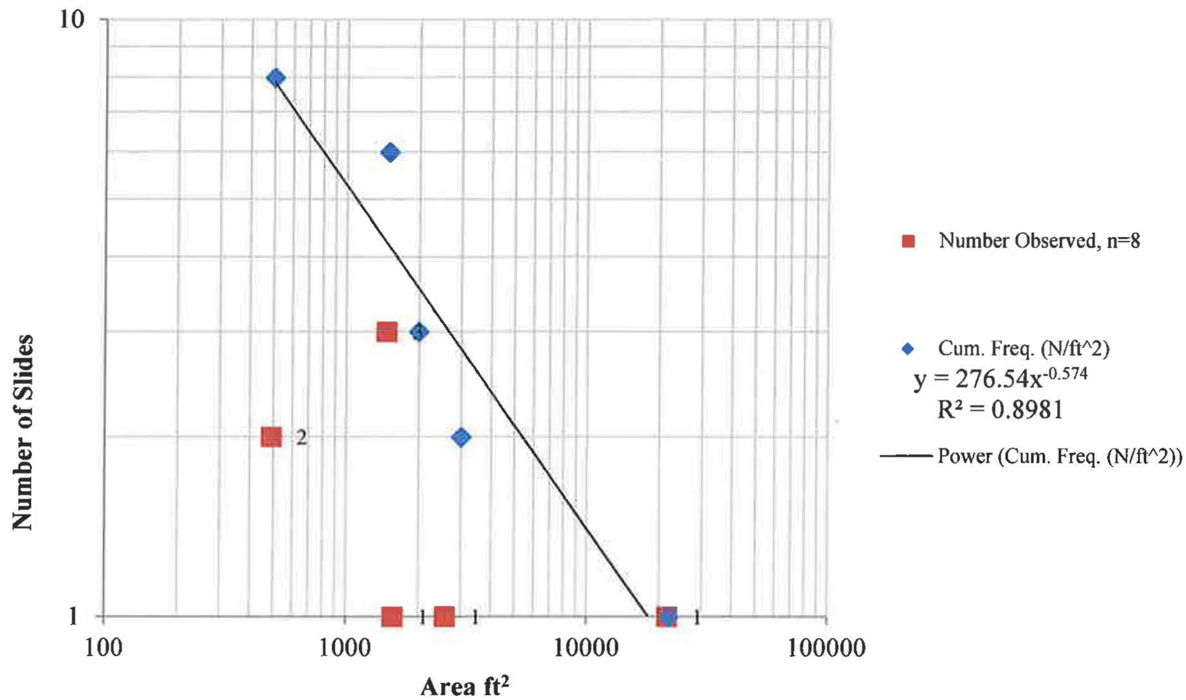


Figure 8: Log-log area-frequency distribution for 2010 landslide inventory. Trend line is a log transformed power function

Geomorphic Association

The majority of the landslides in all three aerial photographic years are associated with geomorphic landforms that developed on, or in conjunction with, steep to very steep slopes, particularly where adjacent watercourses. Swales (SW), bluffs (BL), break-in-slope (BIS), and inner gorge slopes (IG) are associated with the highest frequency of landsides. One hundred and fifty four (77%) of the mapped landslides initiated from within one of these four geomorphic terranes. Approximately 82% of all the landslides recorded in the 2003 inventory and slightly over 65% of all landslides for the 2006 season were associated with these morphologies. In the 2010 season, 75% of landslides occurred on one of these geomorphic associations.

Figure 9 is a graphical representation of landslide population and its relationship to the identified geomorphic associations. While intuitive that the slope gradient of landslide initiation sites are predominantly located on steep to very steep slopes, this data set reinforces that geomorphic landforms identified as associated with failure are more likely to occur on steeper slopes.

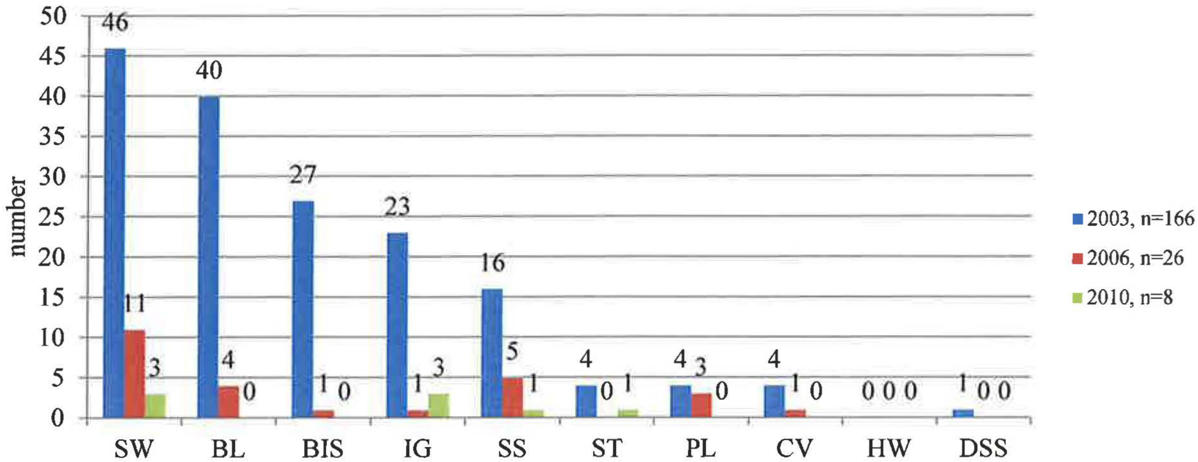


Figure 9: Geomorphic associations of landslides for the 2003, 2006, and 2010 landslide inventories.

Management Association

Several attributes presented in Figures 10-12 and discussed below, were gathered to compare landslide occurrences with management associations. Management activities included silvivulutral prescription and grading activities (i.e road/skid trail construction). In order to acquire a clearer picture of the influence of management-related activities on landslides, it is necessary to determine if each landslide is a reactivation, and its temporal relationship to management activities. The data indicates 56%, 73%, and 88% of the landslides were reactivations of pre-existing failures for the 2003, 2006, and 2010 WYs respectively. The significance of this relationship to current and future management strategies will be discussed later.

Land Use Associations

Land use categorizes included general levels of harvest (clearcut [CC], partial [PC], etc.,) noted through aerial imagery and review of past harvest plans in addition to instabilities that are directly linked to road-building activities (road cut [RC], road fill [RF], etc.). Land use association refers to the land use activity observed at the site of failure and is shown in Figure 10. Several types of road associations are listed but differ from road condition associations discussed below. When used in this category road associations indicate actual observed failure on a road prism, whereas road condition associations indicate roads that cross or lead to a failure and have a possible association with the failure that may only be spatial in nature.

Fifty-six failures occurred directly adjacent to or within road/skid trail travel ways, with 60% of these events initiating in fill embankments. Many of the failed segments occurred along roadways that were constructed in the mid 1980's. Road-related landslide activity from this era is often a reflection of un-engineered fill slopes and excessive cut slope heights resulting from poor route placement. Clear cuts and road fill slopes are significant contributors to management related landslides.

Partial harvesting (PC) accounts for the majority of these potential harvest-related landslides observed in 2003 (32%), 2006 (42%), and 2010 (25%). The most common partial harvest silviculture system used in Stitz Creek basin was a Seed Tree Removal which is an even-age management strategy. Few mature trees were retained over approximately 100 acre harvest blocks. HRC's harvest history data indicates 1,115 acres were harvested using even-age management between 1986 and 1989, an additional 510 acres of even-age management occurred between 1990 and 1999, and 232 acres of even-age management between

2000 and 2007. The aggressive management practices during decades prior to this landslide inventory likely had a negative impact on slope stability.

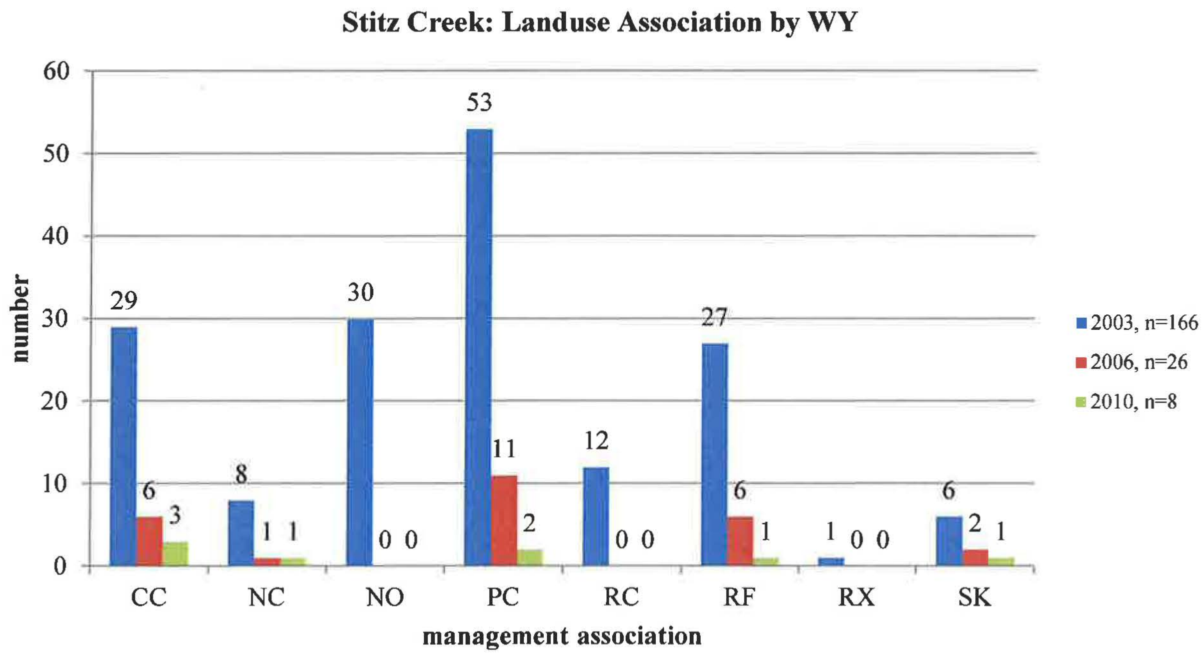


Figure 10: Land use associations for the 2003, 2006, and 2010 landslide inventories.

Road Condition Association

Approximately 71%, 77%, and 88% of failures in the 2003, 2006, and 2010 seasons, respectively, were categorized as not being road-related (Figure 11). Our survey also shows a decline in road-related failures during the inventory period. This is not surprising because of the sizable amount of decommissioning, upgrading, and storm proofing conducted since the implementation of the HCP.

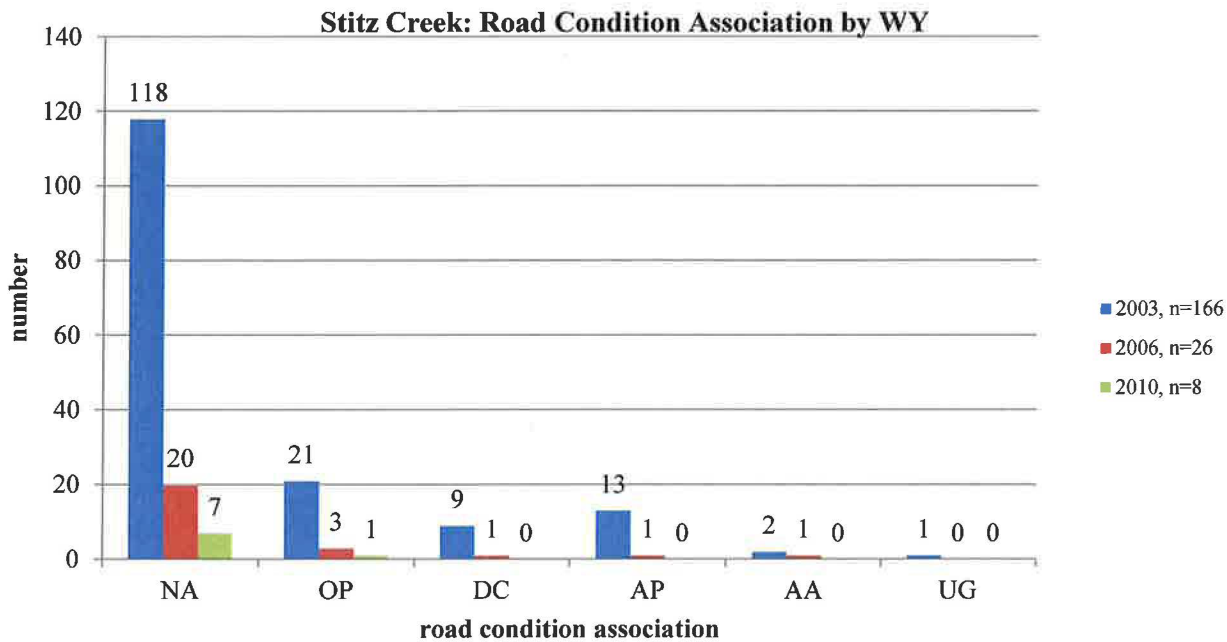


Figure 11: Road condition association for the 2003, 2006, and 2010 landslide inventories.

Stand Age

The 2003 season significantly increased the number of failures in the 10-20 year stand age class over the less than 10-year stand age (Figure 12). This is consistent with studies showing maximum loss of root strength cohesion occurs during the 7-10 year post harvest time range at which point the timing of large rain events is critical (Ziemer, 1981). The data shows a similar pattern for the 2006 season. This pattern is not present in 2010, likely due to the reduced number of observed landslides coupled with reduced acreage of stands less than 20 years old.

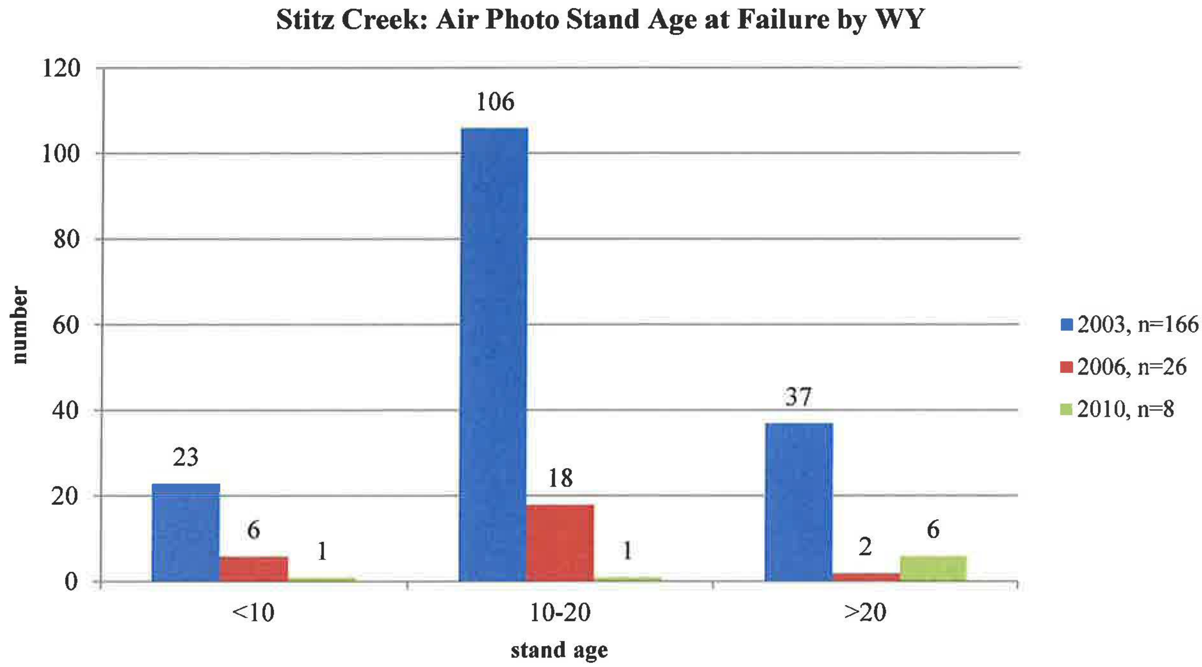
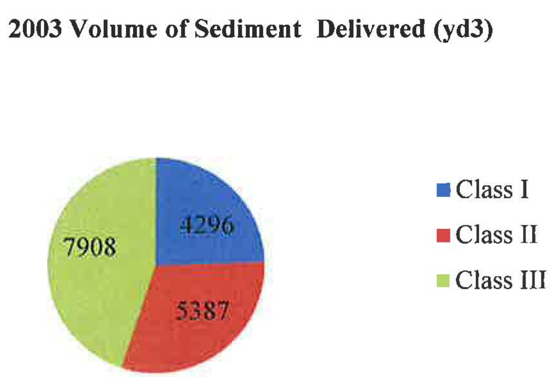


Figure 12: Air photo determined stand age at landslide locations for the 2003, 2006, and 2010 landslide inventories. Time intervals for histogram are <10, t=10 yr; <20, t=10, >20, t=30 ± 10yr; initial harvest circa 1900-1920.

Sediment Delivery Characteristics

Landslide volumes were estimated from aerial photograph measured areas and depth estimates. The volumes were calculated for displaced and delivered volumes. Percentage delivery of displaced volumes was estimated from aerial photographs. The volume estimates are crude and rely on several estimated parameters and likely contain some error. The volumes do allow for an order of magnitude estimate of sediment delivery associated with the respective years of study.



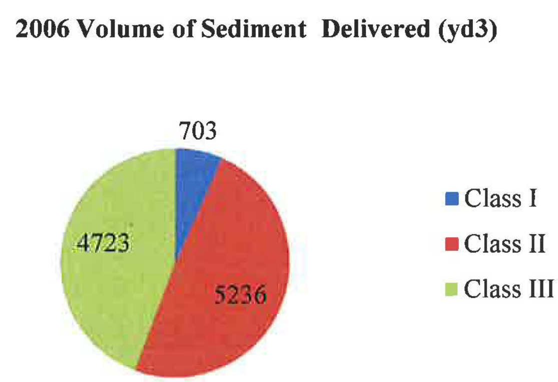


Figure 13: Volume of sediment delivered to watercourse by class for the 2003 and 2006 landslide inventories.

2010 Volume of Sediment Delivered (yd3)

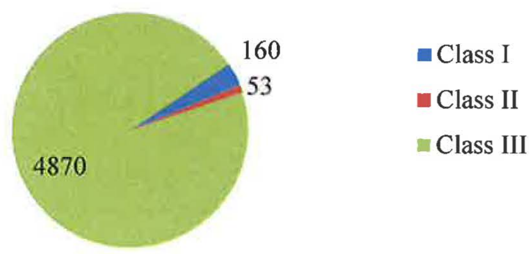


Figure 14: Volume of sediment delivered to watercourse by class for the 2010 landslide inventory.

Delivery Rate

Around half of the landslides for any given study year delivered sediment to a watercourse. In 2003, 43% of landslides delivered sediment to a watercourse, 54% delivered in 2006, and 50% delivered in 2010. Landslides that did not deliver are typically smaller and road related. Also, bluff failures/topples were less likely to delivery due to the failed material depositing at the base of the bluff with little to no runout.

Delivery Amount and Geomorphic Association

In 2003 approximately 82,944 cubic yards of earthen material was displaced by landslides. Of that, approximately 17,591 cubic yards delivered to a watercourse which equates to 21% of displaced sediment entering a watercourse in the 2003 WY. For the 2006 season 33,502 cubic yards were estimated to have been displaced and 10,662 cubic yards delivered resulting in 32% of displaced material delivering. Assessing the 2010 data indicates 6,395 cubic yards displaced with 5,083 cubic yards delivering for 79% of displaced material delivering to a watercourse. Although there is a sharp increase in percentages delivered, a significant reduction in total volume delivered occurred during the study period..

Watercourse Class

The aerial photographic inventory compiled the watercourse classification of streams that receive sediment using existing stream data. Figures 13 and 14 show delivered sediment volumes to watercourses by class. For the 2003 season, 24% of delivered sediment entered a Class I reach, 31% to Class II reaches, and 45% to Class III watercourses. Delivery characteristics for the 2006 season show 7% of delivered sediment entering a Class I reach, 49% entered a Class II reach, and 44% to a Class III. Continuing to 2010, 3% of delivered sediment entered a Class I reach, 1% to a Class II, and 96% entered a Class III watercourse. The 2010 delivery characteristics are heavily skewed due to a very small sample size (only four landslides delivered) with one large landslide entering a Class III watercourse. A potential reason for the reduced delivery volumes to the Class I streams in the 2006 season may be due the existing colluvium in the valley bottom, much of it transported there in the late 1990's. In many locations, it appears the watercourse is down-cutting within the colluvial wedge and not scouring the base of hillslopes forming the valley walls.

Timing of Management-Related Failures

A review of HRC's harvest history data was conducted to determine the timing and aerial extent of past management activities. This management layer was then overlaid across the landslide inventory layer and used to determine landslide rates for pre- and post-HCP prescriptions (Appendix G). Rates of landsliding for pre-HCP (1984-1998) and post-HCP (1999-2010) THPs were calculated by taking total number of landslides reported within operational areas of THPs and dividing by total operational acreage and years of record. Landslides occurring in areas designated as no harvest are not included in rates for THP harvest acres, but are counted in rates for no THP and unharvested acres. Rates for no harvest areas or no THP areas were calculated over the entire period of record (1984-2010). The most recent harvest operations underlying the failure initiation site were determined and compiled for each failure.

Harvest history data goes back to 1984 for the Stitz Creek watershed. For large portions of the watershed, this is the second entry. The initial harvest entry occurred between 1900 and 1919. Harvest entries prior to 1984 were not evaluated for this analysis. A total of 177 individual landslides were mapped for the 2003, 2006, and 2010 landslide inventories. Of those, thirty-seven (21% of total) were not associated with any reported harvest activity or in non-operational areas of THPs. There are 135 (76%) landslides associated with operational areas of pre-HCP THPs. Post-HCP landslides within operational areas of THPs account for 5 (3%) of the total number of landslides.

Eight-six pre-HCP failures initiated on slopes within four harvest plans: 1-84-440HUM (34 landslides), 1-85-616HUM (12), 1-86-644HUM (18), and 1-87-342 (22). Several commonalities were observed between these four harvests. The harvest operations were conducted between 1984 and 1987 and all used the seed tree removal silviculture. Three of the four are over 100 acres and significant road construction was required to facilitate the harvests. Road-related landslides account for 42% of the landslides in these four plans. Lastly, these plans are all underlain by the Undifferentiated Wildcat bedrock which is less indurated and more prone to mass wasting then the other Wildcat Group formations present in the watershed.

There were eleven post-HCP harvest plan operations executed in Stitz Creek covering approximately 452 acres. Within these operational areas, five landslides occurred in two of the THPs: 1-01-152 HUM (2) and 1-04-139HUM (3). The silviculture prescriptions were shelterwood removal and commercial thin respectively and both were helicopter yarded. The two landslides in the 2001 THP were both road-related cut bank failures that did not deliver to a watercourse. The three landslides in the 2004 THP were all bluff failures with the only delivery occurring where a watercourse intersects the affected bluff.

The analysis of the most recent harvest history of Stitz Creek shows that approximately 83% of the watershed has undergone operations over the 26-year period (1984-2010) recognized for this study. Close to 65% occurred under pre-HCP Forest Practice Rules and 18% under post-HCP prescriptions. The landslide rate for pre-HCP THPs is calculated at $5.8X10^{-3}$ landslides $acre^{-1}$ $year^{-1}$. The rate for post-HCP THP operational areas is calculated at $1.4x10^{-3}$ landslides $acre^{-1}$ $year^{-1}$, over 4 times less than the pre-HCP rate. A landslide rate of $2.6x10^{-3}$ landslides $acre^{-1}$ $year^{-1}$ applies to 24% of the acres in the watershed classified as no harvest or areas with no THP recorded in the last 26 years. The no harvest/no THP acreage incorporates high hazard portions of the watershed avoided under pre- and post-HCP prescriptions, and possibly THPs operated on shortly before 1984.

The analysis of the timing and rate of failures combined with the majority (56%, 73%, and 88%) being reactivations of existing landslides that existed prior to 2003, 2006, and 2010 storms strongly suggests that landslides observed in the Stitz Creek watershed are overwhelmingly associated with pre-HCP operations. The review of the performance of pre-HCP and post-HCP THPs show the HCP interim and post-watershed analysis prescriptions appear to delineate and avoid or mitigate operations on and adjacent unstable areas resulting in a significant improvement over the rate of failures associated with pre-HCP harvest operations.

CONCLUSION

Previous mapping of the Stitz Creek watershed by the California Geologic Survey and HRC show that landsliding in Stitz Creek is strongly associated with inner gorges, bluff formations, and road construction. The HRC watershed analysis also indicated that pre-HCP and, in many cases, pre-California Forest Practice Rules management practices were responsible for many of the landslides. This investigation also shows association of pre-HCP management practices with landsliding in Stitz Creek.

The 2003 and 2006 seasons were significantly wetter and contained periods of relatively prolonged and intense rainfall when compared with the historical precipitation record. The two seasons should be considered precipitation-driven landslide-triggering events and are the first two events since management under the HCP began in 1999.

Review of the geomorphic and non-management associations with landsliding also points to the fact that most of the landslides in Stitz Creek are associated with inner gorges, steep streamside slopes, and vertical bluff faces. Slopes from which all of the landslide-delivering events originate are regulated under the HCP prescriptions for the Lower Eel Eel Delta watershed. The relative success of this management strategy is clearly seen in the difference in hillslope response between pre- and post-HCP THPs observed following the 2003, 2006, and 2010 seasons.

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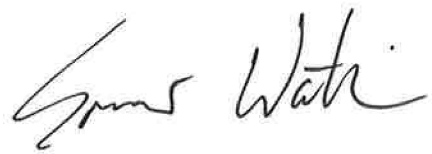

Spencer Watkins, PG 9081
Humboldt Redwood Company

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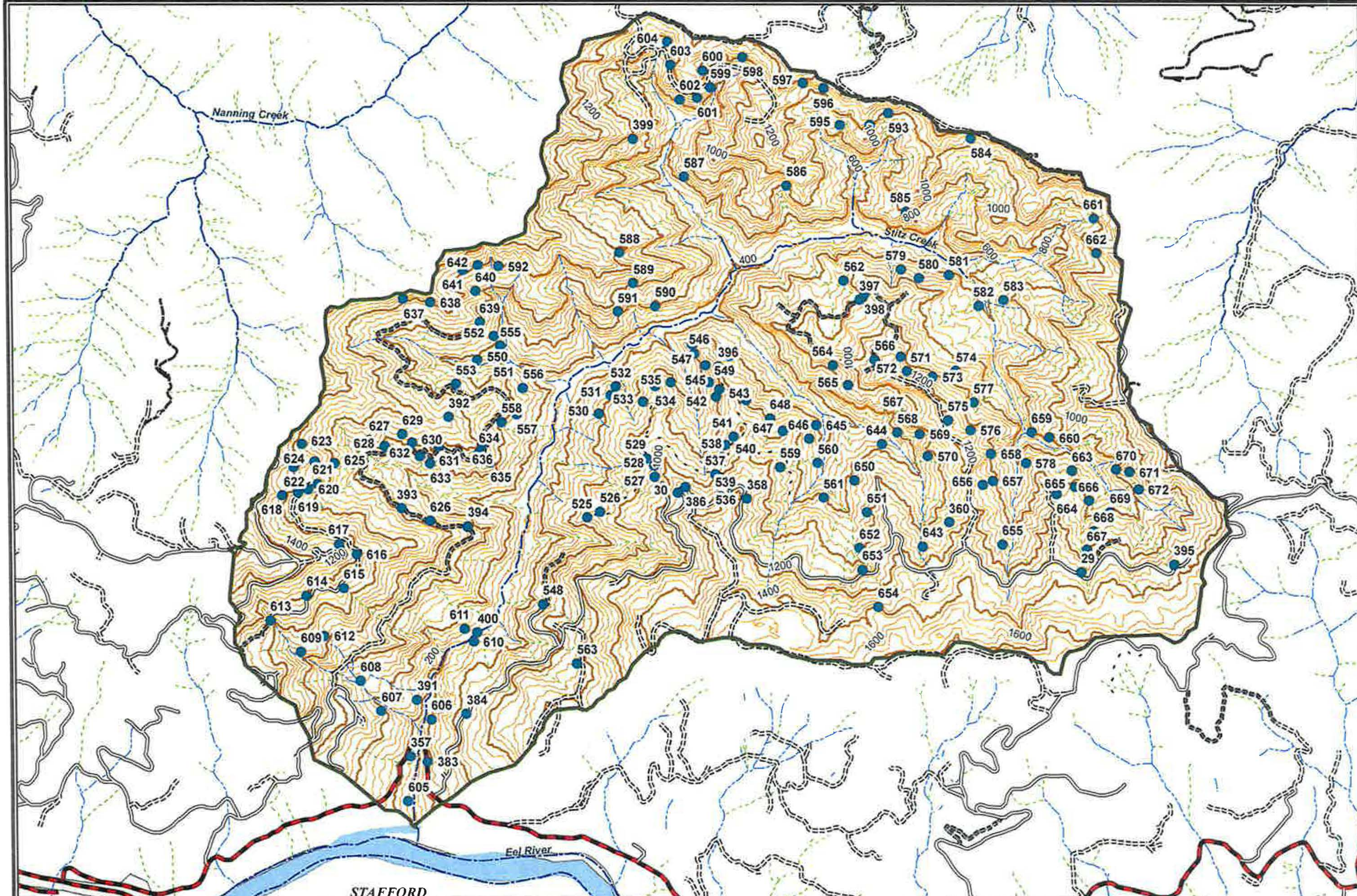

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Stitz Creek, landslide inventory 2003 Air Photo

1 inch = 2,000 feet

Feet

2,000 1,000 0 2,000

Stitz LS 2003

Stitz Creek Watershed

Class 1

Class 2

Class 3

River

Other Private

HRC

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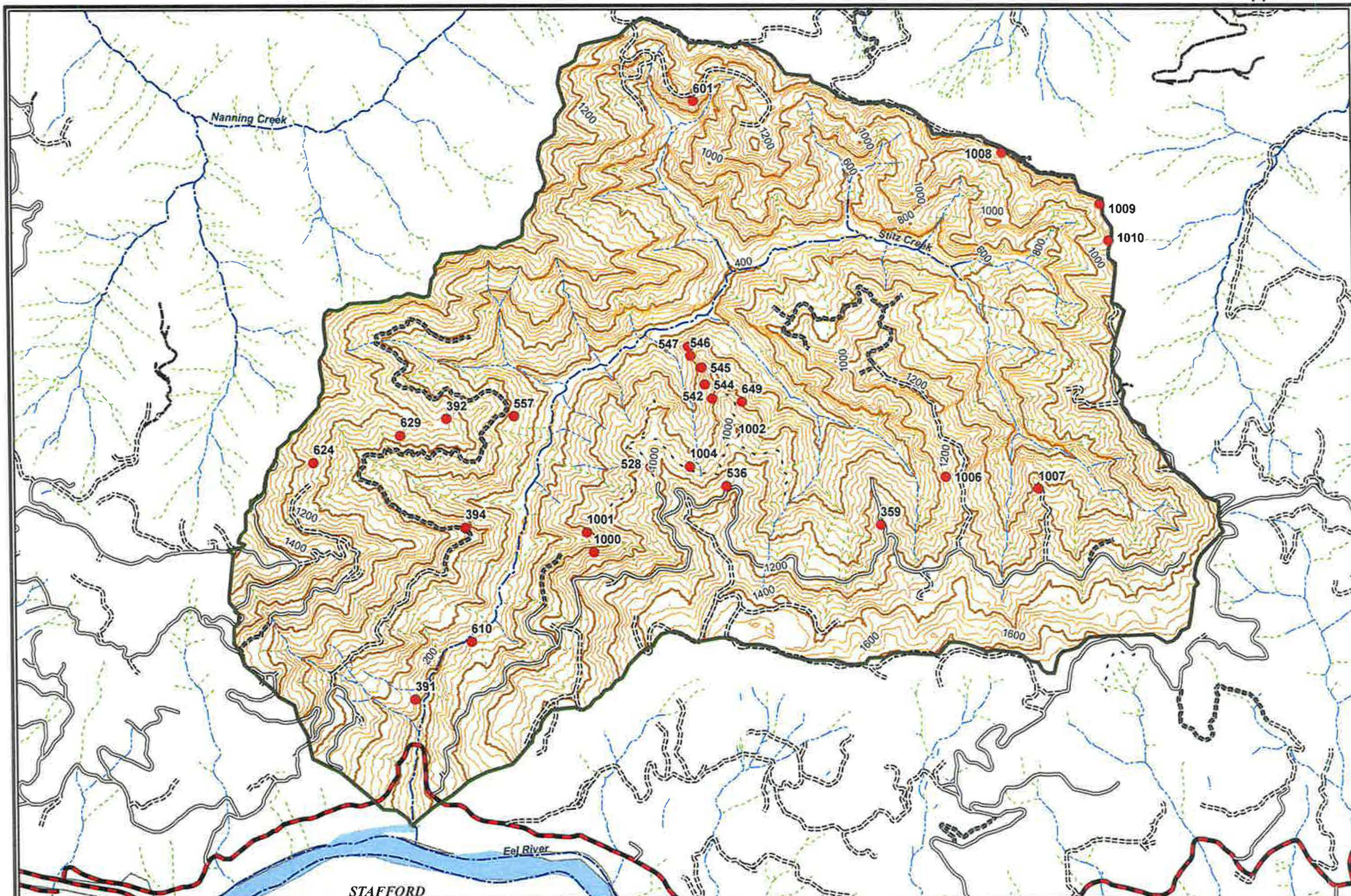

Humboldt Redwood Company, LLC

Stitz Creek, landslide inventory 2006 Air Photo

1 inch = 2,000 feet

2,000 1,000 0 2,000 Feet

Stitz LS 2006
Stitz Creek Watershed
River
Class 1
Other Private
Class 2
HRC
Class 3

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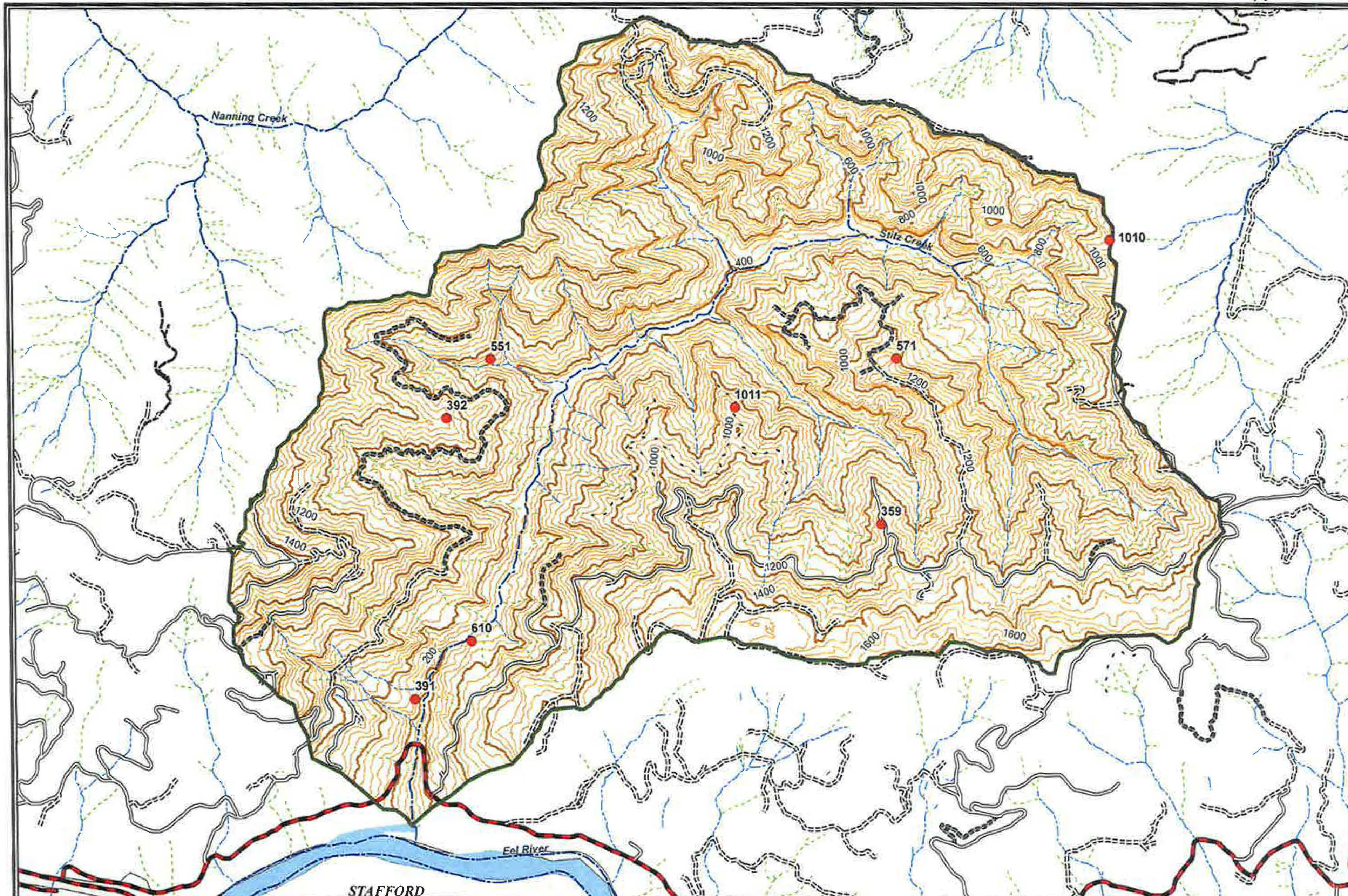

Humboldt Redwood Company, LLC

Stitz Creek, landslide inventory 2010 Air Photo

N

1 inch = 2,000 feet

2,000 1,000 0 2,000 Feet

Stitz LS 2010	Stitz Creek Watershed	River
	Class 1	Other Private
	Class 2	HRC
	Class 3	

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LS ID	Photo Year	AP #	Watershed	Subbasin	Failure Mode	Reactiv ation	Geomorphic Assoc.	Width (ft)	Length (ft)	Slide Area (ft^2)	Depth (ft)	Runout	Del	Stream Class	Road Condition (@time of AP)	SPR Y/N (@ time of slide)	Landuse Association	AP Stand Age	Volume Displaced (yd3)	% del est.	Volume Delivered (yd3)	Notes
29	2003	13-15	Lower Eel	Stitz	DS	N	CV	25	75	1473	4.4	NP	Y	3	OP	Y	RF	10-20	160	100%	160	fill failure @ DRC
30	2003	12-25	Lower Eel	Stitz	DS	Y	IG	25	75	1473	4.4	NP	N	NA	OP	Y	RF	10-20	160	0%	0	IG/SS Failure
357	2003	11-27	Lower Eel	Stitz	DFTT	Y	IG	25	75	1473	5	NP	Y	1	NA	N	NO	10-20	182	90%	164	IG failure on toe of larger existing LS
358	2003	12-25	Lower Eel	Stitz	DS	N	SW	70	50	2749	5	80	N	NA	OP	Y	RF	10-20	339	0%	0	small fill failure in broad swale
360	2003	13-15	Lower Eel	Stitz	DS	Y	SW	25	50	982	4.4	50	Y	3	NA	N	PC	10-20	107	25%	27	denser veg on left lat indicates reactivation
383	2003	11-27	Lower Eel	Stitz	DF	N	IG	50	125	4909	5	NP	Y	1	CTY RD	N	RF	>20	606	100%	606	fillslope failure on Shively Rd
384	2003	11-27	Lower Eel	Stitz	TR	N	IG	75	75	4418	10	NP	N	NA	OP	Y	RF	10-20	1091	0%	0	slumping fill from retrogression of IG, appears laid back
386	2003	12-25	Lower Eel	Stitz	DS	N	BIS	50	50	1963	4.4	50	N	NA	OP	Y	RF	10-20	213	0%	0	fill failure, lightly vegetated
391	2003	11-27	Lower Eel	Stitz	DS	N	IG	75	125	7363	4.4	NP	Y	1	NA	N	NC	<10	800	75%	600	downslope of <10 yr heli cc, within RMZ no cut
392	2003	11-28	Lower Eel	Stitz	TR	Y	SW	50	75	2945	4.4	75	Y	3	NA	N	PC	10-20	320	25%	80	retrogression of large existing LS (1997)
393	2003	11-28	Lower Eel	Stitz	DS	N	SW	75	75	4418	5	35	N	NA	AP	N	RF	10-20	545	0%	0	fill failure on steep slope
394	2003	11-28	Lower Eel	Stitz	DFTT	Y	SW	75	100	5890	15	300	Y	3	AP	N	RF	10-20	2182	75%	1636	reac. of large persistant fill failure
395	2003	13-15	Lower Eel	Stitz	DF	N	SW	25	50	982	4.4	125	Y	3	OP	Y	RF	10-20	107	25%	27	fill failure
396	2003	12-26	Lower Eel	Stitz	DF	Y	SW	75	150	8836	4.4	150	Y	2	NA	N	PC	10-20	960	10%	96	landing at head/rt lat. Retrogression of existing
397	2003	12-26	Lower Eel	Stitz	DS	N	ST	25	25	491	3	NP	Y	3	AA	Y	RF	<10	36	10%	4	slumping fill
398	2003	12-26	Lower Eel	Stitz	DS	N	SW	70	25	1374	5	NP	Y	3	AA	Y	RF	10-20	170	10%	17	fill failure/slump
399	2003	12-27	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	>20	107	0%	0	bluff failure, bluff does not support timber
400	2003	11-27	Lower Eel	Stitz	DS	N	IG	25	25	491	4.4	NP	Y	1	NA	N	NO	10-20	53	100%	53	break in canopy adjacent 610 and 611, all in shadows, non-distinct
525	2003	12-25	Lower Eel	Stitz	DS	Y	BIS	100	150	11781	4.4	100	Y	3	DC	N	PC	10-20	1280	75%	960	top in DSS upslope of IG
526	2003	12-25	Lower Eel	Stitz	DS	N	SW	25	50	982	4.4	NP	N	NA	DC	N	RF	10-20	107	0%	0	fillslope failure
527	2003	12-25	Lower Eel	Stitz	DS	N	SW	65	70	3574	5	NP	N	NA	DC	N	PC	10-20	441	0%	0	fillslope failure
528	2003	12-25	Lower Eel	Stitz	TR	Y	SW	125	225	22089	11	NP	Y	3	DC	N	RF	10-20	6000	10%	600	fillslope failure retrogressing failure on rd downslope
529	2003	12-25	Lower Eel	Stitz	TR	N	SW	80	125	7854	9	NP	Y	2	DC	N	RF	10-20	1745	25%	436	fillslope failure to rd downslope
530	2003	12-26	Lower Eel	Stitz	TR	N	SS	100	75	5890	10	NP	Y	2	NA	N	NC	10-20	1454	25%	364	steep bluff formed on hogback ridge
531	2003	12-26	Lower Eel	Stitz	DS	N	BIS	25	25	491	4.4	NP	N	NA	NA	N	CC	10-20	53	0%	0	bluff on hogback ridge
532	2003	12-26	Lower Eel	Stitz	DS	N	CV	25	50	982	4.4	NP	N	NA	NA	N	CC	<10	107	0%	0	stopped short of retained creek trees
533	2003	12-26	Lower Eel	Stitz	DS	N	BIS	25	50	982	4.4	NP	N	NA	NA	N	PC	10-20	107	0%	0	small bluff failure
534	2003	12-26	Lower Eel	Stitz	DS	Y	SW	25	75	1473	4.4	NP	N	NA	DC	N	RF	10-20	160	0%	0	retrogress old LS, log drag @ landing edge
535	2003	12-26	Lower Eel	Stitz	DFTT	N	SW	25	75	1473	4.4	125	Y	2	NA	N	PC	10-20	160	25%	40	steep draw adj small bluff
536	2003	12-26	Lower Eel	Stitz	DF	N	BL	125	50	4909	5	NP	N	NA	OP	Y	PC	10-20	606	0%	0	bluff, poss. DRC outlet at bluff
537	2003	12-26	Lower Eel	Stitz	TR	Y	BL	150	200	23562	10	NP	N	NA	DC	N	RC	10-20	5818	0%	0	bluff intersection w/rd. old LS
538	2003	12-26	Lower Eel	Stitz	DS	Y	BL	150	200	23562	10	200	Y	2	DC	N	RC	10-20	5818	25%	1454	bluff intersection w/rd. old LS
539	2003	12-26	Lower Eel	Stitz	DS	N	BL	80	75	4712	5	NP	N	NA	OP	Y	RF	10-20	582	0%	0	fill failure
540	2003	12-26	Lower Eel	Stitz	TR	Y	CV	100	100	7854	10	400	N	NA	AA	N	PC	10-20	1939	0%	0	reac. of margin of large old fill failure
541	2003	12-25	Lower Eel	Stitz	TR	Y	CV	150	300	35343	15	NP	N	NA	DC	N	PC	10-20	13090	0%	0	raveling of large old T/R LS (1997)
542	2003	12-26	Lower Eel	Stitz	DFTT	Y	SW	25	100	1963	4.4	300	Y	2	NA	N	PC	10-20	213	80%	171	poor regeneration/brush. Top of narrow steep swale on DSS
543	2003	12-26	Lower Eel	Stitz	DF	Y	BIS	25	25	491	4.4	75	N	NA	NA	N	PC	10-20	53	0%	0	poor regeneration/brush. Top of narrow steep swale on DSS react.
544	2003	12-26	Lower Eel	Stitz	DF	Y	SW	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	poor regeneration/brush. Top of narrow steep swale on DSS (headwall)
545	2003	12-26	Lower Eel	Stitz	DF	Y	BL	25	50	982	4.4	125	N	NA	NA	N	PC	10-20	107	0%	0	poor regeneration/brush. Top of narrow steep swale on DSS (headwall)
546	2003	12-26	Lower Eel	Stitz	DFTT	Y	BL	25	50	982	4.4	100	Y	2	NA	N	PC	10-20	107	10%	11	poor regeneration/brush. Top of narrow steep swale on DSS (headwall)
547	2003	12-26	Lower Eel	Stitz	DF	N	SW	50	125	4909	4.4	250	Y	1	NA	N	PC	10-20	533	50%	267	DSS on north facing dipslope ridge nose
548	2003	11-27	Lower Eel	Stitz	DFTT	N	ST	50	100	3927	4.4	400	Y	3	DC	Y	CC	10-20	427	100%	427	initiated at pulled rd xing
549	2003	12-26	Lower Eel	Stitz	DS	N	SW	25	75	1473	4.4	NP	N	NA	NA	N	PC	10-20	160	0%	0	dipslope failure
550	2003	11-29	Lower Eel	Stitz	DS	Y	IG	25	50	982	4.4	NP	Y	2	NA	N	PC	10-20	107	100%	107	IG failure large existing req'd LS cross stream
551	2003	11-29	Lower Eel	Stitz	DS	Y	IG	25	25	491	4.4	NP	Y	2	NA	N	PC	10-20	53	100%	53	IG failure
552	2003	11-29	Lower Eel	Stitz	DS	Y	IG	50	75	2945	4.4	25	Y	3	NA	N	PC	10-20	320	75%	240	reac. of portion of large IG scour
553	2003	11-29	Lower Eel	Stitz	DS	N	BIS	25	50	982	4.4	NP	N	NA	AP	N	RF	10-20	107	0%	0	fill failure
554	2003	11-29	Lower Eel	Stitz	DS	Y	IG	50	25	982	4.4	NP	Y	2	NA	N	PC	10-20	107	100%	107	IG failure
555	2003	11-29	Lower Eel	Stitz	DS	Y	IG	25	50	982	4.4	NP	Y	2	NA	N	PC	10-20	107	100%	107	IG failure
556	2003	11-28	Lower Eel	Stitz	DS	Y	SW	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	reac. of sm portion of large LS (1997)
557	2003	11-28	Lower Eel	Stitz	DS	Y	SW	100	200	15708	10	NP	N	NA	NA	N	PC	10-20	3879	0%	0	retrogression of large existing LS
558	2003	11-28	Lower Eel	Stitz	DS	Y	BIS	25	25	491	4.4	NP	Y	3	AP	N	RF	10-20	53	75%	40	reac. of fill failure
559	2003	12-26	Lower Eel	Stitz	DF	Y	SW	50	100	3927	4.4	200	Y	3	OP	Y	RC	>20	427	75%	320	retrogression of large existng rd failure (unstable landform)
560	2003	12-26	Lower Eel	Stitz	TR	N	IG	100	175	13744	10	NP	Y	2	NA	N	CC	>20	3394	10%	339	large triangular T/R failure w/ds at toe
561	2003	12-26	Lower Eel	Stitz	DS	Y	IG	75	100	5890	4.4	NP	Y	2	NA	N	CC	>20	640	25%	160	IG failure
562	2003	12-26	Lower Eel	Stitz	DS	N	BL	25	50	982	4.4	NP	Y	3	NA	N	CC	<20	107	50%	53	steep bluff
563	2003	12-25	Lower Eel	Stitz	DS	N	SW	50	150	5890	3	75	N	NA	UG	N	RF	>20	436	0%	0	sm landing failure. No del.
564	2003	12-26	Lower Eel	Stitz	DS	Y	BIS	25	25	491	4.4	NP	N	NA	NA	N	CC	<20	53	0%	0	sm. failure from bluff
565	2003	12-26	Lower Eel	Stitz	DS	Y	BIS	25	25	491	4.4	NP	N	NA	NA	N	CC	<20	53	0%	0	bluff failure
566	2003	12-26	Lower Eel	Stitz	DS	Y	SW	75	75	4418	4.4	NP	N	NA	AP	Y	CC	<20	480	0%	0	rd crossing bluff w/large existing LS downslope (1997)
567	2003	12-26	Lower Eel	Stitz	DS	Y	SW	25	50	982	4.4	NP	Y	3	NA	N	NO	>20	107	25%	27	IG failure
568	2003	12-26	Lower Eel	Stitz	DS	Y	IG	50	25	982	4.4	NP	Y	2	NA	N	NO	>20	107	50%	53	IG failure
569	2003	13-16	Lower Eel	Stitz	DS	Y	IG	25	50	982	4.4	NP	Y	3	NA	N	NO	<10	107	10%	11	ravel of toe region of large existing slide (1997)
570	2003	13-16	Lower Eel	Stitz	DS	Y	IG	50	25	982	4.4	NP	N	NA	NA	N	PC	<10	107	0%	0	retrogression of IG slope failure
571	2003	12-26	Lower Eel	Stitz	DS	Y	BL	25	75	1473	4.4	NP	N	NA	NA	N	CC	<20	160	0%	0	bluff failure
572	2003	12-26	Lower Eel	Stitz	DS	Y	SW	75	50	2945	4.4	NP	N	NA	NA	N	CC	<20	320	0%	0	bluff failure
573	2003	13-16	Lower Eel	Stitz	DS	Y	BL	50	100	3927	4.4	NP	N	NA	NA	N	CC	<20	427	0%	0	steep slope/bluff failure
574	2003	13-16	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	CC	<20	107	0%	0	steep slope/bluff failure
575	2003	12-26	Lower Eel	Stitz	DS	N	BIS	25	25	491	4.4	NP	N	NA	OP	Y	CC	>20	53	0%	0	fill failure

LS ID	Photo Year	AP #	Watershed	Subbasin	Failure Mode	Reactivation	Geomorphic Assoc.	Width (ft)	Length (ft)	Slide Area (ft^2)	Depth (ft)	Runout	Del	Stream Class	Road Condition (@time of AP)	SPR Y/N (@ time of slide)	Landuse Association	AP Stand Age	Volume Displaced (yd3)	% del est.	Volume Delivered (yd3)	Notes
576	2003	12-26	Lower Eel	Stitz	DS	Y	SW	25	25	491	4.4	NP	N	NA	NA	N	CC	>20	53	0%	0	reac. of larger existing LS (1997)
577	2003	13-16	Lower Eel	Stitz	DFTT	Y	SW	25	75	1473	4.4	50	Y	3	NA	N	CC	>20	160	50%	80	reac. of existing LS (1997)
578	2003	13-16	Lower Eel	Stitz	DS	Y	IG	25	75	1473	4.4	NP	Y	2	NA	N	CC	>20	160	50%	80	IG failure
579	2003	12-26	Lower Eel	Stitz	DS	N	BIS	25	100	1963	4.4	NP	N	NA	NA	N	CC	<20	213	0%	0	old dormant LS mainscope?
580	2003	13-17	Lower Eel	Stitz	DFTT	Y	SW	25	50	982	4.4	NP	Y	3	NA	N	CC	<20	107	50%	53	reac. of existing LS (1997)
581	2003	13-17	Lower Eel	Stitz	DS	N	BIS	25	25	491	4.4	NP	N	NA	NA	N	CC	<20	53	0%	0	steep slope (dipslope)
582	2003	13-18	Lower Eel	Stitz	DS	N	SS	25	25	491	4.4	NP	Y	2	NA	N	CC	<20	53	50%	27	bank scour/slump
583	2003	13-17	Lower Eel	Stitz	DS	Y	IG	75	200	11781	4.4	NP	Y	2	NA	N	NO	>20	1280	50%	640	IG SS failure, partially obscured by shadows
584	2003	13-18	Lower Eel	Stitz	DS	Y	BL	75	200	11781	4.4	150	Y	3	NA	N	NO	<10	1280	75%	960	bluff failure, 2001 heli CC down slope
585	2003	12-27	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	>20	107	0%	0	bluff failure
586	2003	12-27	Lower Eel	Stitz	DS	Y	BL	25	25	491	4.4	NP	N	NA	NA	N	NO	>20	53	0%	0	bluff failure
587	2003	12-27	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	>20	107	0%	0	bluff failure
588	2003	12-27	Lower Eel	Stitz	DS	Y	BL	25	25	491	4.4	NP	N	NA	NA	N	NO	>20	53	0%	0	bluff failure
589	2003	12-27	Lower Eel	Stitz	DS	Y	BL	25	25	491	4.4	NP	N	NA	NA	N	NO	>20	53	0%	0	bluff failure
590	2003	12-27	Lower Eel	Stitz	DFTT	Y	SS	25	50	982	4.4	75	Y	1	NA	N	NO	>20	107	100%	107	bluff crossing stream
591	2003	12-27	Lower Eel	Stitz	DS	Y	SW	25	50	982	4.4	NP	N	NA	NA	N	NO	>20	107	0%	0	bluff/swale failure
592	2003	11-29	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	>20	107	0%	0	bluff failure
593	2003	12-28	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	<10	107	0%	0	bluff failure
594	2003	12-28	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	<10	107	0%	0	bluff failure
595	2003	12-28	Lower Eel	Stitz	DS	Y	BIS	25	50	982	4.4	NP	N	NA	NA	N	NO	<10	107	0%	0	bluff failure
596	2003	12-28	Lower Eel	Stitz	DS	Y	BL	50	75	2945	4.4	NP	N	NA	NA	N	CC	<10	320	0%	0	bluff failure, legacy road upslope
597	2003	12-28	Lower Eel	Stitz	DS	Y	BL	25	50	982	4.4	100	N	NA	NA	N	NO	>20	107	0%	0	bluff retrogression
598	2003	12-28	Lower Eel	Stitz	TR	Y	BL	50	100	3927	4.4	NP	N	NA	NA	N	CC	<10	427	0%	0	cutbank/bluff failure
599	2003	12-28	Lower Eel	Stitz	DFTT	Y	BL	25	50	982	4.4	100	Y	2	NA	N	PC	>20	107	75%	80	IG failure
600	2003	12-28	Lower Eel	Stitz	DS	N	SW	75	25	1473	4.4	NP	N	NA	NA	N	SK	>20	160	0%	0	dip-slope failure
601	2003	12-28	Lower Eel	Stitz	DFTT	N	SW	25	75	1473	4.4	200	Y	2	NA	N	CC	>20	160	25%	40	steep swale, legacy road upslope
602	2003	12-28	Lower Eel	Stitz	DS	Y	BL	50	75	2945	4.4	100	Y	2	NA	N	PC	>20	320	25%	80	bluff failure
603	2003	12-28	Lower Eel	Stitz	DFTT	N	SW	25	50	982	4.4	200	Y	2	OP	N	RF	>20	107	50%	53	pulled crossing failure
604	2003	12-28	Lower Eel	Stitz	DS	N	PL	25	50	982	4.4	75	Y	2	NA	N	PC	>20	107	50%	53	cutbank failure
605	2003	11-27	Lower Eel	Stitz	DF	Y	IG	50	100	3927	9	NP	Y	1	NA	N	NO	>20	873	50%	436	IG failure at mouth of Stitz
606	2003	11-27	Lower Eel	Stitz	DS	Y	PL	75	75	4418	5	NP	Y	1	NA	N	SK	<10	545	100%	545	reac. of large IG failure toe of huge deep LS toe @ LS 384
607	2003	11-27	Lower Eel	Stitz	DS	N	SS	25	25	491	4.4	NP	Y	2	NA	N	NC	>20	53	100%	53	Class II retention CC both sites <10 yr old CC
608	2003	11-27	Lower Eel	Stitz	DS	N	SS	25	25	491	4.4	NP	Y	2	NA	N	NC	>20	53	100%	53	Class II retention pre HCP CC bank scour
609	2003	11-27	Lower Eel	Stitz	DS	Y	IG	25	25	491	4.4	NP	Y	2	NA	N	NC	>20	53	100%	53	bank slump in IG
610	2003	11-27	Lower Eel	Stitz	DS	Y	SS	75	75	4418	10	NP	Y	1	NA	N	NC	>20	1091	100%	1091	IG scour on outside bend of Stitz
611	2003	11-27	Lower Eel	Stitz	DS	Y	IG	50	100	3927	4.4	NP	Y	1	NA	N	NO	<20	427	100%	427	reac. of toe of large IG failure (1997)
612	2003	11-27	Lower Eel	Stitz	TR	N	SW	75	75	4418	4.4	NP	N	NA	NA	N	PC	>20	480	0%	0	slump I swale adj WC
613	2003	11-27	Lower Eel	Stitz	DS	N	SS	50	100	3927	7	NP	Y	2	OP	N	RF	<10	679	75%	509	fill failure at crossing reac. of larger LS/withn RMZ pulled xing
614	2003	11-27	Lower Eel	Stitz	TR	N	BIS	25	75	1473	4	NP	N	NA	OP	N	RC	<10	145	0%	0	cutbank failure
615	2003	11-27	Lower Eel	Stitz	DS	N	ST	25	50	982	5	NP	Y	3	OP	N	RX	<10	121	25%	30	fill slup @ xing
616	2003	11-27	Lower Eel	Stitz	DS	N	BIS	50	30	1178	3	NP	N	NA	OP	N	RC	<10	87	0%	0	cutbank ravel
617	2003	11-27	Lower Eel	Stitz	DS	Y	SW	25	100	1963	4.4	NP	N	NA	OP	N	RC	10-20	213	0%	0	reac. of existing larger cutbank failire
618	2003	11-28	Lower Eel	Stitz	TR	Y	BIS	50	100	3927	4.4	NP	N	NA	NA	N	NO	10-20	427	0%	0	reac. of existing LS mostly translatinal
619	2003	11-28	Lower Eel	Stitz	TR	N	BL	50	75	2945	4.4	NP	N	NA	OP	N	RC	10-20	320	0%	0	cutbank slump onto road surface
620	2003	11-28	Lower Eel	Stitz	DS	N	BL	25	25	491	4.4	NP	N	NA	OP	N	RF	10-20	53	0%	0	fill failure
621	2003	11-28	Lower Eel	Stitz	DS	N	BL	75	75	4418	4.4	NP	N	NA	OP	N	RF	10-20	480	0%	0	fill failure - landing
622	2003	11-28	Lower Eel	Stitz	DS	N	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	10-20	107	0%	0	bluff slump
623	2003	11-28	Lower Eel	Stitz	DS	Y	SW	25	25	491	4.4	NP	N	NA	NA	N	NO	10-20	53	0%	0	reac. of portion of larger existing LS (1997)
624	2003	11-28	Lower Eel	Stitz	DS	Y	BL	50	50	1963	4.4	NP	N	NA	NA	N	PC	10-20	213	0%	0	raveling mainscarp of existing larger LS
625	2003	11-28	Lower Eel	Stitz	DS	Y	BL	25	75	1473	4.4	NP	N	NA	NA	N	PC	10-20	160	0%	0	retrogression of rt. lat. of existing large LS (1997)
626	2003	11-28	Lower Eel	Stitz	DFTT	Y	SW	25	50	982	3	50	Y	3	AP	N	RF	10-20	73	10%	7	persistant fill failure, larger before
627	2003	11-28	Lower Eel	Stitz	DS	Y	BIS	25	50	982	4.4	200	N	NA	NA	N	SK	10-20	107	0%	0	reac. of existing larger LS (1997)
628	2003	11-28	Lower Eel	Stitz	TR	N	BIS	50	50	1963	3	NP	N	NA	AP	N	RC	10-20	145	0%	0	cutbank slump
629	2003	11-28	Lower Eel	Stitz	DS	N	SW	25	25	491	4.4	NP	N	NA	NA	N	SK	10-20	53	0%	0	steep swale on ridgeline
630	2003	11-28	Lower Eel	Stitz	DS	Y	SW	50	100	3927	4	NP	N	NA	AP	N	RC	10-20	388	0%	0	reac. of older LS
631	2003	11-28	Lower Eel	Stitz	DS	Y	BIS	50	25	982	4.4	NP	N	NA	AP	N	RC	10-20	107	0%	0	cutbank reac.
632	2003	11-28	Lower Eel	Stitz	DS	N	SS	50	50	1963	4	50	Y	3	AP	N	RF	10-20	194	50%	97	fill slope failure
633	2003	11-28	Lower Eel	Stitz	DS	N	BIS	25	75	1473	4.4	NP	N	NA	NA	N	NO	10-20	160	0%	0	very steep slope
634	2003	11-28	Lower Eel	Stitz	DS	N	CC	25	75	1473	4.4	NP	N	NA	AP	N	RC	10-20	160	0%	0	cutbank failure
635	2003	11-28	Lower Eel	Stitz	DFTT	N	SW	25	50	982	4.4	150	N	NA	AP	N	RF	10-20	107	0%	0	landing fill failure
636	2003	11-28	Lower Eel	Stitz	DS	Y	BIS	50	50	1963	4.4	NP	N	NA	AP	N	RC	10-20	213	0%	0	retrogression of large existing LS (1997,unstable landform)
637	2003	11-29	Lower Eel	Stitz	DS	Y	BL	25	75	1473	4.4	100	N	NA	NA	N	SK	10-20	160	0%	0	reac. bluff failure
638	2003	11-29	Lower Eel	Stitz	DS	Y	BL	25	75	1473	4.4	NP	N	NA	NA	N	SK	10-20	160	0%	0	reac. bluff failure
639	2003	11-29	Lower Eel	Stitz	DS	Y	SW	50	50	1963	4.4	NP	N	NA	NA	N	NO	10-20	213	0%	0	slump on top of SS slope
640	2003	11-29	Lower Eel	Stitz	DS	Y	ST	25	50	982	4.4	NP	Y	3	NA	N	NO	>20	107	75%	80	SS slump into scour by previous older large LS
641	2003	11-29	Lower Eel	Stitz	DS	N	BL	25	50	982	4.4	NP	N	NA	NA	N	NO	>20	107	0%	0	bare bluff failure
642	2003	11-29	Lower Eel	Stitz	DS	N	BL	25	25	491	4.4	50	N	NA	NA	N	NO	>20	53	0%	0	bare bluff failure
643	2003	13-15	Lower Eel	Stitz	DS	N	SS	25	25	491	4.4	NP	Y	3	NA	N	PC	10-20	53	50%	27	SS failure
644	2003	12-26	Lower Eel	Stitz	DS	Y	BIS	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	raveling main scarp of dormant LS

LS ID	Photo Year	AP #	Watershed	Subbasin	Failure Mode	Reactivation	Geomorphic Assoc.	Width (ft)	Length (ft)	Slide Area (ft^2)	Depth (ft)	Runout	Del	Stream Class	Road Condition (@time of AP)	SPR Y/N (@ time of slide)	Landuse Association	AP Stand Age	Volume Displaced (yd3)	% del est.	Volume Delivered (yd3)	Notes
645	2003	12-26	Lower Eel	Stitz	DS	N	PL	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	on planner slope ~ 75' upslope WC
646	2003	12-26	Lower Eel	Stitz	DS	Y	PL	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	poor regen. Reac of DSS
647	2003	12-26	Lower Eel	Stitz	TR	Y	BIS	25	50	982	4.4	NP	N	NA	NA	N	PC	10-20	107	0%	0	poor regen. Reac of DSS
648	2003	12-26	Lower Eel	Stitz	DS	N	SS	50	25	982	4.4	50	Y	3	NA	N	PC	10-20	107	50%	53	SS failure
649	2003	12-26	Lower Eel	Stitz	DFTT	Y	SW	25	50	982	4.4	75	N	NA	NA	N	PC	10-20	107	0%	0	in toe of older longer LS (1997)
650	2003	12-26	Lower Eel	Stitz	DS	Y	SW	25	25	491	4.4	NP	Y	3	NA	N	PC	10-20	53	10%	5	reac. of body of existing large LS (1997)
651	2003	12-25	Lower Eel	Stitz	DS	N	BL	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	bluff failure
652	2003	12-25	Lower Eel	Stitz	DS	N	SS	25	50	982	4.4	NP	Y	3	NA	N	PC	10-20	107	50%	53	SS failure
653	2003	12-25	Lower Eel	Stitz	DS	N	SS	100	100	7854	9	50	Y	3	OP	Y	RF	10-20	1745	75%	1309	landing fill failure @ xing
654	2003	12-25	Lower Eel	Stitz	TR	N	SW	75	125	7363	4.4	100	Y	3	NA	N	PC	10-20	800	25%	200	dipslope headwall swale
655	2003	13-15	Lower Eel	Stitz	TR	N	SS	100	150	11781	4.4	NP	Y	3	NA	N	PC	10-20	1280	25%	320	SS failure
656	2003	13-16	Lower Eel	Stitz	TR	Y	BIS	50	50	1963	4.4	NP	N	NA	NA	N	PC	10-20	213	0%	0	bluff failure/slump
657	2003	13-16	Lower Eel	Stitz	DS	Y	BIS	25	75	1473	4.4	NP	N	NA	NA	N	PC	10-20	160	0%	0	reac. of existing LS (1997)
658	2003	13-16	Lower Eel	Stitz	DS	N	BL	25	75	1473	4.4	NP	N	NA	NA	N	PC	10-20	160	0%	0	bluff failure
659	2003	13-16	Lower Eel	Stitz	DS	Y	IG	25	50	982	4.4	NP	Y	2	NA	N	NC	<10	107	100%	107	IG failure, 2 yr old CC upslope
660	2003	13-16	Lower Eel	Stitz	DS	Y	IG	25	25	491	4.4	NP	Y	2	NA	N	NC	<10	53	75%	40	IG failure, 2 yr old CC upslope
661	2003	13-17	Lower Eel	Stitz	DS	N	BL	25	25	491	4.4	25	N	NA	NA	N	CC	<10	53	0%	0	bluff failure
662	2003	13-17	Lower Eel	Stitz	DS	N	BL	25	50	982	4.4	NP	N	NA	NA	N	CC	<10	107	0%	0	bluff failure
663	2003	13-16	Lower Eel	Stitz	DF	Y	SW	25	50	982	4.4	25	N	NA	NA	N	PC	10-20	107	0%	0	reac. of existing LS
664	2003	13-16	Lower Eel	Stitz	DS	N	BIS	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	fill slump failure
665	2003	13-16	Lower Eel	Stitz	DS	N	SW	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	down slope from landing
666	2003	13-16	Lower Eel	Stitz	TR	N	SW	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	open slope
667	2003	13-15	Lower Eel	Stitz	DS	N	SS	25	25	491	4.4	NP	Y	3	NA	N	PC	10-20	53	10%	5	~50' upslope from WC
668	2003	13-15	Lower Eel	Stitz	DS	Y	SS	25	25	491	4.4	NP	N	NA	NA	N	PC	10-20	53	0%	0	reac. of longer flow
669	2003	13-15	Lower Eel	Stitz	DS	Y	BIS	50	75	2945	4.4	NP	N	NA	NA	N	PC	10-20	320	0%	0	reac. of existing LS
670	2003	13-16	Lower Eel	Stitz	DS	N	BL	25	25	491	4.4	NP	Y	2	NA	N	CC	<10	53	10%	5	recent cut, bottom of unit 1a/SS, end slope
671	2003	12-28	Lower Eel	Stitz	DS	N	DSS	75	25	1473	4.4	NP	N	NA	NA	N	CC	<10	160	0%	0	bluff failure/recent cut
672	2003	13-16	Lower Eel	Stitz	TR	N	SS	25	75	1473	4.4	50	Y	2	NA	N	CC	<10	160	10%	16	on edge of Class II buffer

LS ID	Photo Year	AP #	Watershed	Subbasin	Failure Mode	Reactivation	Geomorphic Assoc.	Width (ft)	Length (ft)	Slide Area (ft^2)	Depth (ft)	Runout	Del	Stream Class	Condition (@time of	(@ time of slide)	SPR Bank Year	Landuse Association	AP Stand Age	Displace (yd3)	% del est.	Delivered (yd3)	LS ID	AP Notes
391	2006	13-24	Lwr Eel Rvr	Stitz	DS	Y	CV	50	130	5105	5	75	Y	1	NA	N	NA	NC	<10	630	25%	158	391	head & L lat reactivated, heli CC upslope of expanded RMZ no cut
392	2006	13-25	Lwr Eel Rvr	Stitz	DS	Y	SW	100	500	39270	4.4	150	Y	3	NA	N	NA	SK	>20	4266	5%	213	392	small reactivation in '03, whole slide react in '06
394	2006	13-24	Lwr Eel Rvr	Stitz	DFTT	Y	SW	75	150	8836	4.4	250	Y	3	AP	N	NA	RF	10-20	960	10%	96	394	reactivated in '03, remains bare and larger in '06
528	2006	14-24	Lwr Eel Rvr	Stitz	DS	Y	SW	75	100	5890	9	NP	Y	3	AA	N	NA	RF	10-20	1309	10%	131	528	retrogressing upslope
542	2006	13-25	Lwr Eel Rvr	Stitz	DS	Y	PL	25	25	491	4.4	NP	N	NA	NA	N	NA	PC	10-20	53	0%	0	542	on brush covered DSS
544	2006	13-25	Lwr Eel Rvr	Stitz	DS	Y	PL	25	25	491	4.4	NP	N	NA	NA	N	NA	PC	10-20	53	0%	0	544	on brush covered DSS
545	2006	13-25	Lwr Eel Rvr	Stitz	DFTT	Y	SW	20	50	785	4.4	50	Y	3	NA	N	NA	CC	10-20	85	5%	4	545	react @ lower lat margin, side suck
546	2006	13-25	Lwr Eel Rvr	Stitz	DS	Y	BL	25	25	491	4.4	20	N	NA	NA	N	NA	PC	10-20	53	0%	0	546	bluff toppel
547	2006	13-25	Lwr Eel Rvr	Stitz	DFTT	Y	SW	25	80	1571	4.4	100	N	NA	NA	N	NA	PC	10-20	171	0%	0	547	reactivation much smaller that initial event
557	2006	13-25	Lwr Eel Rvr	Stitz	TR	Y	PL	75	200	11781	4.4	100	N	NA	NA	N	NA	PC	10-20	1280	0%	0	557	react along L lat margin, bulk of slide mass did not move
601	2006	13-25	Lwr Eel Rvr	Stitz	DFTT	Y	SW	25	50	982	4.4	25	N	NA	NA	N	NA	PC	<10	107	0%	0	601	react at head much smaller than initial event
610	2006	13-24	Lwr Eel Rvr	Stitz	DS	Y	IG	75	75	4418	5	NP	Y	1	NA	N	NA	PC	>20	545	100%	545	610	3 small active areas add up to 75' x 75' w/in 610
624	2006	12-25	Lwr Eel Rvr	Stitz	DS	Y	BIS	50	50	1963	4.4	NP	N	NA	NA	N	NA	PC	10-20	213	0%	0	624	raveling scarp
629	2006	13-25	Lwr Eel Rvr	Stitz	DS	Y	SW	35	125	3436	4.4	50	N	NA	NA	N	NA	SK	10-20	373	0%	0	629	very hard to tell if 629 is same slide from '03 (630,632,627,628,?) veged over by
649	2006	14-24	Lwr Eel Rvr	Stitz	DFTT	Y	SW	50	200	7854	4.4	325	Y	3	NA	N	NA	PC	10-20	853	70%	597	649	react from 1997 (?)
1000	2006	13-24	Lwr Eel Rvr	Stitz	DS	N	SS	100	150	11781	4.4	75	Y	3	NA	N	NA	PC	10-20	1280	75%	960	1000	no reg. very high albedo
1001	2006	13-24	Lwr Eel Rvr	Stitz	DS	Y	SS	50	125	4909	4.4	NP	Y	3	NA	N	NA	PC	10-20	533	75%	400	1001	reactivation @ toe of larger DH, DS
1002	2006	13-25	Lwr Eel Rvr	Stitz	DS	Y	SW	25	50	982	4.4	40	N	NA	NA	N	NA	CC	<10	107	0%	0	1002	on brush covered DSS
536	2006	14-24	Lwr Eel Rvr	Stitz	TR	Y	SW	100	75	5890	5	600	Y	3	OP	Y	2000	RF	10-20	727	50%	364	1003	~50' NE of LS 536
1004	2006	14-24	Lwr Eel Rvr	Stitz	DS	N	SS	40	100	3142	4.4	150	Y	3	DC	N	NA	RF	10-20	341	60%	205	1004	back tilted tree down slope of head indicates not full evacuation
359	2006	14-24	Lwr Eel Rvr	Stitz	DFTT	Y	SW	100	300	23562	12	1000	Y	2	OP	Y	2000	RRF	10-20	6981	75%	5236	359	clearly fill related, huge runout
1006	2006	14-24	Lwr Eel Rvr	Stitz	DS	Y	SS	75	275	16199	4.4	150	Y	3	NA	N	NA	CC	10-20	1760	50%	880	1006	react from toe of older feature not ID in 2003
1007	2006	14-24	Lwr Eel Rvr	Stitz	DS	Y	SS	75	400	23562	5	NP	Y	3	OP	Y	2000	RF	10-20	2909	30%	873	1007	shallow raveling, react event did not affect initial slide
1008	2006	14-24	Lwr Eel Rvr	Stitz	DS	N	BL	25	150	2945	4.4	50	N	NA	NA	N	NA	CC	<10	320	0%	0	1008	bluff failure
1009	2006	14-24	Lwr Eel Rvr	Stitz	DS	N	BL	25	50	982	4.4	NP	N	NA	NA	N	NA	CC	<10	107	0%	0	1009	small bluff toppel
1010	2006	14-24	Lwr Eel Rvr	Stitz	DS	N	BL	25	50	982	4.4	NP	N	NA	NA	N	NA	CC	<10	107	0%	0	1010	small bluff toppel

LS ID	Photo Year	AP #	Watershed	Subbasin	Failure Mode	Reactivation	Geomorphic Assoc.	Width (ft)	Length (ft)	Slide Area (ft^2)	Depth (ft)	Runout (ft)	Del	Stream Class	Road Condition (@time of AP)	SPR Y/N (@ time of slide)	Landuse Association	AP Stand Age	AP Volume Displaced (yd^3)	% del est.	AP Volume Delivered (yd^3)	Notes
391	2010	15-23	Lwr Eel Rvr	Stitz	DS	Y	IG	50	40	1571	5	30	N	1	NA	N	NC	<10	194	0%	0	small react at head
392	2010	15-24	Lwr Eel Rvr	Stitz	DF	Y	ST	100	275	21598	10	950	Y	3	NA	N	SK	>20	5333	90%	4800	fresh in '07, full react of pre-existing LS, abandon mid-sloperd @ base of evac zone
551	2010	15-24	Lwr Eel Rvr	Stitz	DS	Y	IG	25	25	491	4.4	NP	Y	2	NA	N	PC	>20	53	100%	53	high albedo area in creek appears to corrolate w/551
571	2010	16-23	Lwr Eel Rvr	Stitz	DS	Y	SW	25	25	491	4.4	25	N	NA	NA	N	CC	10-20	53	0%	0	raveling of head scarp from 2003 event
610	2010	15-23	Lwr Eel Rvr	Stitz	DS	Y	IG	25	75	1473	4.4	NP	Y	1	NA	N	PC	>20	160	100%	160	persistant IG failure on outside bend Stitz
1011	2010	16-23	Lwr Eel Rvr	Stitz	DF	N	SW	25	75	1473	4.4	100	N	NA	NA	N	CC	>20	160	0%	0	initiated upslope of 649. Does not appear to be retrogression
359	2010	16-22	Lwr Eel Rvr	Stitz	DS	Y	SW	25	75	1473	4.4	50	N	NA	OP	Y	RF	>20	160	0%	0	initiated at head of LS 359
1010	2010	16-22	Lwr Eel Rvr	Stitz	DS	Y	SS	30	110	2592	4.4	NP	Y	3	NA	N	CC	>20	282	25%	70	initialed at toe, it's close to creek, del?

Appendix G: Landslides and Associated THPs

THP	THP Acres	# LS							
84-440	307.9	34	grnd-bsd str	392 393 550 - 558 617 - 639					
85-113	114.7	1		654					
85-616	117.2	12	cbl str	30 386 525 526 527 528 529 536 539 1000 1001 1004					
86EM-004	11.6	0							
86-086	50.2	4		360 643 644 1006					
86-198	39.2	1		562					
86-577	102.4	6		358 359 650 651 652 653					
86-644	54.9	18	cbl str	29 395 575 - 578 655 - 658 663 - 669 1007					
87-178	83.2	4		394 400 610 611					
87-342	117.4	22	cbl str	396 535 537 538 540 - 549 560 561 645 -649 1002 1011					
88-452	62.3	6		571 572 573 574 581 582					
89-826	99.6	2		384 563					
90-404	1.1	0							
92-378	92.7	3		548 606 607					
93-112	118.1	2		612 613					
94-138	100.7	7	grnd-bsd str, cbl cc	397 398 564 565 566 579 580 581					
95-150	60.5	5		530 531 532 533 534					
96-407	108.1	8		661 662 670 671 672 1008 1009 1010					
98-089	33.9	0	**#LS pre-hcp**	135	**pre-hcp acre**	1675.70	**ls/acre/yr pre-hcp**	0.0058	14 yr
00-415	27.1	0							
00-479	1.9	0							
01-141	56.6	0							
01-425	14.5	0							
01-152	87.6	2	heli shr, rcb	614 616					
02-244	1.6	0							
04-078	9.3	0							
04-139	73.1	3	heli thin, bluff	586 589 590					
04-235	20.8	0							
05-040	1.5	0							
07-161	158.4	0	**#LS post-hcp**	5	**post-hcp acre**	452.40	**ls/acre/yr post-hcp**	0.0014	8 yr
no thp	623.7	37	**#LS no cut/thp**	35	**no cut/thp acre**	623.70	**ls/acre/yr no cut/thp**	0.0026	22 yr
Total	2751.8	177							

Explanation for Mass Wasting Inventory Form

LS ID: Landslide Identification code corresponding to the landslide designation used in the geologic report and maps .

AP #: Aerial Photographic number corresponding to the flight-line and frame of the image in which the landslide was observed.

Failure Mode: Description of the failure mode of the mass-wasting feature or the geomorphic feature.

DS	Debris slide
DF	Debris flow
DFTT	Debris flow/Torrent track
TR	Translational/Rotational slide
EF	Earthflow
DG	Disturbed ground

Geomorphic Association: Observed geomorphology at the initiation point (upper-most point) of the mass-wasting feature.

DSS	Debris Slide Slope
HW	Headwall
SS	Stream Side
ST	Stream Channel
SW	Swale Channel
BIS	Major Break-In-Slope on hillslope, not inner gorge
PL	Planar
BL	Bluff
IG	Inner Gorge

Land Use Association:

CC	Clear Cut
NC	No Cut
NO	No Land Use Association
PC	Partial Cut
RC	Road Cut Slope

RF	Road Fill Slope
RX	Road Stream Crossing
SK	Skid Trail

Road Condition: The observed condition of the road at the time the aerial photograph was taken

AA	Abandon Actively
AP	Abandon Passively
DC	Decommissioned
OP	Open
UG	Upgraded

Other Abbreviations:

Y	Yes
N	No
NA	Not Applicable
% del est	Estimated Percent Delivery