SIX RIVERS NATIONAL FOREST SERVICE

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Water Quality Monitoring and Reporting Program Annual Report
(Reporting Period 2015)

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INTRODUCTION

This Monitoring and Reporting Program (MRP) is associated with the Categorical Waiver of Waste Discharge Requirements for Nonpoint Source Discharges on National Forest Lands Order Number R1-2015-0021 (hereinafter referred to as "Waiver"). The terms and conditions of the Waiver stipulate a monitoring and reporting program that assesses water quality in upland watersheds as well as in-stream channel reaches. This MRP provides the annual report on the suite of monitoring activities [for the Six Rivers National Forest Water Quality Assurance Protection Plan (QAPP)]. The U.S. Forest Service is responsible for conducting monitoring as required in the Six Rivers Land and Resource Management Plan (LRMP) and in the Waiver MRP. The North Coast Regional Water Quality Control Board is responsible for reviewing and approving the Forest Service monitoring plan.

Water quality monitoring activities are required in the Waiver (Monitoring and Reporting Program No. R1-2015-0021 – October 8, 2015) and include upslope monitoring actions such as Best Management Program Effectiveness Monitoring (BMPEP), use of implementation Checklists, Roads and Trails patrols and inspections, as well as Baseline In-Channel Monitoring across the forest in selected watersheds. In addition, the annual MRP includes a summary of the annual watershed restoration actions implemented in selected watersheds to reduce sedimentation and other water quality concerns described in TMDLs for the Klamath, Trinity, Eel, and Mad River watersheds. This MRP also summarizes stream temperature monitoring.

Water Quality Monitoring Objectives

The objectives of the MRP program are to:

1. Determine whether BMPs collectively are effective in protecting and improving water quality at the watershed scale. BMP effectiveness will be assessed by monitoring trends in channel characteristics that affect beneficial uses and by comparing measures of central tendency for channel characteristics of streams downstream of managed areas with those in reference watersheds
2. Share monitoring results and trends of in-channel monitoring.
3. Share annual watershed and fisheries restoration activities that implement goals and objectives lined out in watersheds with TMDL requirements.
4. Share other incidental monitoring activities that occur on the forest as they apply to watershed condition and beneficial uses.

MONITORING AND REPORTING: HILLSLOPE MONITORING

Hillslope monitoring includes the assessment of water quality associated with current management activities and a process for describing corrective actions taken to address water quality implementation or effectiveness problems. This section will describe the regional and national BMP, Waiver Implementation Checklists, Road and Trail Annual Maintenance and Storm patrols and their associated protocols and annual reporting requirements.

Best Management Practices Evaluation Program (BMPEP)

Since the 1980's the Forest Service in California has adopted regional BMPs and implemented the BMPEP program with oversight by the Regional and State Water Boards. All projects that could affect water quality are subject to monitoring under the Pacific Southwest Region's (Region 5) Best Management Practices Evaluation Program (BMPEP). The BMPs are described in the Region 5 Forest Service Handbook 2509.22 – Chapter 10 Water Quality Management Handbook. BMPEP monitoring protocols and forms were updated and are available upon request. A new National Best Management Practices Technical Guide was adopted in 2012 (USDA, Forest Service, 2012). Then in 2013 Volume 2 National Core BMP Monitoring Protocols Technical Guide; FS-990b was adopted. Forest Service Region 5 is in the process of transitioning to only conducting National BMP evaluations in 2017, with both Regional and National BMP evaluations being conducting 2013-2016. The Forest Service Regional Office directed Region 5 Forests to complete 12 National BMPs during fiscal years 2015 and 2016. If a comparable Regional BMP does not exist, the direction was to only complete a National BMP evaluation.

Under both BMP programs, sites are selected randomly from among all activities that meet the selection criteria. Each BMP has its own criteria related to when an evaluation can take place (e.g., number of winters experienced), although some (e.g., range allotments, recreation sites) are in the sample pool every year. Generally, sites that are in the sample pool every year are not evaluated if they were selected the preceding year.

The objective of the BMP program is to evaluate the implementation and effectiveness of individual BMP's to determine the success of the BMP program. BMPs are mitigations that are applied on projects to reduce the impact of activity on soil and water resources.

Each BMP has a unique field form assessing specific project activities that may impact water quality. Copies of the BMP evaluations are at the Supervisor's Office, and were entered into both the Regional and National BMP National Resource Manager (NRM) database, a Citrix Based GIS database. The Regional database will be retired in November 2016.

Summary Best Management Practices

At the end of each year, BMPEP results are collated and reported to the regional and/or national programs and their associated databases of record. At the local Six Rivers National Forest (SRNF) level, the report shows which BMPs were implemented and/or effective. If any evaluation shows a BMP was not implemented and/or not effective, a discussion follows regarding why things were not optimum and recommendations are made to improve performance. There is also discussion about progress on issues that were brought up in the previous year.

A total of six National BMP evaluations were conducted, spanning four BMP evaluation categories, during the summer and fall of 2015 (Table 1). Issues noted during the fall 2014 National BMP evaluations and how the issues were address are listed in Table 2. Four comparable Regional BMP evaluations were also completed in 2015, spanning two BMP categories (Table 3). The 2015 Mad River Complex Fire, River Complex Fire, and Nickowitz Fire limited access to areas of the Forest to conduct BMP evaluations. Additionally without the Range Specialist position staffed it was difficult to completed grazing BMP evaluations, but one was completed on the Barry Creek Unit of the Van Horn Allotment (Table 4). A majority of the

SRNF grazing allotments are on the Mad River Ranger District, with a few allotments occurring on the Lower Trinity Ranger District.

Table 1. National BMP Result 2015

Activity	Implementation	Effectiveness	Location/Comments
Range A Grazing Management	Fully	Fully	Barry Creek Unit of the Van Horn Grazing Allotment
Rec D Motorized Trail Operation and Maintenance	-	Fully	5E41 (Pilot Creek)
Rec D Motorized Trail Operation and Maintenance	-	Fully	5E43 (Pilot Creek)
Road E Active Road Decommissioning	Fully	Fully	1165A
Road E Active Road Decommissioning	Fully	Fully	11N44

Analysis of the 2015 National BMP data indicates that 100% of applicable BMPs are being properly implemented and fully effective on SRNF. T

Table 2. 2014 National BMP Water Quality Issues Addressed

Activity	Implementation	Effectiveness	Location/Comments
Water Uses B Operations and Maintenance of Spring Source Facilities	Not Assessed	Mostly	Water 4 Wildlife Pond 2S02/Creosote fence post needs to be replaced with redwood post. Fence post replaced Nov 2015.
Recreation D (Motorized Trail Operation and Maintenance)	Fully	Mostly – (Erosion Without Sedimentation)	Trail 5E39/East side w/o stream crossings needs maintenance. Needs additional waterbars and wider barricade. Engineering and Rec Departments are aware of issue.

Issues noted during the 2014 BMP evaluations that effect water quality were addressed. Due to limited funding and prioritization, maintenance/repair of sites with little or no potential of sedimentation are lower priority.

Table 3. Region 5 Best Management Practices Monitored 2015

R5BMPEP # and Category	Implementation	Effectiveness	Location/Comments
G 24 Range Management/Grazing	Fully Implemented	Fully Effective	Barry Creek Grazing Allotment
E16 – Water Source Development	Fully Implemented	Fully Effective	Water 4 Wildlife Pond 2S02
R31 - Off Highway Vehicles	Fully Implemented	Fully Effective	5E41 (Pilot Creek)
R31 - Off Highway Vehicles	Fully Implemented	Fully Effective	5E43 (Pilot Creek)

The 2015 Regional BMPEP results indicate that all four sites reviewed had fully implemented and effective BMPs. A small portion of the sites had BMP's not implemented. Refer to the National BMP discussion for issues addressed from the 2012-2014 reporting period.

Table 4. Grazing Allotment BMP Summary 2015

Grazing Allotment	**6th Field Watershed**	**Pasture/ Management Unit**	**Implementation** **Riparian Herbaceous Utilization S&G's:** **< 30% Riparian Herbaceous Vegetation Utilized**	**Implementation** **Streambank Alteration S&G's:** **< 20-30% Bank Alteration**	**Effectiveness** **Ground Cover S&G's:** **> 60% Ground Cover (Pasture Transect)** **and** **> 50% Bank Cover Herbaceous Vegetation (Channel Reach)**	**Effectiveness** **Streambank Stability S&G's[1] :** (Footnote at end of Table 3) **< 20-30% Bank Alteration**
Van Horn	Upper Mad River	Barry Creek	< 30% Herbaceous Veg Utilized	Unaltered 92%	Pasture >60% Channel 88%	Stable 75% Vulnerable 11% Unstable 14%
Comments: Looks great. No changes needed. No impacts to water quality. Very little evidence of cattle presence.						
1: During grazing management best management practice effectiveness evaluations, a transect point can be deemed vulnerable or unstable, but unaltered from cattle; therefore, to appropriately determine if LRMP S&G's for bank stability are being meet for grazing management, percent bank alteration is used as the S&G criterion.						

Table 5. 2012-2014 Grazing Allotment BMP Issues Addressed

Allotment	**6th Field Watershed**	**Pasture/ Management Unit**	**Implementation** **Compliance with Herbaceous Utilization S&G's**	**Implementation** **Compliance with Streambank Alteration S&G's** **< 20-30% Altered**	**Effectiveness** **S&G's** **>60% Ground Cover (Pasture Transect) /** **> 50% Herbaceous Vegetation (Channel Reach)**	**Effectiveness** **Bank Stability S&G's**[1] (Footnote at end of Table 3)
2012						
Van Duzen	Upper Van Duzen River	Crooks Ridge	Yes	Yes	>60% / >50%	Stable 50% Vulnerable 38% Unstable 22%
Comments: Channel is naturally unstable. Site is on earthflow margin with streamside landslide present (occurred due to natural conditions, not due to cattle). Channel is intermittent (dry 10/04/2012). Some incision and head cutting – the only effects from cattle are in vicinity of spring trough, upstream of channel head. Less than 10% of spring habitat affected by livestock hoof prints. Spring fencing could be extended to include downslope extend of source spring. Work has yet to be completed. Otherwise, AOP and LRMP Standard and Guides S&G's met. Minimal effect to beneficial uses as instability is within natural variability.						
2013						
Van Horn (Nation. BMPEP Review)	Lost Creek (6th Field) – Upper Mad River	Three Forks/ Clover Gulch	Yes (Professional Judgement – National BMP Doesn't Specify % of S&G Met)	No (53% Altered)	Yes	Stable 72% Vulnerable 26% Unstable 3%
Comments: Drought year. Some troughs have been removed from the riparian area, but there is more work to be done. Channel geometry/ width to depth ration might be useful. Need more staff to check range conditions more frequently.						
2014						

Allotment	6th Field Watershed	Pasture/ Management Unit	Implementation Compliance with Herbaceous Utilization S&G's	Implementation Compliance with Streambank Alteration S&G's < 20-30% Altered	Effectiveness S&G's >60% Ground Cover (Pasture Transect) / > 50% Herbaceous Vegetation (Channel Reach)	Effectiveness Bank Stability S&G's[1] (Footnote at end of Table 3)
Van Horn	(Upper) North Fork Eel River	Rock Creek	No	No (50% Altered)	% 62 / <30%	Stable 25% Vulnerable 40% Unstable 35%
Comments: Evidence of minor erosion at 10-20% of sample locations in the channel reach. Vegetation class and diversity is reduced, with increase in early serial and decadent stages. Less than 30% of herbaceous vegetation s composed of mid to late serial stages or exhibiting root masses capable of withstanding annual runoff flows. Minor effects related to channel changes, but reduced shade.						
1: During grazing management best management practice effectiveness evaluations, a transect point can be deemed vulnerable or unstable, but unaltered from cattle; therefore, to appropriately determine if LRMP S&G's for bank stability are being meet for grazing management, percent bank alteration is used as the S&G criterion.						

When the Range Specialist positon is staffed, the range related issues noted in 2011-2014 will be brought to their attention, and will be addressed as appropriate. Any ground disturbing work requires NEPA to be completed prior to project implementation.

Waiver Implementation Checklists

The Waiver stipulates that checklists will be developed by USFS project staff (timber, soils, range, recreation, hydrology, engineering, etc.) based on National Environmental Policy Act (NEPA) document BMP's/PDFs, and contract specifications All project design features (PDFs) for water quality protection for Category B type projects will be included in the checklist to ensure that the measures were actually implemented. Checklists will be completed during the field evaluations by project staff and reviewed by Forest Hydrologist to ensure that any deviations from the project BMPs or project prescriptions are corrected effectively.

Summary Checklist

Checklists for category B projects have been developed for the typical suite of management activities conducted on the Six Rivers National Forest. The list of typical checklists is found in Appendix A of the Draft Six Rivers MRP Quality Assurance Protection Plan (QAPP).

As of fiscal year 2015, most of the Six Rivers projects requiring a Waiver were grandfathered in under the old Waiver and as such, no checklists have been conducted as of yet. Checklists are

likely under all new project decisions in subsequent fiscal years. In 2015 Six Rivers did have one Category B Waiver Enrollment for the Sims Culvert Replacement Project. The project was partially implemented last year due to the contractor being overbooked with task orders. The project will be completed this year and have checklists completed as well.

Total Maximum Daily Load (TMDL) Compliance Monitoring

The North Coast Regional Water Quality Control Board and the Environmental Protection Agency (EPA) have developed Total Maximum Daily Loads (TMDLs) for impaired watersheds across the Six Rivers National Forest. Many of these TMDLs list specific waste load reductions and target indices. With the exception of the Smith River Basin, all of the streams within the SRNF are on the 303(d) list of impaired waterways. In response, the SRNF emphasizes road decommissioning and storm proofing as the most effective methods with which to comply with the established TMDLs because we recognize that road-related sediment sources have the greatest management related impact to water quality. Road decommissioning and storm proofing in key watersheds along mainstems and along tributaries is the focus of SRNF TMDL compliance efforts as well as critical road maintenance and improvements. Road decommissioning and storm proofing significantly reduce sedimentation risks as roads are the main contributing source to sediment loads. For the 2015 reporting period nine miles of road were decommissioned and 13 culverts were upgraded in key watersheds.

Tables 6 provides a summary of the TMDL listing for each of the five rivers and which tributaries have existing restoration histories available atwww.fs.usda.gov/goto/srnf/Water-FishRestoration. Table 7 provides a list of activities that were implemented in 2015 that address TMDL compliance.

Table 6: Summary of TMDL 303(d) Listings on Six Rivers National Forest

River	Sediment (tons/mi2/yr)	Temperature (langleys/day or % shade)	Carbonaceous Biochemical Oxygen Demand (CBOD) (lbs)	Phosphorous (lbs)	Nitrogen (lbs)
Klamath River	No	Yes	Yes	Yes	Yes
Trinity River	Yes	Yes	Yes	Yes	Yes
South Fork Trinity	Yes	Yes	No	No	No
Van Duzen River	Yes	No	No	No	No
North Fork Eel River	Yes	Yes	No	No	No
Mad River (Upper & Middle)	Yes	No	No	No	No
Smith River	No	No	No	No	No

Four miles of roads were decommissioned and one mile of road maintenance was completed in the Bluff Creek-Klamath River HUC 5 Watershed in 2015. Eleven stream crossing were removed during road decommissioning for a total savings of nearly 9,000cy. Additionally, 12

miles of road maintenance was implemented and approximately 1,340 cubic yards of slide material was removed in the Rock Creek-Klamath River Watershed (refer to Table 7).

Twenty-one road maintenance miles and approximately 6.5 cubic yards of road prism erosion/slide material was prevented causing sedimentation in the Horse Linto Creek-Trinity River Watershed in 2015 (refer to Table 7).

There were 13 culvert upgrades (Sims Culvert Replacement Project) and one road maintenance mile in the Lower South Fork Trinity HUC 5 Watershed. Nearly 3,000cy of material was potentially prevented from entering waterways due to the culvert upgrades. Additionally, there were 4 miles of road maintenance in the Upper Van Duzen River Watershed in 2015 (refer to Table 7).

There was one mile of road maintenance implemented in the Upper Mad River Watershed in 2015 (refer to Table 7). There was no work completed in the North Fork Eel in 2015.

Given roads are the largest contributors to sedimentation, road maintenance activities are attributed with reducing actual sediment delivered to waterways as well as reducing potential sedimentation. **Please refer to the Annual Road Maintenance section for further discussion of TMDL compliance related activities by watershed.**

Annual Road Maintenance

Road maintenance occurs annually on national forest transportation system roads. Regular road maintenance is the primary mechanism to reduce road-related sedimentation risks and impacts to water quality. Properly designed and maintained road surfaces and drainage systems can reduce adverse effects to water resources by facilitating natural hydrologic function. Roads and drainage systems normally deteriorate because of traffic, weather, and effects of maintenance. In addition, roads occasionally become saturated by new groundwater springs and seeps after a wildfire, unusually wet periods, or seismic activity. Many such conditions can be corrected by timely maintenance. The extent of the road maintenance is dependent on annual funding appropriations from Congress and can vary significantly from year to year.

Road maintenance plans are implemented through contracts, cooperators, force account, and active timber sales or other authorized activities. Contract, timber sale, and other authorized or permitted operations are bound by specifications and drawings. BMPs are incorporated as specifications, contract or sale clauses, operating plan requirements, or permit clauses, and are often shown in the drawings. The contracting officer's representative is responsible for assuring compliance by contractors. The engineering representative, timber sale administrator (TSA), or Forest Service Representative (FSR) assures compliance by cooperator, purchaser or permitted operator. Project manager and crew supervisor assures compliance for force account work. Optimally, the forest hydrologist works with the forest quality assurance personnel to determine if approved maintenance tasks are completed with minimal resource impacts. A more detailed summary of annual road maintenance inventory, planning, and implementation is found in Appendix C – Six Rivers National Forest Annual Road Maintenance Guidance.

Summary Road Maintenance

Six Rivers National Forest accomplished approximately 94 miles of road maintenance. The Table 7 Key below provides a brief explanation of the items listed in Table 7, which summaries the suite of actions that are typical of annual road maintenance activities. The Engineering Department is the lead for road maintenance activities.

Table 7 provides a list of activities that were implemented in 2015 that address TMDL compliance. Road maintenance activities included constructing drivable or rolling dips and clean ditches. Table 7 does not include roads that only received brushing or spot rocking maintenance. Road maintenance activities include blading, cleaning culverts, cleaning ditches, removing slide material, and placing rock slope protect (rip rap) to stabilize slopes. This data is entered into the Watershed Maintenance Tracking (WIT) GIS database. **When cubic yardage of slide material removed was recorded, the volume is listed in the CY Saved column of the below table. When cubic yardage of slide material wasn't estimated, 1 cubic yard (industry standard) was assumed to be removed from the site. A Water Erosion Prediction Project (WEPP) Forest Road Erosion Predictor model was ran to determine average tons of erosion saved from the road prism per mile of road maintenance work.**

WEPP Model input defaults in were replaced with inputs reflective of Six Rivers National Forest roads. Inputs were conservatively chosen, meaning values were chosen that would generate a smaller savings estimate. The WEPP model is known to have a +/- 50% error with estimating rates of erosion. Knowing this bias, inputs were selected to decrease the over estimation. The assumed road width was 21 feet, with 10% rock content is the soil, graveled road surface, 4% road gradient, low traffic, a 50% gradient and 25 foot length for road fill, and a 50% gradient and 130 foot buffer length. When the road gradient was increased to 7%, the amount of erosion and associated savings were greatly exaggerated. Therefore; the default 4% road gradient was not changed in the model. The average modeling savings of erosion from the road prism was calculated as 0.25 tons of sediment/mile. Given clay loam has an average bulk density of 1.3 Mg/m^3, 0.25 tons of sediment is equivalent to 0.25 cy.

Table 7 Key

Blading: Blading of the road surface for evenness, filling of potholes, and general grading.

Culvert Clearing: Culverts are cleaned so water can flow freely from the culvert inlet, through the culvert, exiting the culvert outlet

Ditch Cleaning: Ditches are clean to increase water conveyance capacity; thereby reducing the risk of diversion of water from the road side ditch, culvert, and channel network. Diversion of water across a road prism erodes the road surface and fill. Erosion of the road material can lead to sedimentation (delivery to waterways).

Rebuttress and Contour Slope: Equipment operator preforming road maintenance must follow side-cast restrictions, wet weather operation standards, and erosion control plan when placing rip rap to rebuttress and contour a (road cut) slope that needs stabilization.

Install Driveable Drainage Dips: Driveable drainage dips decrease slope length, slow down water, decrease erosive power, and directs water off the road into appropriate areas to avoid sedimentation to waterways.

Removal of Minor Slide and Sluff Material: Along roadsides minor slide and sluff material (less than one cubic yard, which is industry standard) is removed and disposed of in an appropriate location away from waterways.

Table 7: Summary of TMDL Compliance Activities for 2015

HUC 5	HUC 6	Road #s	Road Maintenance Activities	Miles	CY Saved
Blue Creek	Crescent City Fork	14N01, 15N02	Remove Slides, Culvert Cleaning, Ditch Cleaning, Rip Rap	11	5
Blue Creek	Lower Blue Creek	14N01	Remove Slide, Culvert Cleaning, Rip Rap	1	1.25
Bluff Creek-Klamath River	Camp Creek	11N31	Compact Install Driveable Dips	1	0.25
Horse Linto Creek-Trinity River	Mill Creek	8N01, 8N10, 10N02	Clean Culverts, Clean Ditches, Install Driveable Dips	18	4.50
Horse Linto Creek-Trinity River	Tish Tang A Tang Creek	8N01, 8N10, 10N02	Remove Slide, Clean Culverts, Clean Ditches, Install Driveable Dips	3	2
Lower South Fork Trinity River	Grouse Creek	4N38	Install Driveable Dips	1	0.25
Middle Fork Smith River	Lower Middle Fork Smith River	17N05, 18N10	Blade, Clean Culverts, Clean Ditches, Reconstruct and Buttress Slope	5	1.25
Middle Fork Smith River	Siskiyou Fork Smith River	17N05	Reconstruct and Buttress Slope	3	0.75
Redwood Creek	Noisy Creek-Redwood Creek	4N38	Install Driveable Dips	1	0.25
Rock Creek-Klamath River	Reynolds Creek-Klamath River	12N02, 12N48, 13N13	Remove Woody Debris, Remove Two 500CY Slides, Remove One 300CY Slide, Clean Culverts	7	1,300
Rock Creek-Klamath River	Rock Creek	13N13	Clean Culverts	4	1
Rock Creek-Klamath River	Ti Creek-Klamath River	13N11	Remove 40 CY Slide	1	40
South Fork Smith River	Goose Creek	14N01, 15N01	Remove slides, Culvert Cleaning, Ditch Cleaning, Rip Rap	12	5
South Fork Smith River	Hurdygurdy Creek	17N05	Reconstruct and Buttress Slope	7	2
South Fork Smith River	Middle South Fork Smith River	15N01, 15N34, 16N18	Remove Slide, Blade, Culvert Cleaning, Ditch Cleaning	12	4
South Fork Smith River	Upper South Fork Smith River	16N18	Blade, Remove Slide Material	1	1.25
Upper Mad River	Blue Slide Creek-Mad River	3S13	Blade, Spot Rock, Clean Culverts, Rip Rap	1	0.25
Upper Van Duzen River	Mill Creek-Van Duzen River	1N09, 1N10	Blade, Spot Rock, Clean Culverts	3	0.75
Upper Van Duzen River	Shanty Creek-Van Duzen River	1N10	Blade, Spot Rock, Clean Culverts	1	0.25
Wooley Creek	Lower Wooley Creek	12N02	Remove Woody Debris and 500CY Slide	1	500
Total Road Maintenance Miles and Total Cubic Yards Saved From Potentially Entering Waterways				**94**	**1,869**

Road and Trail Implementation and Monitoring

Roads are the leading source of management related sediment on the Six Rivers National Forest, particularly during storm events. All road drainage systems, stream crossings with culverts, and unstable slopes have the potential to fail during periods of high precipitation. Potential consequences to aquatic systems vary dramatically from no impacts, to severe and potentially long-term impacts to water quality and beneficial uses.

The purpose of the road and trail implementation and monitoring report is to make available to the Water Board and interested publics the forest management actions taken to reduce the water quality risks associated with roads. Activities that will be covered include storm patrol, annual road maintenance activities, OHV trail monitoring, transportation planning actions, and road restoration activities such as road decommissioning and road upgrading (e.g., road storm proofing).

Storm Patrol

Assessing roads during or soon after major storms is critical to timely detection of problems. Observation of problems caused by storm runoff is of great value in understanding both the causes of failure and in adapting designs and prescriptions that reduce both the probability and consequences of future road failures. Over time, this kind of monitoring illustrates how and where roads, can fail and corrective actions that can reduce adverse effects to water quality and watershed function.

2015 Storm Patrol Summary

When a storm patrol is initiated and extensive storm damage to roads has occurred, a storm damage report is produced as part of the annual MRP. Where failures are observed, the size and percent delivery from the failure are noted. In addition, sites repaired with Emergency Relief for Federally Owned Roads (ERFO) funds, if any, will also be summarized in the annual report. Refer to the Appendix A for complete Storm Patrol Reports.

Weather related road conditions warranted a storm patrol February 6-8, 2015. A storm patrol was also conducted January 19-28, 2016. Storm damage was documented during patrol efforts and reported to the engineering and hydrology staff. Culverts and ditches were cleaned by forest service employees as needed while on patrol. A brief discussion of the storm patrol conducted is provided below for each District on SRNF.

Approximately 57 miles of road were cleared of debris and brush, four downed trees removed, and a rock slide cleared on the Smith River Ranger District, almost 100 miles of road were patrolled in the Lower Trinity Ranger District, approximately 34 miles were patrolled for the Orleans Ranger District, and since a majority of the District did not experience in the way of storm damage 5 total miles were patrolled in February 2015. There were no sites requiring reporting to the Water Board.

The storm patrol in January 2016 covered approximately 45 miles on the Smith River National Recreation Area, 171 miles on the Lower Trinity Ranger District, 82 miles on the Orleans/Ukonom, and 50 miles on the Mad River Ranger District. Snow level was around 3800-4000 feet, was 1.5 to 2 feet deep, and was heavy/wet. The 2015 Lassics fire area was not patrolled due to snow levels.

Storm Patrol Findings

The site on Route 6 milepost 1.0 was reported to the Water Board on January 22, 2016 by Adam Dresser. A slide completely plugged a culvert near Madden Creek. A conservative, meaning over estimate of the slide dimensions are 20ft (L) x 2ft (W) x 2ft (D), or 2.3cy. There is potential for approximately 50% of the material to be delivered to Madden Creek with no delivery as of 1/21/2016.

The site on 1N10 was reported to the Water Board January 27, 2016 by Adam Dresser. The site at 1N10 mile post 3.0 was a major fill failure that evacuated a large portion of the road prism at a perennial stream crossing (Kuntz Canyon). The delivered estimate is 1,000-2,000cy. The estimated additional fill volume likely to fail is 700-1,400cy. The natural hillslope volume failed estimate is 30cy. The natural hillslope volume at risk of failure is 1,400cy. There appears to be little recourse in terms of corrective measures that can be taken to reduce further fill failure, landsliding and sediment delivery. The road has been barricaded with a K-rail and a road closure order will be issued if appropriate. When funding becomes available need repairs will completed.

Off Highway Vehicle Trails (OHV) Green-Yellow-Red (GYR) Monitoring

OHV use has the potential to impact water resources. Use of the newly developed best management practices for OHV planning, construction, maintenance, monitoring [R5 BMP 4.7 (1-8)] provides guidance on reducing water quality risks associated with OHV use.

OHV trails are be monitored for water quality issues and maintenance needs. High-risk and high-maintenance OHV trails are monitored using the Green-Yellow-Red (GYR) OHV Soil Loss Monitoring Protocol as described in *Revised OHV Trail Monitoring Form (GYR Form) and Training Guide*, (USDA 2004). More stable routes are monitored less often. Large storm events may also trigger OHV trail monitoring.

Summary of OHV monitoring

Two trails were assessed using the BMPEP protocol in 2015 on Mad River Ranger District. Trails, 5E41 and 5E43, were monitored using the GYR protocol. Both trails are rated green, meaning acceptable in regard to soil loss, according to the protocol.

In addition, both the Regional (Form R31) and National BMP (Form Rec D. Motorized or Non-Motorized Trail Operation and Maintenance) protocols were followed for assesses the two OHV (5E41 and 5E43) trails. The applicable planning document for these trails are SRNF LRMP Standard and Guides, and the Pilot Creek Watershed Trail Use Strategy EA also covers Trail 5E41 and 5E43 (July 1998). These trails will be included in the Transportation Analysis Process (TAP).

Transportation Planning

The Forest Service is currently engaged in a nationwide effort to identify the minimum road networks needed on national forests for resource management and visitor access. This effort is being implemented under the Travel Management Rule Subpart A (36 CFR, part 212). Roads on NFS lands are assessed through the travel management process both in terms of the benefits provided and the risks to natural resources, including water quality. Decisions as to whether a road will or will not be retained in the NFS road network will be made at the forest level by the forest supervisor.

On the Six Rivers National Forest, implementation of the Travel Management Rule is in various stages of completion. This MRP will annually update current status and progress in completing travel management planning efforts [e.g., Inventory, TAP, NEPA (EA, EIS)].

Transportation Planning Status

The following sections provide an update on transportation planning (e.g., Inventory, Transportation Analysis Process and NEPA) from 1997 through to 2015. This summary includes transportation planning efforts prior to and subsequent to the Travel Management Rule (Subpart A and B). Table 8 summarizes transportation planning efforts to date.

Table 8: Six Rivers National Forest Transportation Planning Status by Ranger District

Smith River National Recreation Area (NRA) Ranger District (RD)			
Watershed	**Road-Watershed Risk Inventory**	**Transportation Analysis (TAP)**	**NEPA Status**
North, Middle and South Fork Smith	All roads on Middle and South Fork Smith inventoried for watershed risks– final report 2003	Smith River Roads Analysis - completed 2005; Subpart A and B in progress	NRA Travel Management FEIS on Subpart A and B – in progress – decision pending summer 2016.
Goose Creek – recently acquired lands	Road risk inventory completed - 2012	Not started	Not started
Lower Trinity/Orleans/Ukonom Ranger Districts			
Lower Trinity RD Watershed	**Road-Watershed Risk Inventory**	**Transportation Analysis (TAP)**	**NEPA Status**
Lower Trinity River including watersheds such Horse Linto, Mill, and Tish Tang watersheds	All roads in the Mill, Tish Tang, and Horse Linto watersheds – completed by 1995	Prior to Subpart A – completed via NEPA	EA completed 1997 and implemented.
South Fork Trinity and Willow Creek	All roads in the South Fork Trinity in 1995 and again in 2004	Prior to Subpart A - completed via NEPA	EA completed 1998-2000 and implemented
Grouse Creek	All roads in the watershed in 1993-95	Prior to Subpart A - completed via NEPA	EA completed 1996 and implemented 1997
Orleans RD Watershed	**Road-Watershed Risk Inventory**	**Transportation Analysis (TAP)**	**NEPA Status**
Bluff, Camp, Slate, Red Cap watersheds and tributaries	All roads completed 2000-2004	Subpart A and B – completed 2006	EA completed in 2007 and fully implemented
Ukonom RD Watershed	**Road-Watershed Risk Inventory**	**Transportation Analysis (TAP)**	**NEPA Status**

East Ishi Pishi watersheds including, Ti and, Irving Creeks	Conducted in 1998	Prior to Subpart A - completed via NEPA for both Subpart B and A	EA completed in 2007 and fully implemented
West Ishi Pishi watersheds including Dillon and Rock creeks		Subpart B completed by Klamath National Forest 2010?, Subpart A completed 2013	NEPA pending
Mad River Ranger District			
Watersheds	**Road-Watershed Risk Inventory**	**Transportation Analysis (TAP)**	**NEPA Status**
Mad River, Van Duzen and North Fork Eel	Completed in 2011	Subpart B completed in 2010; Subpart A District-wide in progress	Not started

Road Restoration Actions

As part of the transportation analysis process, the minimum road network is identified. Roads that are determined to be necessary to the national forest transportation system (NFTS) will be maintained. Roads that are determined to be a risk to water quality and downstream aquatic habitats and are surplus to administrative and public access needs, will be removed from the NFTS system and no longer accessible for motorized vehicle use.

Roads, whether they remain on the NFTS or not, have the potential to pose risks to water quality though surface erosion, risk of mass failures and stream diversion potential. Road restoration actions designed to reduce water quality risks apply to roads that will be maintained on the NFTS as well as roads that will be removed. For roads that were determined to pose water quality risks, but will remain on the NFTS, road upgrading or stormproofing actions can be implemented (e.g., replacing old or undersized culverts, correcting stream diversion potential, installing rolling dips, hardening stream crossing approaches through rocking, etc.). Likewise, for roads no longer to be on the NFTS, road decommissioning activities can be implemented that reduce surface erosion, reduce risk of mass failures, restore natural surface and subsurface drainage patterns and restore stream channel crossings.

Implementation of road decommissioning and road upgrading or storm-proofing actions generally rely on funds garnered through competitive processes and grant cycles. Road decommissioning is an important tool in watershed restoration actions outlined in the Forest Service Watershed Condition Framework, Northwest Forest Plan Aquatic Conservation Strategy and TMDL implementation actions. Best management practices for road decommissioning are described in R5 BMP 2.7 and National BMP Road-6.

Summary of Road Restoration Actions

All annual road restoration actions will be summarized in the annual MRP report and include the road number, road miles, and actions implemented. The following tables provide a summary of road decommissioning and culvert upgrading work that was implemented from 2015. A total of 4 miles of road were decommissioned, removing 11 stream crossings, for a total savings of nearly 9,000cy of material as shown in Table 9.

Table 9: Road Decommissioning Summary 2015

Road Decommissioning	HUC 5	HUC 6	Road #	Miles	CY Saved
Removed 0 Stream Xings	Bluff Creek-Klamath River	Camp Creek	11N14A	1	0
Removed 8 Stream Xings	Bluff Creek-Klamath River	Camp Creek	11N44	2	7,563
Removed 3 Stream Xings	Bluff Creek-Klamath River	Boise Creek-Klamath River	11N65A	1	1,410
Total Miles of Decommissioned Road and Total Cubic Yards Of Material Saved				**4**	**8,973**

In addition to the 11 stream crossings removed during road decommissioning, 13 culverts were upgraded in key watersheds in 2015, with a total savings of nearly 3,000cy as shown in Table 10.

Table 10: Culvert Upgrade Summary 2015

Culvert Upgrades	HUC 5	HUC 6	Sites	CY Saved
Sims Culvert Upgrades	Lower South Fork Trinity River	Old Campbell Creek	2	803
Sims Culvert Upgrades	Lower South Fork Trinity River	Mingo Creek-South Fork Trinity River	11	2,101
Total # Sims Culvert Upgrades and Total Cubic Yards Of Material Saved			**13**	**2,904**

Road decommissioning and culvert upgrading are considered separate efforts than regular annual road maintenance, which is discussed above in the Annual Road Maintenance section.

MONITORING AND REPORTING: IN-CHANNEL MONITORING

In collaboration with the Water Board, the SRNF has developed a network of baseline in-channel monitoring sites at the 5th field hydrologic unit watershed scale (as defined in National Resources Conservation Service (NRCS). Establishment of this network eliminates the need for project-level monitoring within the monitored watersheds. The baseline in-channel monitoring program described below was developed in conjunction with the Water Board, recognizing monitoring constraints present within lands managed by the SRNF (e.g. limited reference streams).

In-channel monitoring follows Stream Condition Inventory (SCI) Version 5.0 (USDA Forest Service Pacific Southwest Region, 2005) protocols. SCI includes measurements of maximum pool depth, riffle crest depth, pool/riffle ratio, riffle particle size distribution (pebble count), percent pool tail fines, large woody debris, bank angle, shore depth, benthic macro-invertebrate composition, percent shade, and width-to-depth and cross-section surveys. Standards for how to measure each attribute are explained in the SCI handbook. Training occurs both in the classroom and at a representative field location before actual in-channel monitoring reaches are surveyed. The Quality Assurance Officer remains with the field crews until they demonstrate competence enough to work unsupervised. Surface Water Ambient Monitoring Program (SWAMP) protocols will also be consulted and incorporated, as appropriate.

Baseline in-channel monitoring results will be entered into the national NRIS AqS database. When sufficient years have been surveyed (minimum of three years of data per reach), channel condition data will be analyzed to look for trends in reach stream condition, and to compare reaches to reference conditions. Monitoring trends in channel characteristics that affect beneficial uses will be accomplished through comparing measures of central tendency for channel

characteristics of streams downstream of managed areas with those in reference watersheds. Listed below are the stream condition monitoring results for where there are at least three years of monitoring data per reach.

Depending on annual funding levels, three to five baseline in-channel monitoring reaches will be surveyed each year, in a rotation that attempts to survey each reach no less than every five years. Locations of SCI reaches and protocols can be found in the draft Six Rivers QAPP. Summary Reporting Requirements for Annual In-Channel Monitoring.

A summary of all annual in-channel monitoring across the forest will be described in the annual MRP report. It will include the watersheds assessed, suite of parameters collected, as well as an evaluation of any trend data associated with watersheds with a minimum of 3 years or more of consecutive data (e.g., trends in pebble counts, shade, macroinvertebrates, channel cross sections etc.). A large storm event (e.g., 15 year reoccurrence interval) will provide additional opportunity to revisit priority monitoring sites and evaluate trends. All in-channel monitoring and assessment is predicated on annual funding availability. Data associated with in-channel monitoring and stream temperature monitoring is annually updated in the national database (NRIS AqS).

Stream Condition Inventory (SCI)

Stream reaches surveyed in 2015 were Bluff Creek, Camp Creek, Horse Linto Creek Middle, and Horse Linto Creek Lower. Three of these SCI reaches now have enough previous surveys (three years) to warrant analysis. Note the field protocol used in 1995 changed in 2005, and again in 2013. The protocols define large woody debris (lwd) definitely, therefore; it would not be appropriate to compare of the large woody debris data collected under varying protocols. Pool frequency, maximum pool depth, particle size distribution, pool tail fines, bank stability, stream shade, and cross-section data for Bluff Creek, Camp Creek, and Horse Linto Creek SCI reaches are discussed in the following sections.

Bluff Creek SCI Reach

Bluff Creek SCI reach has inventory data for the following years: 1995, 1997, 2009, and 2015. This reach is considered a transport reach.

Bluff Creek is a designated key watershed and late-successional reserve. The key concerns influencing long-term health of the Bluff Creek watershed are channel shape and function as a result of mass wasting and the loss of large woody debris in the main channel. Since 1986, Six Rivers National Forest has emplaced instream structures within Bluff Creek to increase channel diversity and stabilize the banks. Approximately 110 individual structures have been emplaced within the Bluff Creek main channel and side channel habitats. Boulder clusters have been placed mid-channel to modify riffle habitat to pocket water habitat, increase depth, increase cover, and increase channel complexity. Weirs (gabion, boulder, and log) have been used extensively to trap suitable gravels and create proper hydraulic conditions for spawning. Deflectors (gabion, boulder, and log) have been used to modify riffle habitat to lateral scour pools which increase the diversity of rearing habitat and increase the amount of pool-tail habitat which is preferred for spawning.

Pool Frequency

Pool frequency increased from 4% to 17%, with riffle frequency decreasing from 96 to 83% from 1995 to 2015. This increase in pool frequency is reflected of improved channel function and habitat.

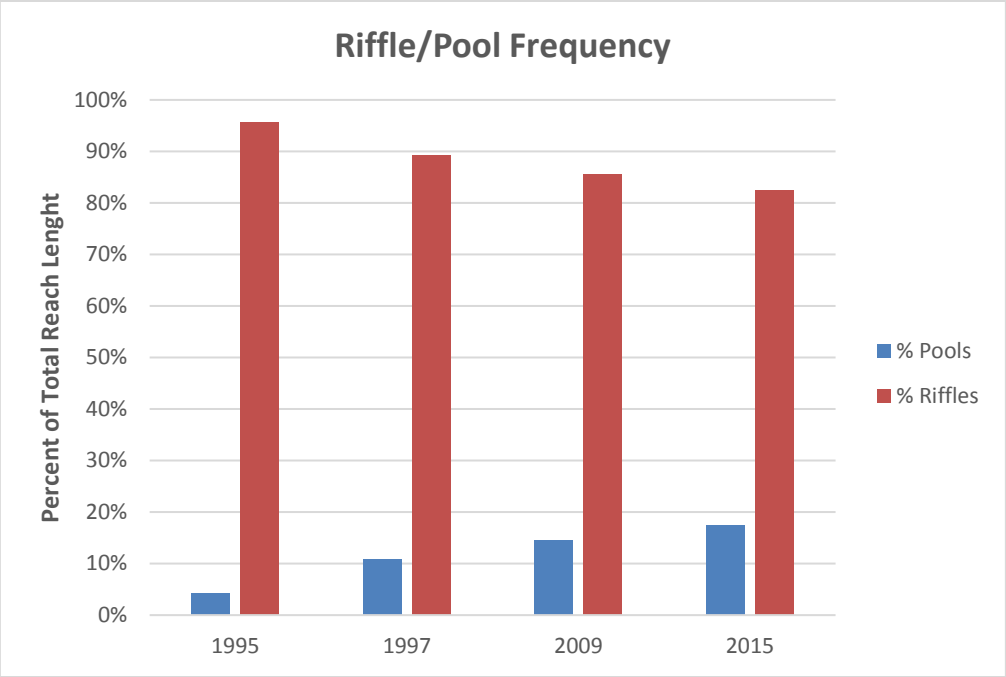

Figure 1: Bluff Creek Pool-Riffle Frequency

Maximum Pool Depth

The maximum pool depth is remaining relatively stable over time from 1.75 meters to 1.85 meters deep (not including 1997). The shallower pools in 1997 (average of 1.2 meters) seems to correspond to an increase in sediment in the system to do large storm events and associated high flows that year.

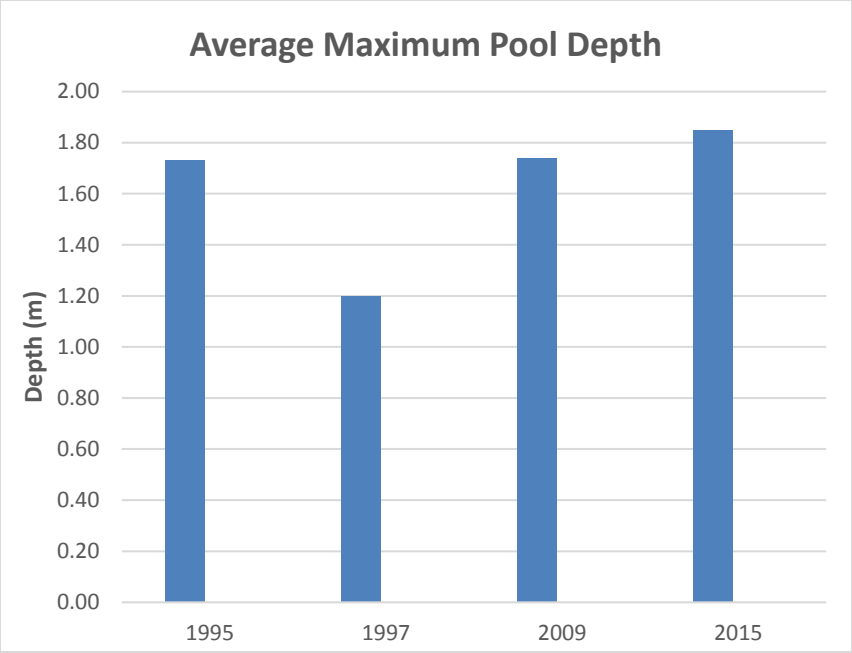

Figure 2: Bluff Creek Average Maximum Pool Depth

Particle Size Distribution

The percent fines increased in 1997, decreased in 2009, then experienced a dramatic increase in 2015. As pools deepen, the scoured material is deposited in the downstream riffle. The increase in riffle percent fines may be accounting for the pools deepening through this reach. The particle size class distribution is very similar comparing 2015 to 1997. The D50 diameter coarsened since 1995. Not including 2009, the D84 diameters have remained roughly 256mm.

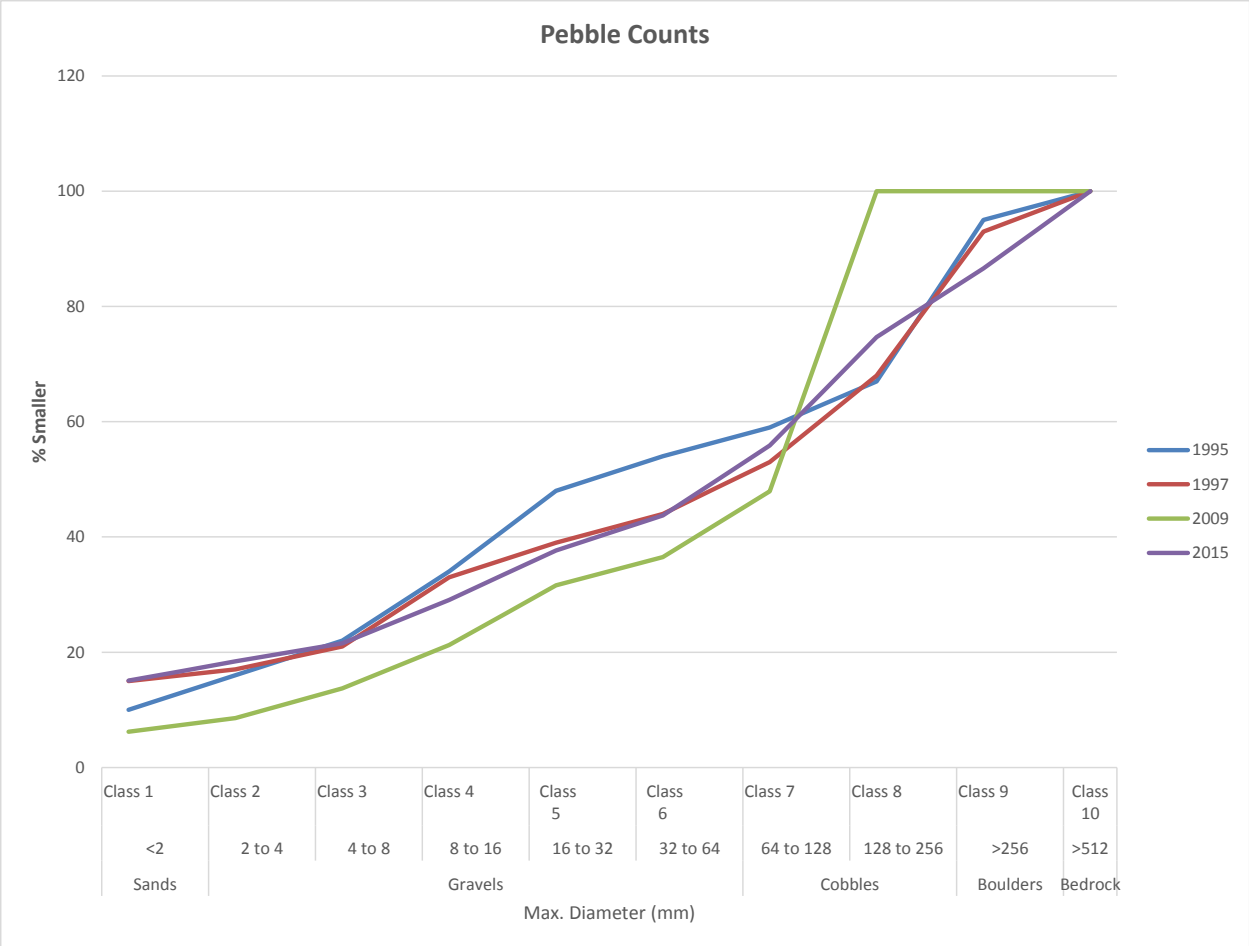

Figure 3: Bluff Creek Particle Count

Pool Tail Fines

The percent of pool tail fines have both increased and decreased over the inventory period from 6.0% to 14.7%. The increase in fines in 1997 potentially could be attributed to sedimentation occurring from the large storm events that occurred in 1997. The decrease in 2009 may indicate the stream is capable of transporting downstream more fine sediment than is delivered to the survey reach during normal flow periods. The increase in fines in 2015 potentially could be attributed to decreased drought flows that are not capable of transporting sediment downstream.

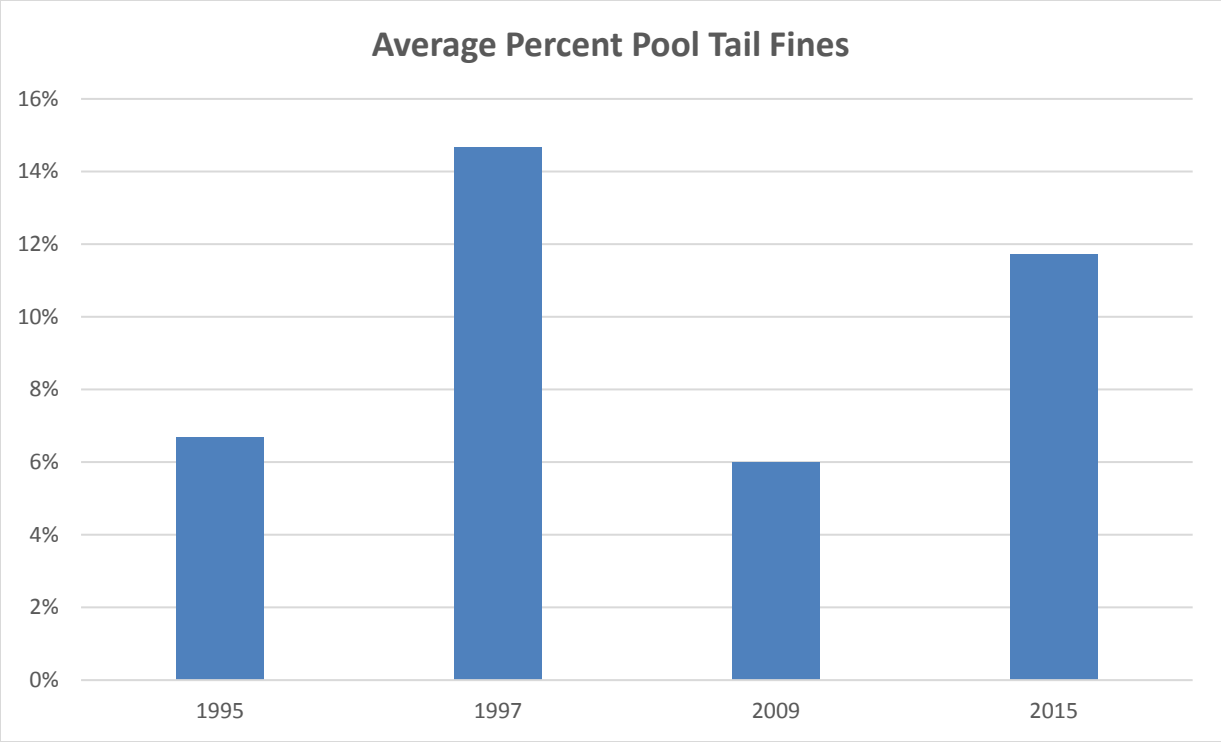

Figure 4: Bluff Creek Average Percent Pool Tail Fines

Stream Shading

Stream shade has increased and decreased over the years, but an overall increase is observed in the average percent shade from 48% in 1995 to 63% in 2015.

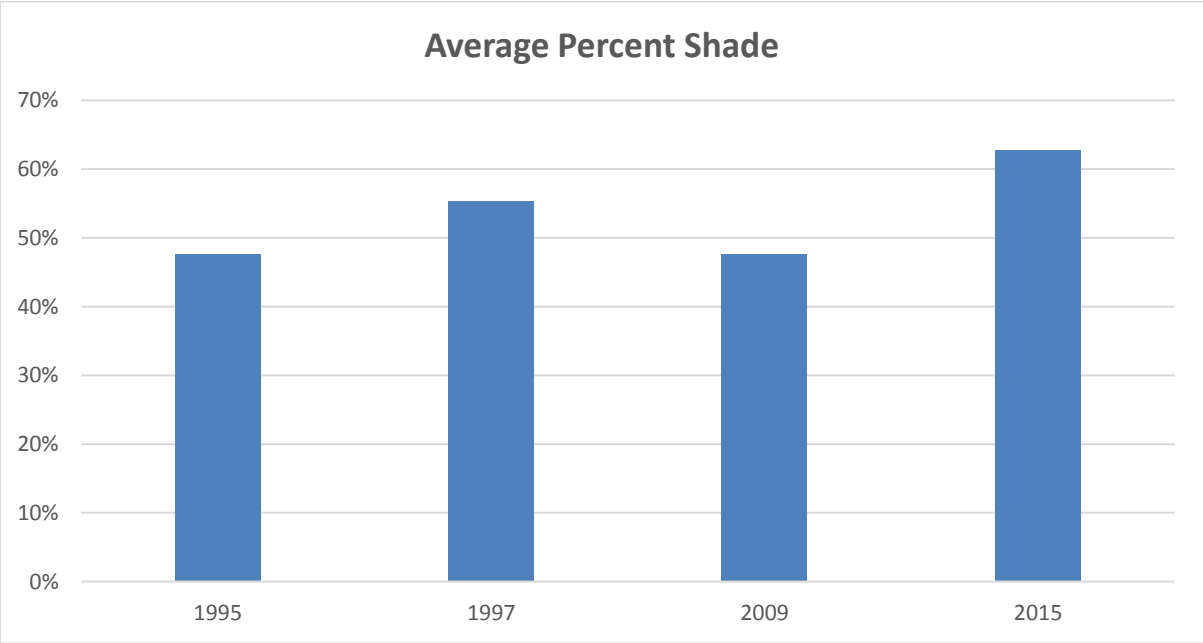

Figure 5: Bluff Creek Average Percent Shade

Bank Stability

Bank stability is significantly increasing over time, with 90% bank stability in 2015.

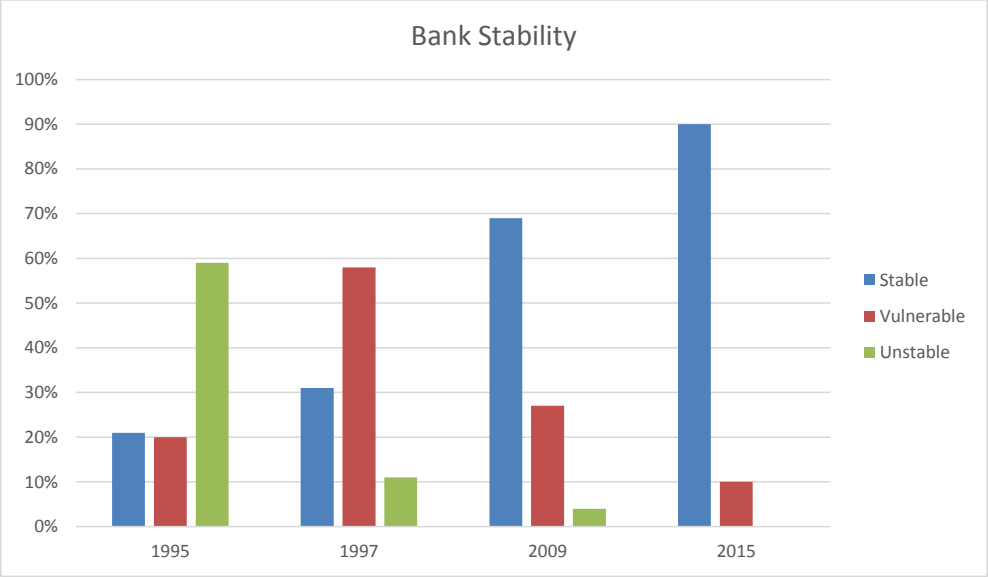

Figure 6: Bluff Creek Bank Stability

Cross-Section Surveys

Unlike monumented cross-sections, width to depths are not established with rebar; therefore, there will be more variability in the width to depth bankfull widths, when compare to bankfull widths measured at cross-sections. Cross-section one had little change in bankfull width between 1995 and 2015. (Bankfull widths are in meters.)

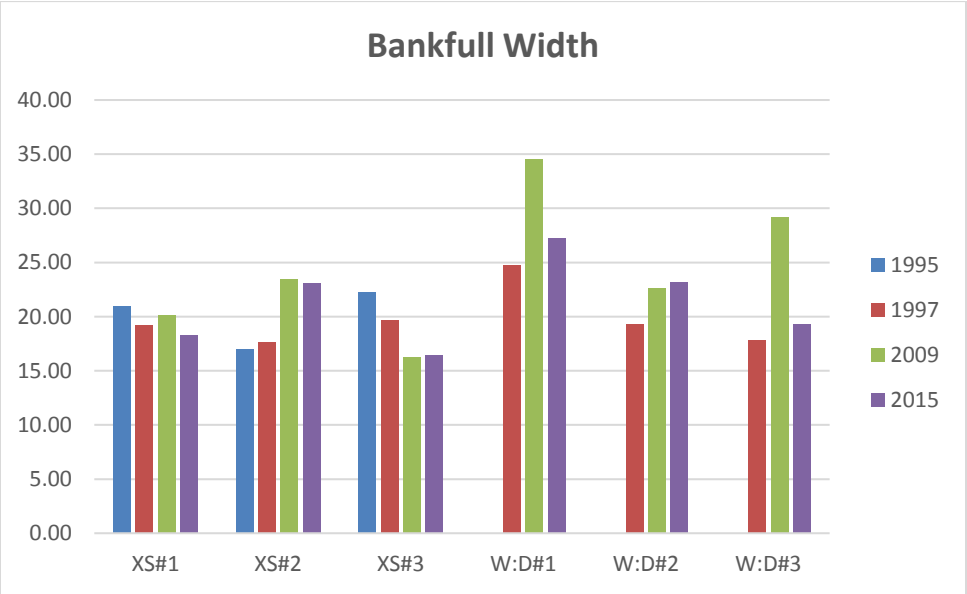

Figure 7: Bankfull Width

When only looking at cross-sections, width to depth ratios have fluctuated over the last 20 years, but generally have decreased at cross-section one and cross-section three since 1997, indicating the channel has depended in these sections of the survey reach. The channel deepening at cross-section three is more pronounced than cross-section one. It was noted during the 2009 survey that all cross-section pins eroded away, with the exception of cross-section 2, meaning cross-sections one and three had to be reestablished. The bankfull width at cross-section two significantly increased in 2009 indicating the channel aggraded in this section.

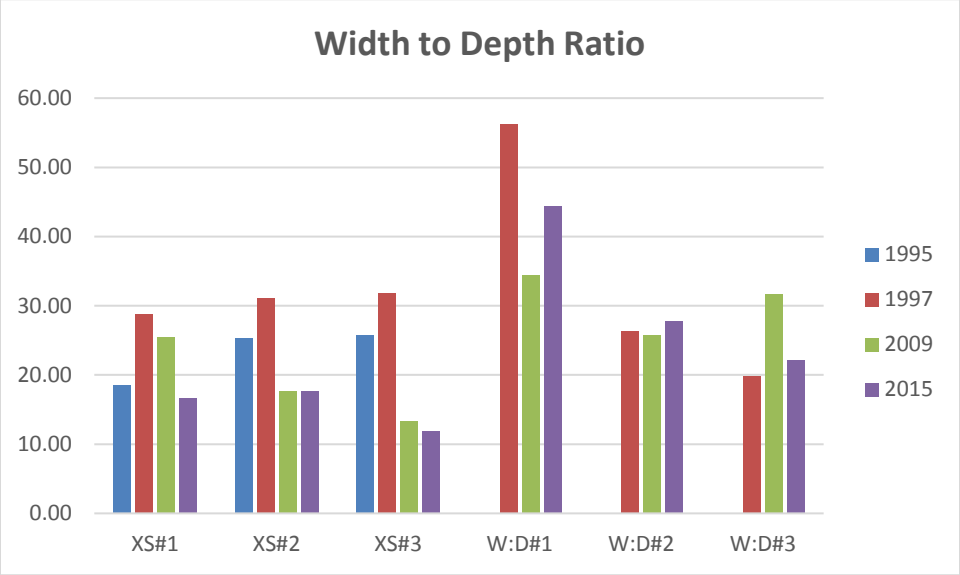

Figure 8: Width to Depth Ratio

Bluff Creek Lower SCI Reach Summary

Results for the monitoring period between 1995 and 2015, show the Bluff Creek monitoring reach improved in most factors such as pool depth, bank stability and shade cover, and decline in others such as pool tail fines. The reach trended toward greater stability, percent shade cover, pool frequency, percent pool length, and pool tail fines, but also showed a trend toward decreased pool depth, less percent fines in riffles, and a coarsening, and increase in diameter of riffle bed substrate. Abrupt changes occurred between 1995 and 2000, and again between 2002 and 2015. These trends support the conclusion that there was a reduction in sediment supply, and/or there were adequate flow events (between 1995-2000 and 2000-2015) that scoured fines from riffles and altered the morphology of substrate to create a greater frequency of pools with lower gradients, and associated greater trap efficiency of pool tail fines. This scenario is consistent with the 20-year flood event in water year 1996-1997. There were four significant precipitation events after 1997 all of which occurred between 2004 and 2014 (http://www.cnrfc.noaa.gov/storm_summaries.php). Cross section data also support the scenario that flow events have had the greatest impact in this reach.

Camp Creek Middle SCI Reach

Restoration efforts spanning from 1979 to 1994 resulted in forty-four in-stream fish structures within Camp Creek's anadromous reaches. These structures were all designed with the goal to increase the stream's capacity for the spawning and rearing of salmonid fish species.

Camp Creek SCI reach has inventory data for the following years: 1996, 1997, 2009, and 2015. This reach is considered a transport reach.

Pool Frequency

There was no change in frequency in the number of pools or percent length of pools over the monitoring period.

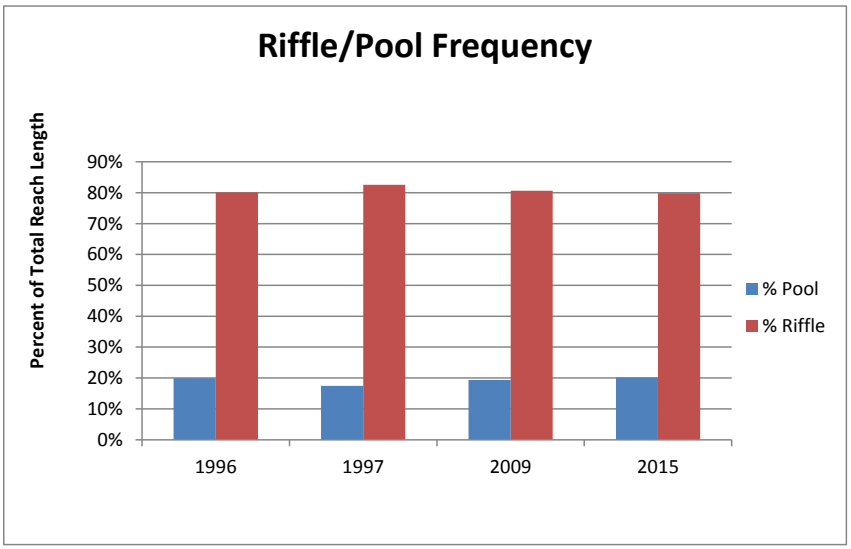

Figure 9: Camp Creek Pool-Riffle Frequency

Maximum Pool Depth

There was a steady increase in average maximum pool depth of nearly triple between 1996 and 2009 and no change between 2009 and 2015. The trend potentially reflects scour caused by the water year 1996-1997, 20-year flood event and subsequent adjustment.

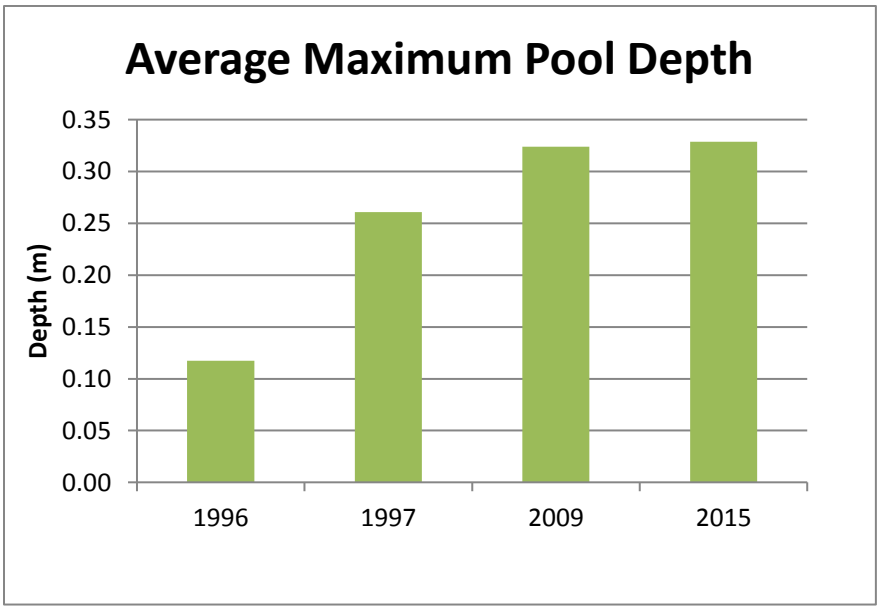

Figure 10: Camp Creek Average Maximum Pool Depth

Particle Size Distribution

There was an increase in gravel sized particles in riffle bed substrate between 1996 and 1997, then, by 2009, a return in particle size distribution to the same as 1996. Then there was a dramatic coarsening of substrate between 2009 and 2015 with an associated increase in D50 and D84 diameters. D64 increase from 158 mm to 470 mm, and D50 increased from 48 mm to 128 mm. over the monitoring period D16 increased steadily from 4 mm in 1996 to 10 mm in 2015. Overall there was a coarsening of riffle bed particle size distribution, but also an increase in percent fines. The trend clearly reflects the water year 1996-1997 20-year flood event.

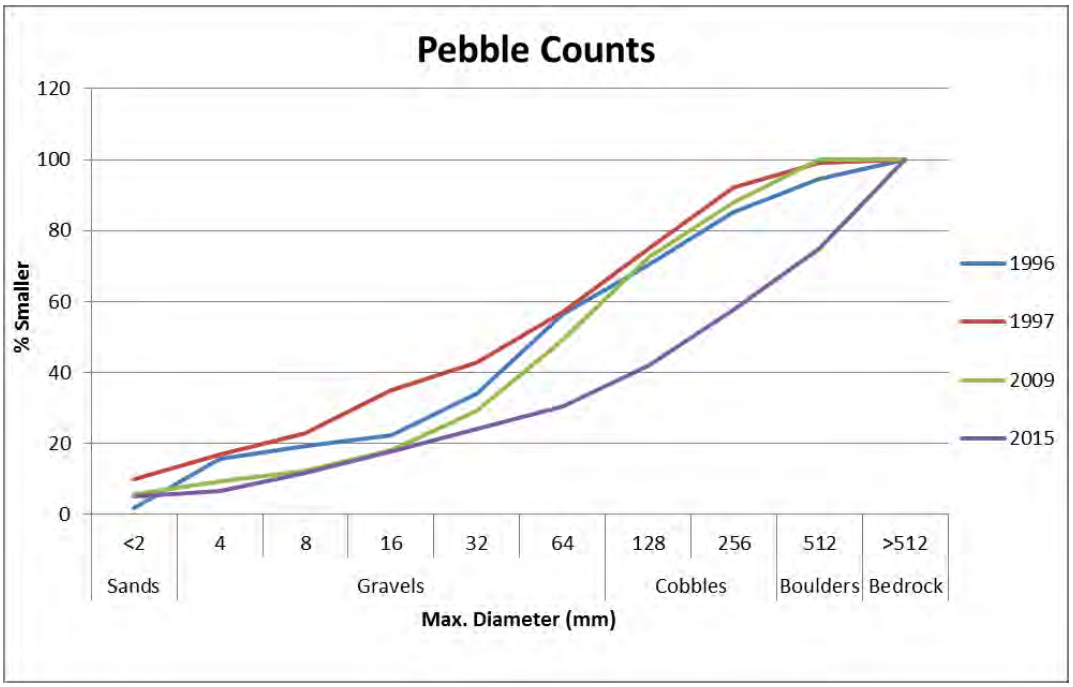

Figure 11: Camp Creek Particle Count

Pool Tail Fines

There was a 30% increase in pool tail fines after 1996, then a dramatic 180% decrease between 1997 and 2015. The trend reflects the water year 1996-1997 20-year flood event and recovery. This trend is opposite that of the increasing percent fines in riffles.

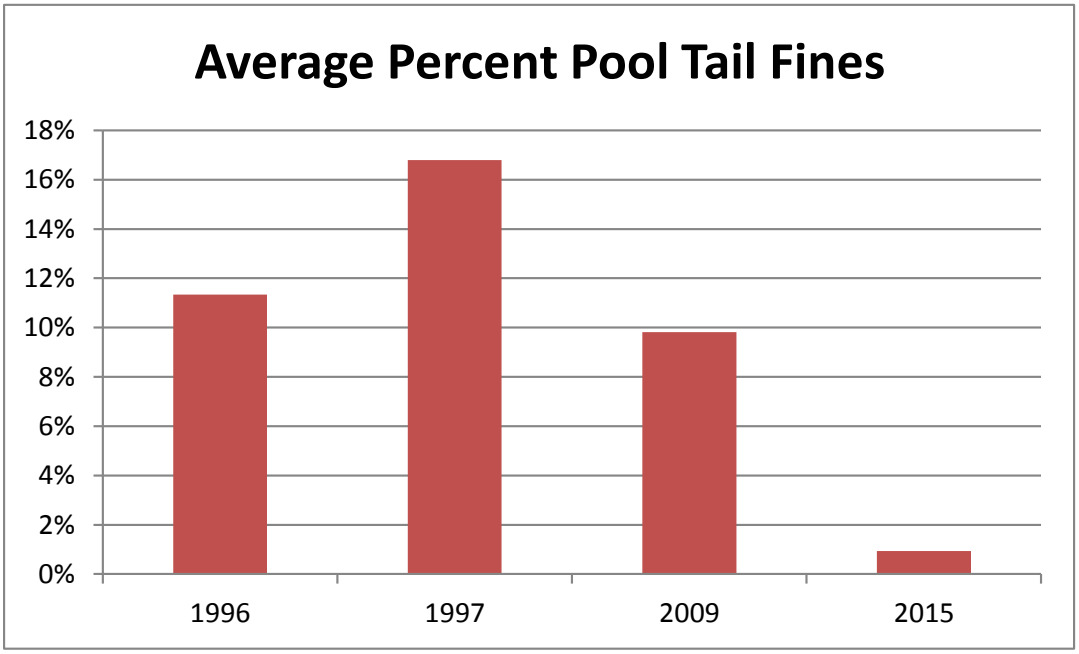

Figure 12: Camp Creek Average Percent Pool Tail Fines

Stream Shading

There was a minor increase in average percent shade cover between 2009 and 2015, but otherwise it was constant.

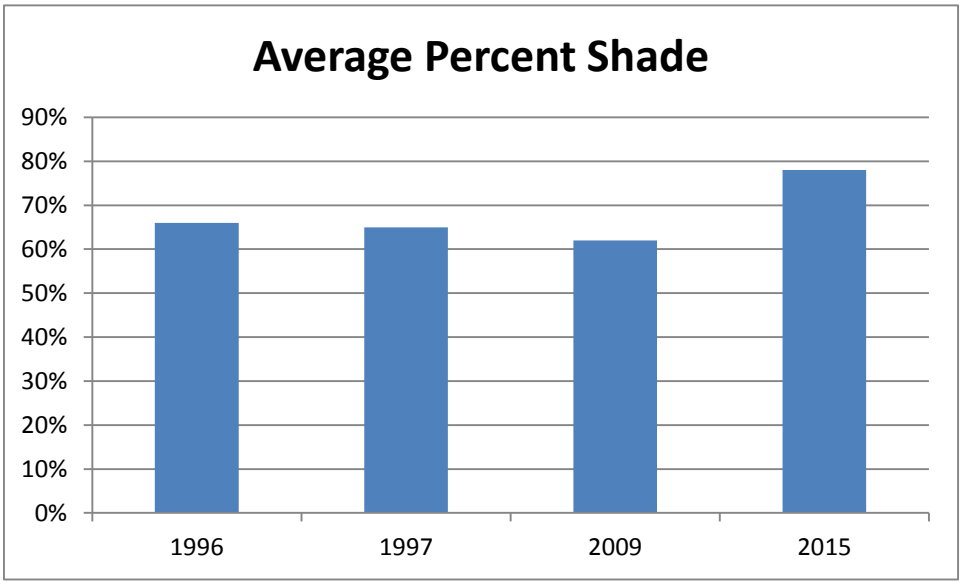

Figure 13: Camp Creek Average Percent Shade

Bank Stability

There was a marked shift from unstable and vulnerable banks to a marked increase in stable banks.

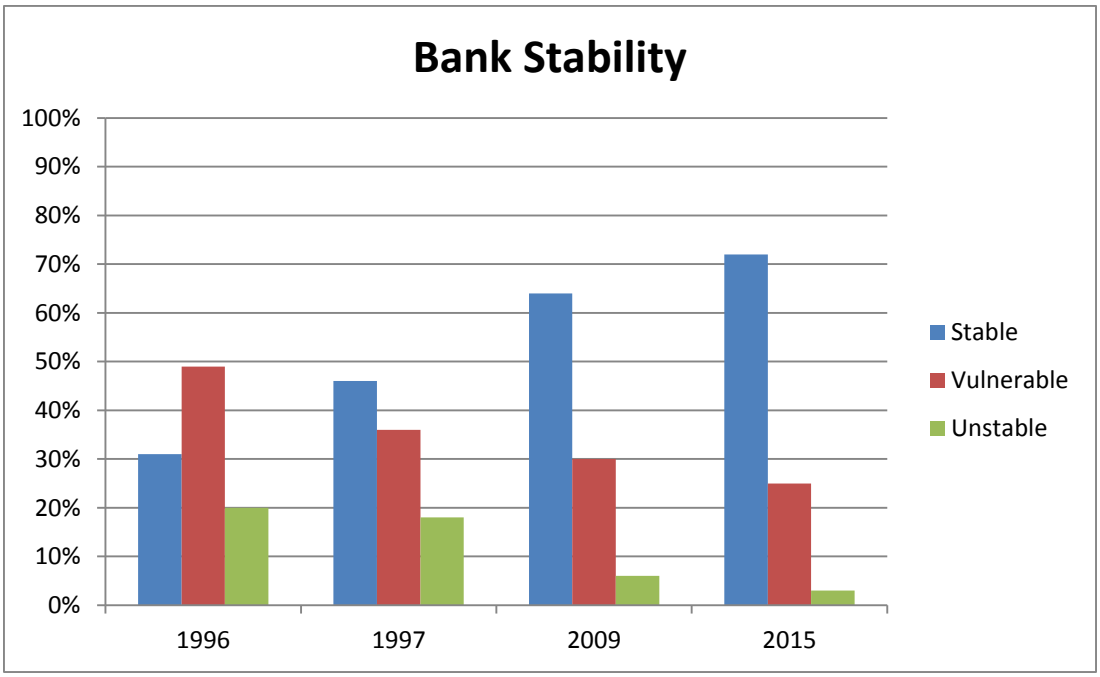

Figure 14: Camp Creek Bank Stability

Cross-Section Surveys

Three monumented cross sections were established. One of the width to depth surveys was repeated three times providing additional channel morphology data. There was variability in cross section morphology along the reach. Bankfull widths widened moderately in cross section three and in the width to depth cross section, but the other cross sections showed only minor changes. However, for the all cross sections, to varying degree, width to depth ratios reduced indicating the channel deepened throughout the reach. This was especially dramatic for cross section two. (Bankfull widths are in meters.)

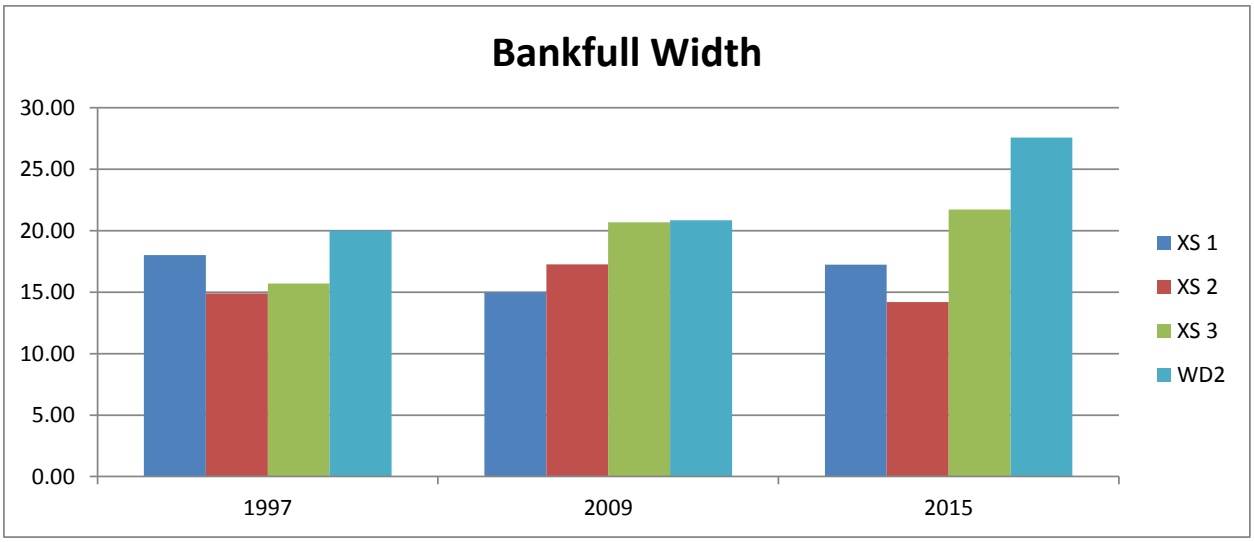

Figure 15. Camp Creek Bankfull Width

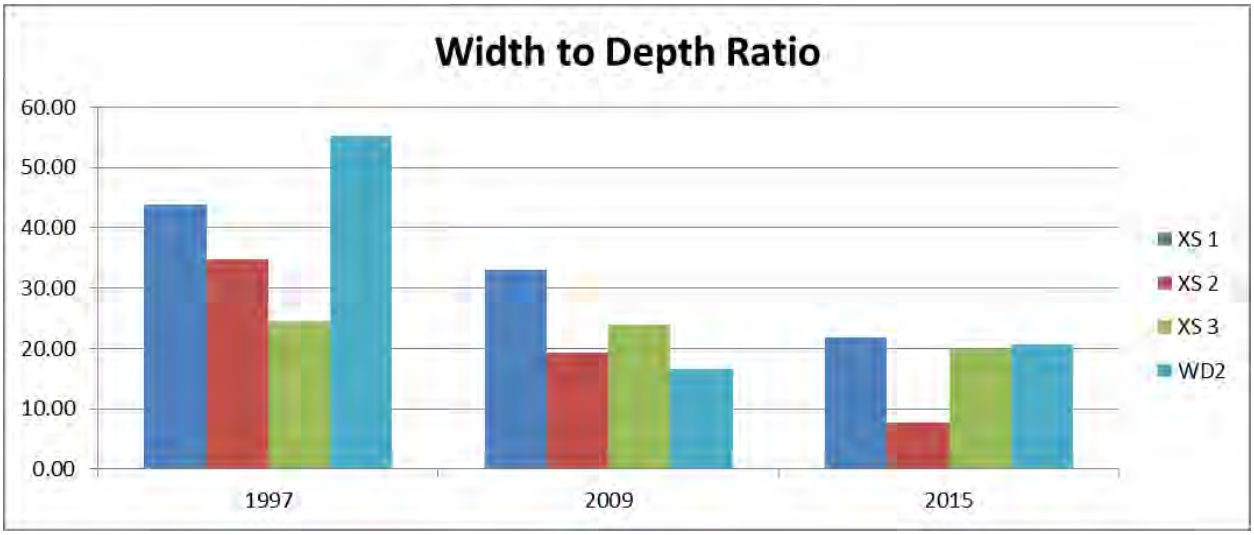

Figure 16. Camp Creek Width to Depth Ratio

Camp Creek SCI Reach Summary

Camp Creek monitoring reach showed changes primarily in morphology and bank stability. Data reflect a major flood disturbance during the water year 1996-1997, 20-year and subsequent recovery. This is evident by abrupt changes between 1996 and 1997 where there was an increase in pool tail fines and maximum pool depths, and greater percent of fines and gravel sized particles in riffles. That was followed in 2009 by a return to a particle size distribution in riffles similar to 1996, further deepening of maximum pool depths that stabilized between 2009 and 2015, and a dramatic reduction in pool tail fines. During the period after 1997, percent fines in riffles increased greatly, while simultaneously, particle size distributions coarsened overall. Channel morphology at cross sections varied, but all showed a trend toward increasing depth and

moderate increase or no change in bankfull width, which supports the scenario that the water year 1996-1997, 20-year event had the greatest impact on this reach.

Horse Linto Creek Middle SCI Reach

Horse Linto Creek Middle SCI reach has inventory data for the following years: 2005 and 2015. This reach was established in 2005 and is considered a transport reach. In order to analyze reach trends, a third monitoring event is needed.

Horse Linto Creek Lower SCI Reach

Horse Linto Creek Lower SCI reach was established in 1995. There are inventory data for the following years: 1995, 2000, 2002, 2005 and 2015. Cross sections 1 and 2 were reestablished in 2000 so comparative data span 2000 to 2015 for those two cross sections. Comparisons regarding cross section 3 include 1995 data.

Pool Frequency

The number of pools increased slightly from 2002 to 2005 from two to four, but the dramatic change is viewed in terms of percent of reach length that was pool or riffle. There was a marked increase in percent length of pool from 8% to 44% in 2005 and 2015.

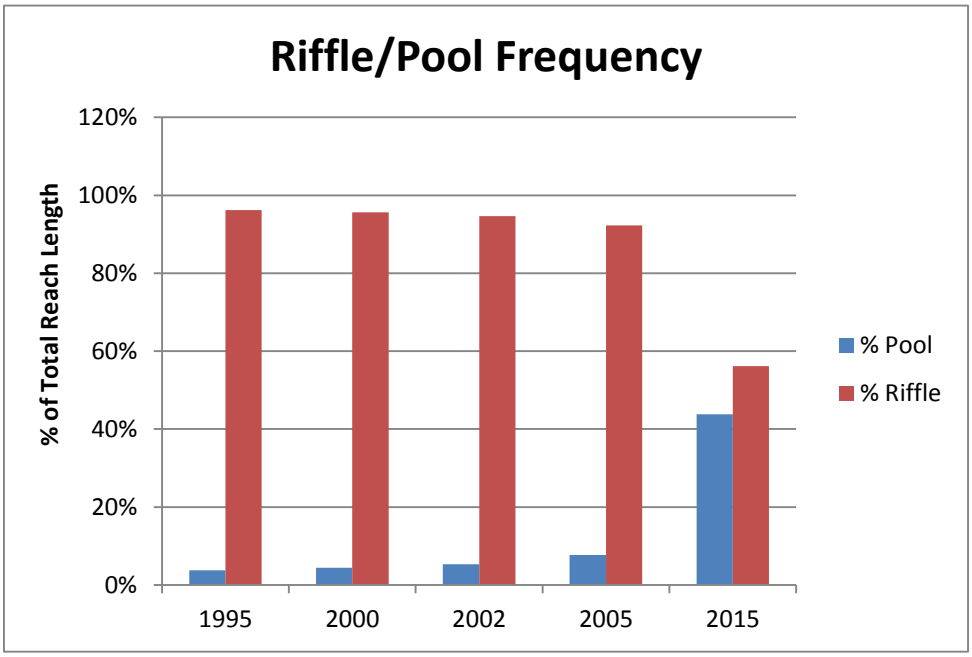

Figure 17: Horse Linto Lower Creek Pool-Riffle Frequency

Maximum Pool Depth

Pools have steadily become shallower with average depth about half in 2015 as they were in 1997.

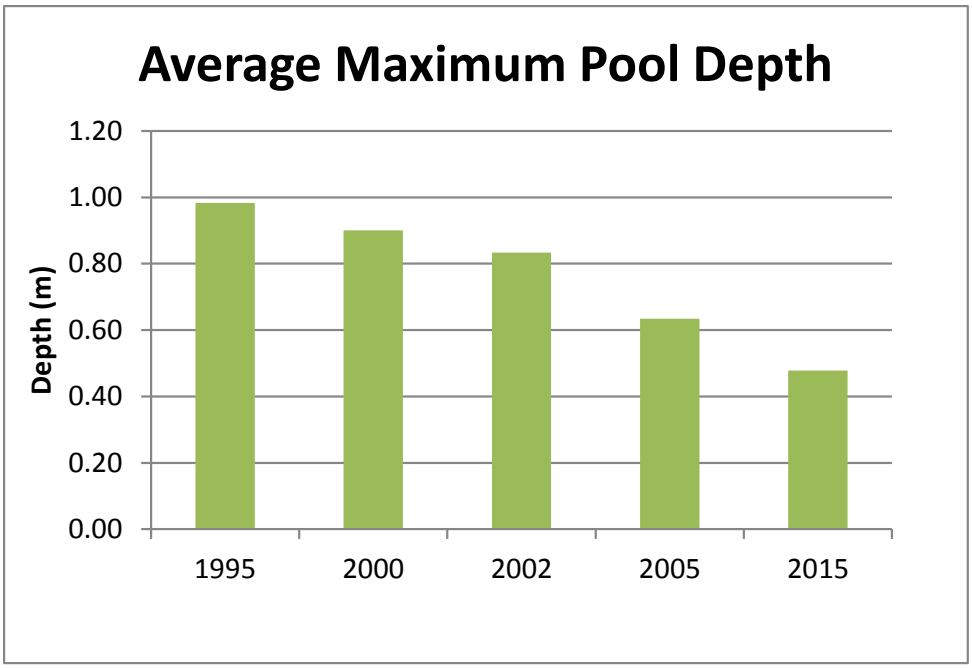

Figure 18: Horse Linto Lower Creek Average Maximum Pool Depth

Particle Size Distribution

Bed substrate has been coarsening especially between 1995 and 2000, and again between 2002 and 2005. There was a dramatic reduction in percent fines from 1995 to 2000, but only relatively minor change thereafter. The D84 value increased dramatically from roughly 120 mm in 2002 to roughly 220 mm in 2005.

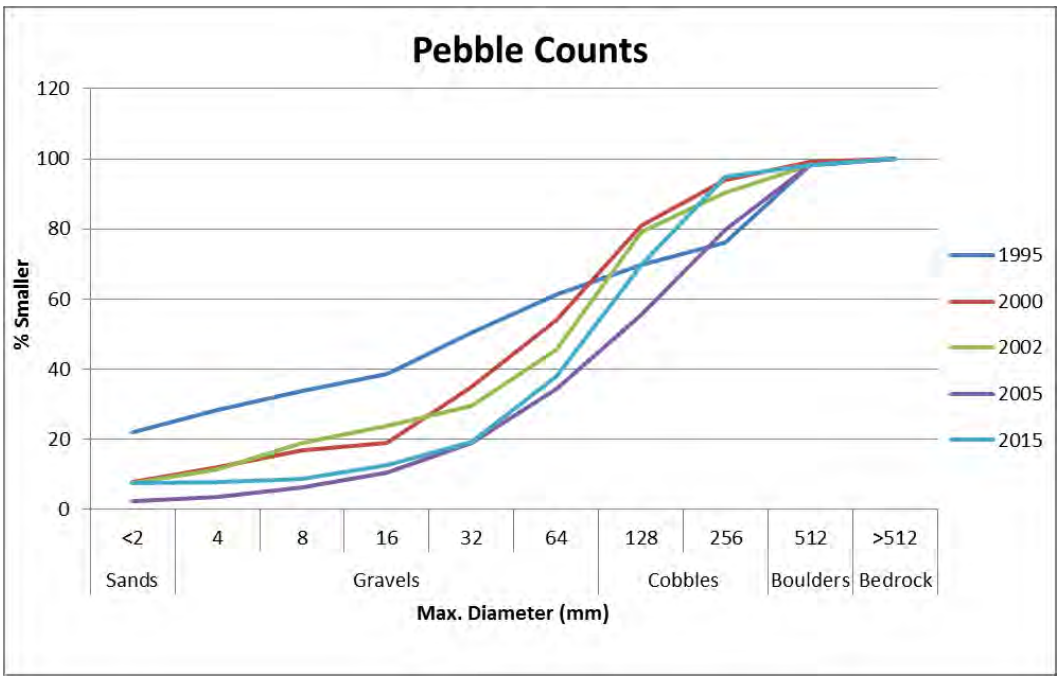

Figure 19: Horse Linto Lower Creek Particle Count

Pool Tail Fines

Average percent pool tail fines within the reach showed a marked increase. There was an abrupt increase from 1995 to 2000, a reduction between 2000 and 2002, then an increasing trend from 2002 to 2015. This is the opposite of the reduction in percent fines in riffles which dropped dramatically after 1995 then remained low between 2000 and 2015.

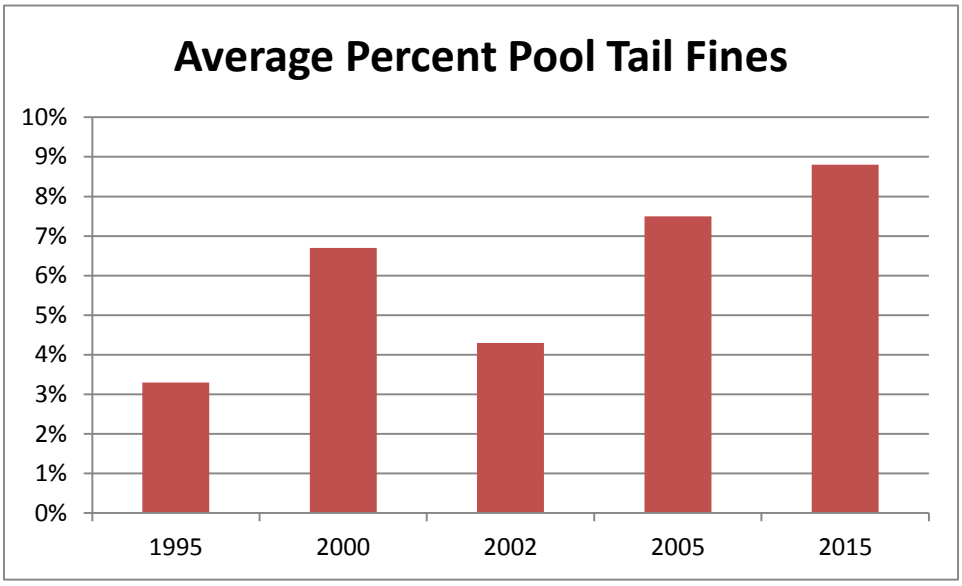

Figure 20: Horse Linto Lower Creek Average Percent Pool Tail Fines

Stream Shading

There was a gradual increase in percent shade cover over the duration of monitoring except for a small decrees between 2002 and 2005.

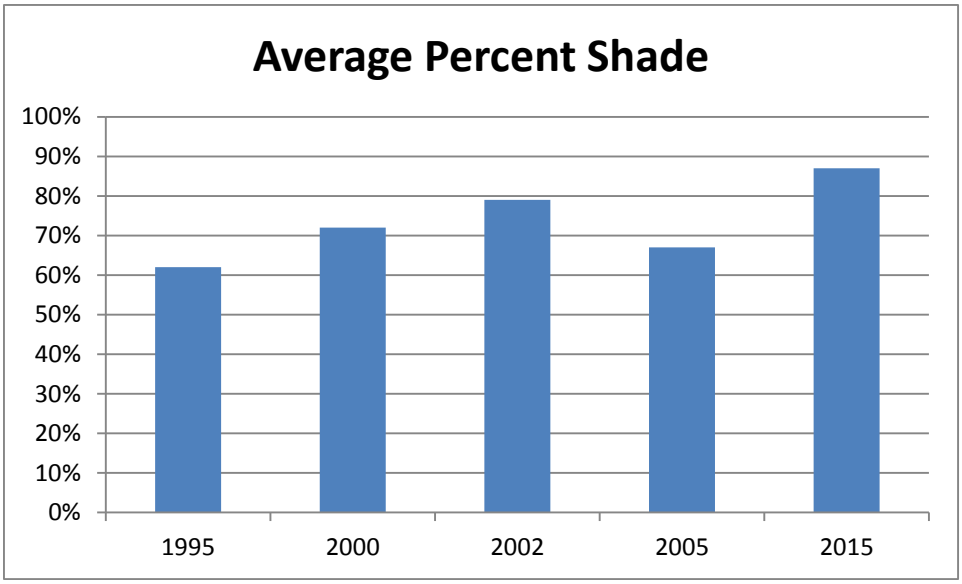

Figure 21: Horse Linto Lower Creek Average Percent Shade

Bank Stability

The change from unstable and vulnerable toward stable banks along the reach was dramatic, with unstable banks decreasing from 20% to 0%, and vulnerable banks from 50% to 15% over the monitoring period.

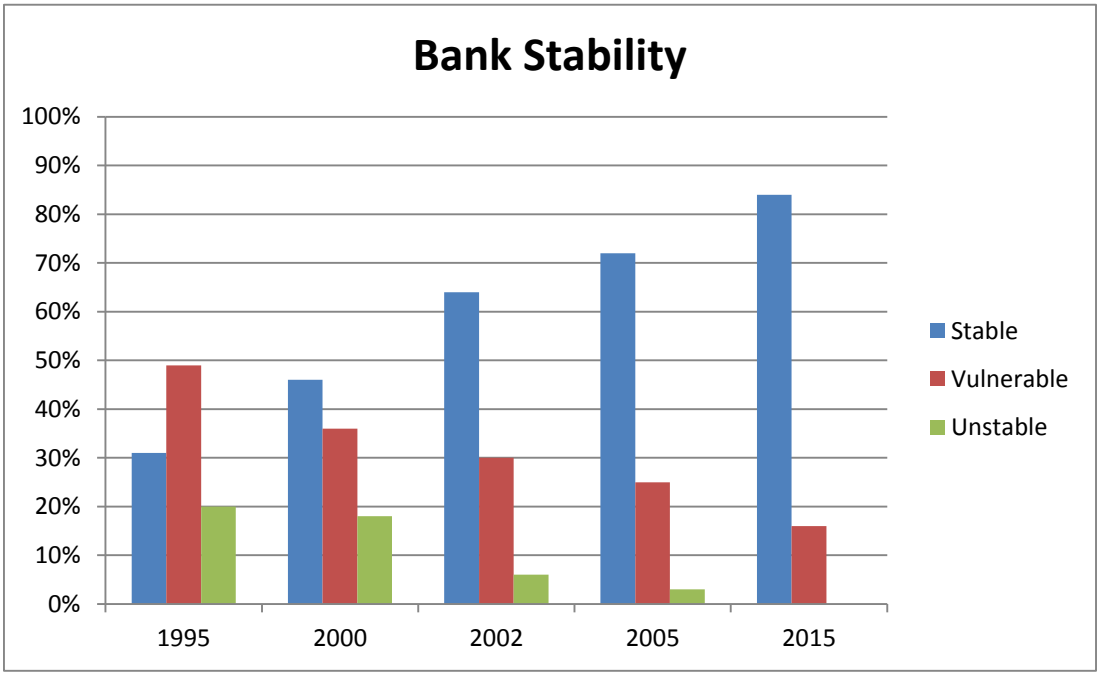

Figure 22: Horse Linto Lower Creek Bank Stability

Cross-Section Surveys

Three monumented cross sections were established. Two of the three cross sections were washed out after 1995 and reestablished in new locations in 2000. Between 2000 and 2015, two cross sections showed lowered bed surface elevations and increases in bankfull widths. Two of the width to depth surveys were repeated three times providing additional channel morphology data. They both increased in width. Width to depth ratios at all cross sections revealed that, as bankfull widths were increasing steadily over time, mean bankfull depths were far more varied. Channel gradients near cross sections decreased overall. An additional problem with Horse Linto Creek Lower (and Middle) SCI Reach was difficulty finding established cross section pins due to heavy Himalayan blackberry growth.

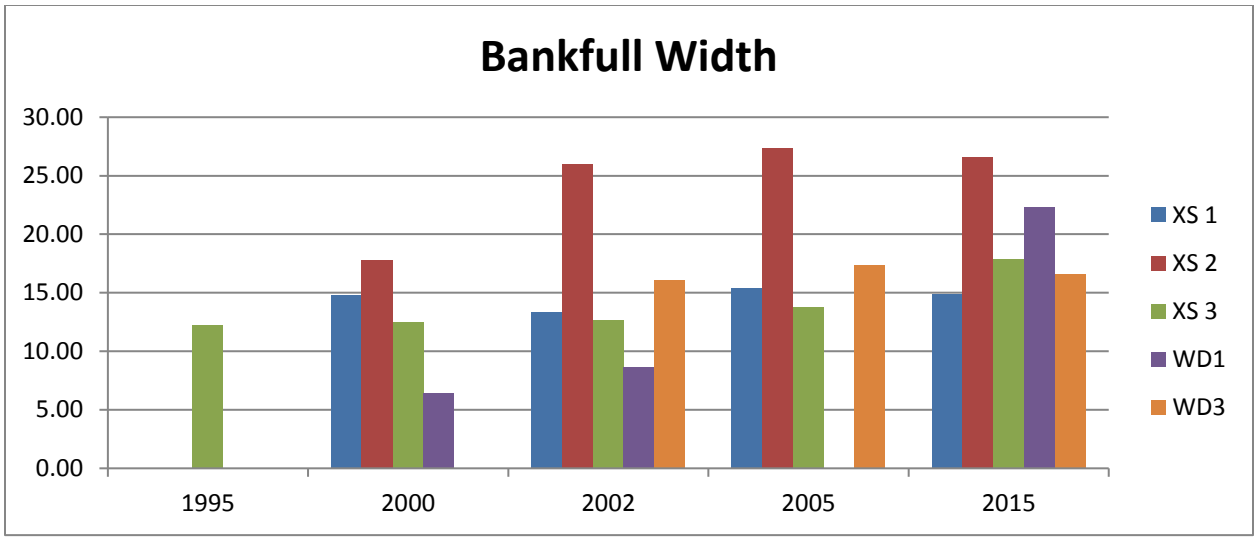

Figure 23. Horse Linto Lower Creek Bankfull Widths

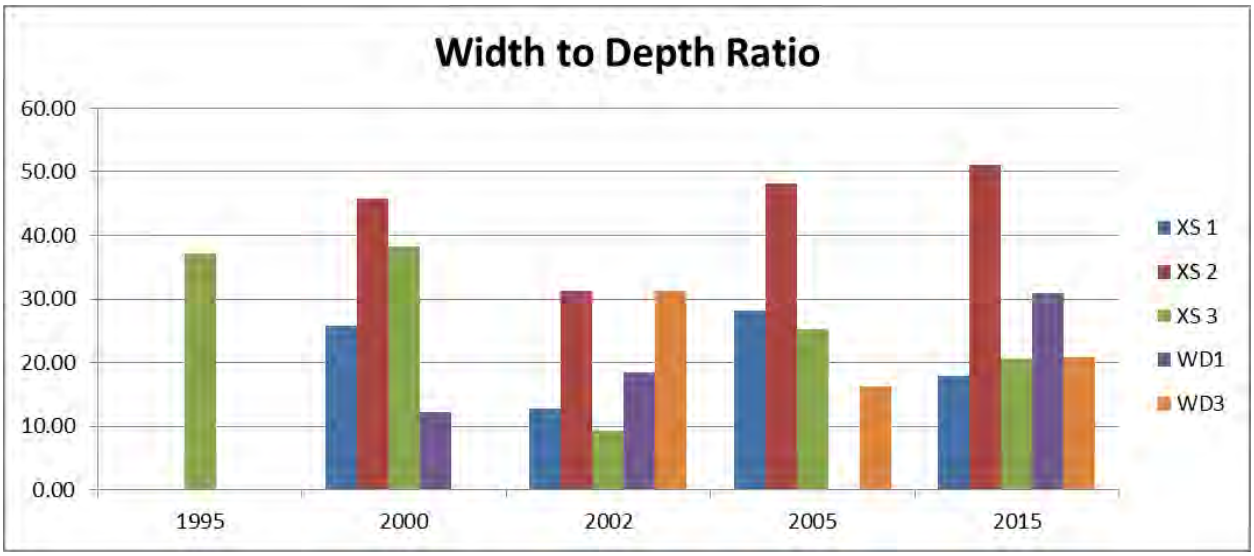

Figure 24. Horse Linto Lower Creek Width to Depth Ratios

Horse Linto Creek Lower SCI Reach Summary

Results for the monitoring period between 1995 and 2015, show the Horse Linto Creek (Lower) monitoring reach showed improvement in some factors such as bank stability and shade cover, and decline in others such as pool depth and pool tail fines. The reach trended toward greater stability, percent shade cover, pool frequency, percent pool length, and pool tail fines, but also showed a trend toward decreased pool depth, less percent fines in riffles, and a coarsening, and increase in diameter of riffle bed substrate. Abrupt changes occurred between 1995 and 2000, and again between 2002 and 2015. These trends support the conclusion that there was a reduction in sediment supply, and/or there were adequate flow events (between 1995-2000 and 2000-2015) that scoured fines from riffles and altered the morphology of substrate to create a greater frequency of pools with lower gradients, and associated greater trap efficiency of pool tail fines. This scenario is consistent with the 20-year flood event in water year 1996-1997. There

were four significant precipitation events after 1997 all of which occurred between 2004 and 2014 (http://www.cnrfc.noaa.gov/storm_summaries.php). Cross section data also support the scenario that flow events have had the greatest impact in this reach.

Table 11: Summary of Stream Conditions based on the Stream Condition Inventory Reaches

Creek Name	Pool Frequency	Average Maximum Pool Depth	Particle Count	Average % Pool Tail Fines	Cross-Sections	Bank Stability	Shade
Bluff Creek	Increased	Increased	Stable	Increase	No Significant Change	Increase	Increase
Camp Creek	No change	Increased	Coarsened	Decreased	Moderately Widended, Deepened	Increased	Minor increase
Horse Linto Creek (Lower)	Increased	Decreased	Coarsened	Increased	Moderately Widened, Deepened, Gradients decreased	Increased	Increased

OTHER MONITORING AND INVENTORY ACTIVITIES

Watershed and fisheries restoration are a key component of ecological restoration and there is extensive guidance and direction to make watersheds resilient to disturbances and uncertainties associated with climate change. National Forests under the Northwest Forest Plan (NWFP) follow the Aquatic Conservation Strategy which emphasizes watershed restoration in Key Watersheds. The Forest Service has adopted the Watershed Condition Framework (WCF), which outlines a process for assessing watershed condition, describing watershed restoration action plans and monitoring. The 2014 Southern Oregon/Northern California Coast Coho Salmon Recovery Plan identifies watershed and fisheries restoration actions that improve and restore watershed functions and instream habitat for coho (and other collocated anadromous fish). All of these restoration mandates have overlapping goals and objectives.

The MRP report will summarize implementation of annual restoration actions by the following mandates and guidance documents:

1. Northwest Forest Plan (actions within Key Watersheds);
2. Watershed Condition Framework [actions implementing Watershed Restoration Action Plans (WRAPS)];
3. Coho Recovery Plan (implementation of actions identified in the Coho Recovery Plan)

Northwest Forest Plan - Actions Within Key Watersheds

Most of the watersheds on the Six Rivers National Forest are listed as water quality impaired under section 303(d) of the Clean Water Act for sediment, temperature, nutrients or dissolved oxygen. With the exception of sediment, these water quality concerns are primarily attributable

to management activities outside of the Forest Boundary. On the Six Rivers National Forest, roads are the leading source of management-related sediment inputs. Where forest roads are located on steep terrain, mass soil movement is a common mechanism of erosion and sediment delivery. Most road-related erosion and sediment delivery are associated with large storm event that trigger culvert failures, stream diversions, and mass wasting. With the decline of road maintenance funding over last 20 years, the risk of road failures and elevated sediment delivery is increasing, especially during large storm events.

Watershed restoration objectives include reducing or eliminating potential sediment sources from roads to maintain/restore watershed processes which protect spawning and rearing habitat and provides critical thermal refugia for migrating juvenile and adult salmonids.

Watershed restoration efforts for the purpose of protecting important anadromous streams began about 1990 and were focused on minimizing surface erosion from inner gorge landslides. Tree planting and other landslide stabilization techniques proved costly and not as effective at meeting our objectives of reducing sedimentation into important anadromous streams. When the Northwest Forest Plan was signed and subsequently incorporated in our Forest Plan in 1995, decommissioning of abandoned Forest roads became the focus of restoration efforts on SRNF.

Detailed watershed restoration histories have been completed in the following areas Middle Fork Smith River, South Fork Smith River, Bluff Creek, Horse Linto Creek, Cedar Creek, and South Fork Trinity River. Watershed restoration history documents can be found online here: www.fs.usda.gov/goto/srnf/Water-FishRestoration. Maps depicting areas of restoration work (1980-2013) can be found on the website for the following areas: Smith River National Recreation Area, Orleans and Ukonom Ranger District, Lower Trinity Ranger District, and Mad River Ranger District. Camp Creek and Horse Linto Middle Creek Watershed Restoration Histories are works in progress. For the 2013-2014 reporting period restoration work was focused in the Bluff and Camp Creek

Watershed and fisheries restoration work is continuing in many watersheds throughout the Forest and is in various stages of development, ranging from field inventories, planning (NEPA) through to grant writing and implementation (Current Watershed and Fisheries Restoration Projects and Partnerships).

Watershed Condition Framework

Actions Implementing Watershed Restoration Action Plans (WRAPs)

The Forest Service has developed a methodology with which to assess watershed health. A Watershed Condition Framework was established to highlight direct threats to overall watershed health across National Forest Lands. From this exercise, watershed restoration action plans are developed to address the identified threats or stressors in a particular watershed. The SRNF has completed three WRAPs, (Upper and Middle Mad River and Bluff Creek Watershed). These WRAPs include a range of activities from fuels reduction to road decommissioning. During this monitoring report period, the SRNF has completed 4 miles of road decommissioning in Camp Creek HUC 6 Watershed (11 total stream crossings removed), 2 road-stream crossings upgrades in Old Campbell Creek HUC 6 Watershed, and 11 road-stream crossings upgrades in the Mingo

Creek-South Fork Trinity HUC 6 Watershed. Implementation will continue as funding allows and future WRAPs are expected to be completed in the next 10 years.

Coho Recovery Plan Implementation

Southern Oregon/Northern California Coast Coho Salmon Recovery Plan: Released in September 2014, the SONCC coho salmon recovery plan (NMFS 2014) was developed to provide a roadmap to recovery of this species which conservation partners can follow together. Specifically, the Recovery Plan was designed to guide implementation of prioritized actions needed to conserve and recover the species by providing an informed, strategic, and voluntary approach to recovery that is based on the best available science. The SONCC coho salmon recovery plan identifies threats and stresses to coho and actions by populations that would lead towards recovery. Actions carried out under the Watershed and Fisheries Restoration Program that implement this recovery include upslope activities that reduce sedimentation in the short and long term (i.e., road treatments including maintenance, upgrading and decommissioning; restoring recreation sites, treating landslides, reduce the risk of high severity fires, etc.) and activities that improve instream conditions for juvenile spawning and rearing (i.e., increasing large wood, riparian planting, gravel augmentation, encouraging beavers etc.). SRNF is in the process of developing a suite of actions under NEPA process to implement a more vigorous instream program.

Biological Monitoring – Fisheries

Seasonal monitoring efforts occur across the forest and are intended to assess the current conditions and trends for salmonid species. These efforts are generally conducted through partnerships and grant funds that vary in size annually. The biological monitoring effort is led by Fisheries Biologists on each District. This MRP Report will briefly list biological monitoring associated with fisheries and fish habitats as well as implementation of actions for threatened and endangered species described in Recovery Plans. Biological monitoring surveys conducted on Six Rivers National Forest include spawning surveys, summer adult salmonid surveys, Smith River Salmon/Steelhead Creel Census, Trinity/Klamath Tributary juvenile salmonid surveys, juvenile salmonid downstream migrant trapping, and aquatic habitat assessment. Stream temperature is also monitored, which is discussed below in further detail.

Stream Temperature

In addition to in-channel monitoring, stream temperature monitoring in selected reaches throughout the forest has been ongoing for many years. The heightened awareness of the effects of increased stream temperatures on salmonids and other aquatic species and the uncertainties associated with climate change has made stream temperature monitoring a priority. Stream temperature data has been monitored on 38 stream locations going back to the early 1990's. Not each site is measured every year. Thus far, we use various temperature recording devices to measure summer and some winter stream temperatures. Since 1996 with the onset of continuous temperature sensor technology, stream temperature data is collected within most mainstem and tributary habitat. Stream temperature data is obtained from these perennial streams for baseline, trend, effectiveness, compliance, or validation monitoring.

Stream temperature monitoring is being conducted on all districts of SRNF by both Forest Service employees and partner groups. The Lower Trinity, Orleans, and Ukonom Ranger Districts are more intensively monitored than Mad River Ranger District or the Smith River Natural Recreation Area. Stream temperature monitoring sites are primarily chosen based on anadromy, SCI reach proximity, proximity to other agencies/groups (i.e., North Coast Regional Water Quality Control Board and local Tribes) monitoring sites, and ease of access.

Smith River National Recreation Area (NRA) Ranger District

Monitoring is conducted by the single NRA Fisheries Biologist in partnership with Cal Fish and Wildlife and Smith River Alliance who help with deploy and retrieval of temperature loggers. The temperature logger locations are coincident with a given year's fish survey (spawner and habitat typing) reaches. The actual reaches to be surveyed are determined each year through an annual random draw (sample) from the pool of all reaches (universe). Reaches are delineated as 1-2 kilometer fish survey reaches and are numbered from 1 (lower river) to 300+ in the North Fork. Each year there are different sites, but there may be repeats from previous years. Some years are lean due because of budget. Due to the random draw, there may be clumping of some sites, but overall the sample distribution is fairly even. The 2015 data for Smith River NRA is currently being complied and is available upon request.

Lower Trinity, Orleans, and Ukonom Ranger Districts

Stream temperature monitoring is conducted on all three districts, although Orleans and Ukonom data is reported together as the monitoring is conducted by the Orleans Ranger District. Monitoring of summer stream temperature is done with temperature data loggers (typically Hobo temperature loggers). The monitoring is led and primarily conducted by two Fisheries Biologists, one in Lower Trinity and one in Orleans, with limited field assistance from AmeriCorps Watershed Steward Project (WSP) Interns. The WSP interns assist with retrieving the temperature data loggers before high winter flows. In addition, the Orleans Fisheries Biologist leads and conducts Klamath mainstem and tributary data.

The below tables provide a summary of the sites monitored in 2015. Stream temperature data is entered into spatial data base referred to as the Natural Resource Information System – Aquatic Surveys (NRIS-AqS) Natural Resource Management (NRM) database that allows for basic statistical analysis such as the Max Weekly Average Temperature (MWAT) and Max Weekly Max Temperature (MWMT). The Lower Trinity, Orleans, and Ukonom data is currently being entered into the database, and will need to have quality assurance/quality control (QAQC) conducted prior to calculating MWAT AN MWMT

Table 12: Lower Trinity Ranger District Stream Temperature Monitoring Sites 2015

Creek	Location (w/ link to pic)	Serial #	GPS (LT Fish #1)	Action	Date	Time	H2O Temp. °C	Air Temp.	Blinking?	Comments - Launch, Retrieve	AQS Location name	Entered in Aqs Y/N	MWAT °C /date	Max temp °C/ date
Cedar Creek	Same as 2014, tree RR ~115 m	10414221	Waypoint #327	Launch	4/3/2015	1235	8.5	10	Y			N	18.65	18.99
				Removal	12/2/2015	1340	7	8.8	N/A	Retrieve: GPS fish #2, point 656			7/21/2015	7/20/2015
Horse Linto - Above Cedar	Same as 2014, tree RR ~74+75 ft	10414220	Waypoint #328	Launch	4/3/2015	1140	7.5	11	Y			N	20.35	20.77
				Removal	12/1/2015	1354	6	6.1	N/A	R- GPS fish #2, point 655, under log RR			7/21/2015	7/20/2015
Horse Linto - Below Cedar	Under camp bridge in turbidity probe	10414219	Waypoint #329	Launch	4/3/2015	1303	8.5	10.5	y			N	20.28	20.67
				Removal	12/2/2015	1406	7.5	6.1	N/A	R- airtemp based on HL above Cedar, GPS fish #2, point 657, not sure exact date			7/21/2015	7/20/2015
Madden Creek	On tree River L. Link to 2014 photo	10414222	Waypoint #330	Launch	4/2/2015	1435	9	16	y		MADBRG_H2O_temp	N	No data	No data
				Removal	12/11/2015	935	6.1	13.3	n	R- Logger not in tube, buried under the gravel, photo 492 - 497				
South Fork Trinity	No photos taken, similar	10414199	Waypoint #331	Launch	6/8/2015	1600	N/A	N/A	y			N	29.02	29.57
				Removal	12/8/2015	1155	N/A	N/A	N/A				7/7/2015	7/5/2015
Willow Creek	915 m RL on tree	1187739	Waypoint #332	Launch	4/2/2015	1515	9	18	y	L - May snag on roots under bank	willowcreektemp	N	21.63	22.15
				Removal	12/15/2015	1420	8	6	N/A	R - Buried under snags			7/7/2015	7/4/2015
Grouse Creek	Same as 2014-upstream of bridge @ outlet	1187748	Waypoint #333	Launch	6/8/2015	1305	19	31	Y			N	23.39	24.03
				Removal	12/4/2015	1115	7	10	Y	R- Covered by leaves, photo 0484 - 0486			7/21/2015	7/4/2015
East Fork Willow Creek	On tree, RR-no new photo	1194216	Waypoint #334	Launch	4/2/2015	13:35	7.5	17	Y		EastForkWillowCrTemp	N	17.1	17.53
				Removal	12/4/2015	1427	6.5	9	N/A				7/7/2015	7/5/2015
Sharber-Peckan	Same as 2014-no new photo	1194217	Waypoint #335	Launch	12/31/2014	9:53	5.5	32F	Y			N	18.13	18.87
				Removal	12/11/2015	1055	8.8	12.2	N/A				7/21/2015	7/30/2015

The data for Lower Trinity Ranger District is in the process of being entered into the NRIS-AqS database. Once the data has been entered and quality analysis – quality control (QAQC) has been completed MWAT and MMWT will be available for the District monitoring sites.

There are twenty-seven sites that were monitoring in the Orleans/Ukonom Ranger District in 2015, seven of which are also monitored over winter. There are three stream temperature sites that are located off Forest Service property, which are the Klamath River below Trinity River (RM 43); Trinity River above the confluence (RM 0.1), and Klamath River above Trinity River (RM 43.7).

In 1997, these monitoring locations were established in cooperation with the Forest Science Project and the Yurok Tribe during the critical period of the summer (typically between June and October). The primary objective was to monitor ambient stream temperatures for the Klamath mainstem above and below the Trinity River as well as within the lower Trinity mainstem (above its confluence with the Klamath River). The Klamath mainstem and tributary data will be reported to the Water Board in a separate report for 1993 through the present.

Table 13: Orleans/Ukonom Ranger Districts Stream Temperature Monitoring Sites 2015

File Name	Location Description	2015	
		summer	winter
k43-05	Klamath River below Trinity River (RM 43.0)	6/8-10/27	
trin	Trinity River above confluence (RM 0.1)	6/8-10/27	
k43-70	Klamath River above Trinity River (RM 43.7)	6/8-10/27	
aikens	Aikens Creek near mouth (RM 0.10)	6/9-10/27	2/2
k48-93	Klamath River below Bluff Creek (RM 48.9)	6/9-10/27	
lbluff	Bluff Creek near mouth (RM 0.3)	6/9-10/27	
ubluff	Bluff Creek at Dragon Bar (RM 6.8)		
ubluff	Bluff Creek at Wrights Ranch (RM 3.8)	8/1-still out	
k50-30	Klamath River below Slate Creek (RM 50.3)	6/9-10/27	
slate	Slate Creek near mouth (RM 0.1)	6/9-10/27	2/2
k52-40	Klamath River below Red Cap Creek (RM 52.4)	6/10- still out	
lred	Red Cap Creek near Adam's Creek (RM 1.6)	6/11-1/6	1/8
lred	Red Cap Creek near mouth (RM 0.1)		
ured	Red Cap Creek above Schnable Bar (RM 9.2)	6/30-still out	
k54-50	Klamath River below Boise Creek (RM 54.5)	6/7-10/27	
boise	Boise Creek near mouth (RM 0.10)		
boise	Boise Creek above bridge (RM 0.40)	6/11-10/27	2/2
k56-40	Klamath River below Camp Creek (RM 56.4)	6/7-10/27	1/13
lcamp	Camp Creek below HWY 96 bridge (RM 0.4)	6/11-10/28	2/2
ucamp	Camp Creek above 3rd Creek (RM 6.4)		
k58-90	Klamath River above Camp Creek (RM 58.9)	5/19-10/28	
pearch	Pearch Creek near mouth (RM 0.1)		
pearch	Pearch Creek near campground (RM 0.7)	5/19-10/28	
k62-65	Klamath River above Pearch Creek (RM 62.6)	6/7-10/28	
k65-25	Klamath River below Salmon River (RM 65.2)	6/4-10/28	
lsalmon	Salmon River at USGS gauge (RM1.0)	6/4-10/28	
usalmon	Salmon River at Wooley pool (RM 5.0)	6/4-10/28	
lwooley	Wooley Creek near mouth (RM 0.3)	6/4-10/28	
uwooley	Wooley Creek above Bridge Creek (RM 10.5)	7/15-Still out	
k66-25	Klamath River above Salmon River (RM 66.2)	5/22-10/28	
k71-50	Klamath River at Green Riffle (RM 71.0)	5/22-10/28	2/2

Table 14: Orleans/Ukonom Ranger District Stream Temperature Monitoring Data Notes

File Name	Data Notes
14ubluff	Logger not retrieved summer/fall 2015
14winuwooley	Logger retrieved, not able to open data file. Will be sent in to manufacturer to try and retrieve any data.
14wink56-40	Logger not retrieved summer 2015, could not be found.

Mad River Ranger District

Historically stream temperature monitoring was conducted annually in Pilot Creek and the North Fork Eel watershed. Placement of hobo temps in these locations has not occurred to the same degree due to limited staff, funding and priorities. In 2015 no temperature data was collected.

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Appendix A Strom Patrol Reports