Water Quality Management Plan
Rogue River Basin
Illinois River Sub Basin

Siskiyou National Forest
Oregon Department of Environmental Quality, Medford Office

March 1, 1999

Watershed at a Glance	
Watershed	Sucker Creek (62,100 acres) USFS Ownership (42,000 acres) BLM Ownership (5,800 acres) Private Ownership (12,000 acres) State/County Ownership (300 acres) Caves National Monument (500 acres)
Stream Miles	Total (428 miles) Perennial (285 miles) Federal Ownership (353 total) (225 perennial) Private Ownership (75 total) (60 perennial)
Watershed Identifier	1710031103 (Hydrologic Unit Code)
303(d) listed Parameters	Temperature, Habitat, and Flow
Key Resources and Uses	Salmonids, Domestic, Agricultural, Industrial
Known Impacts	Mining, Timber Harvest, Roads, Water Withdrawals

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Statement of Purpose

This water quality management plan is prepared to meet the requirements of Section 303(d) of the 1972 Federal Clean Water Act.

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DEQ WQMP Element Location

A Table of Contents for location of the DEQ elements within the Sucker/Grayback WQMP is provided below:

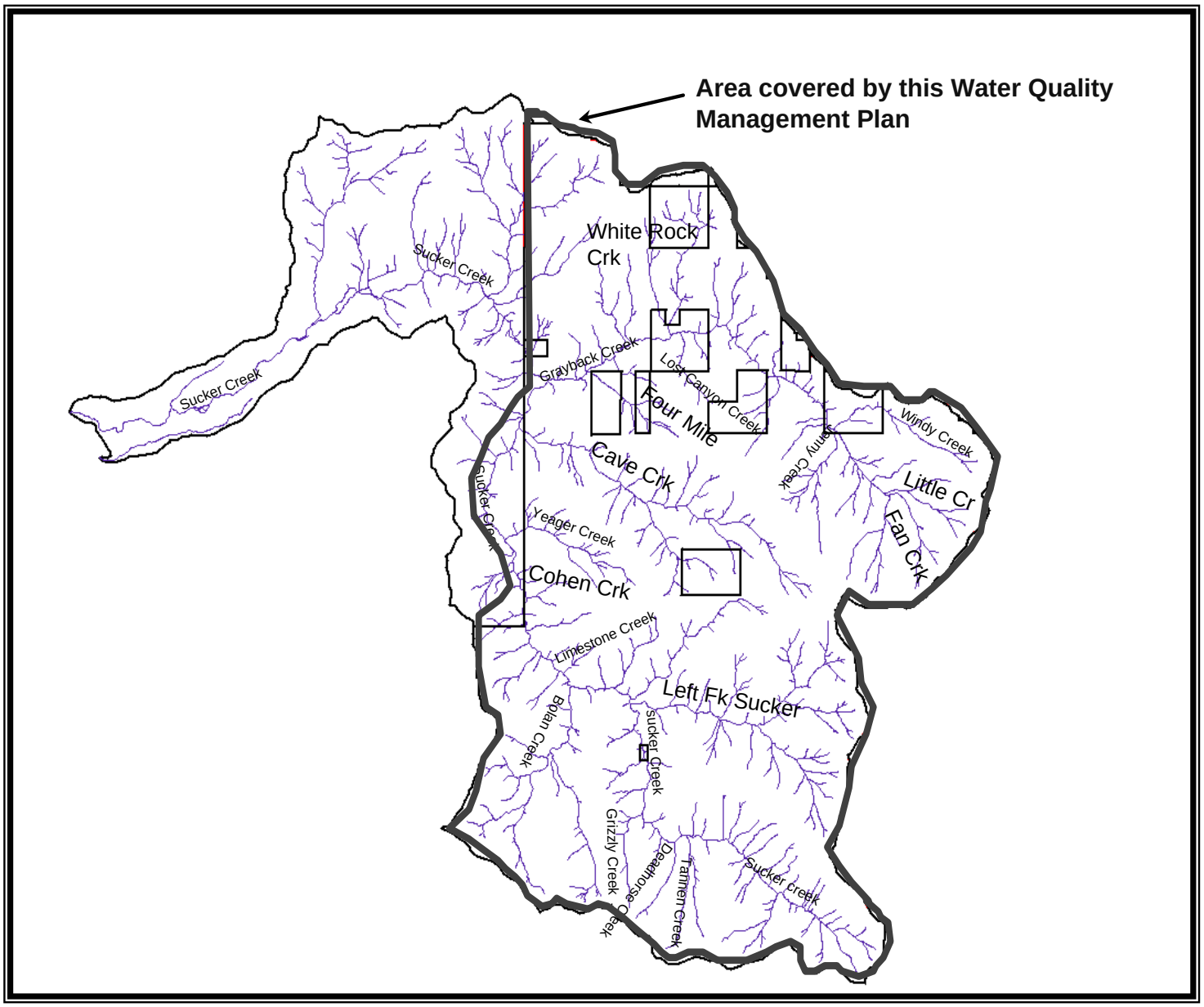

Figure 1. Sucker Creek Watershed

Chapter 1 - Project Overview

INTRODUCTION

Sucker-Grayback is a 62,100-acre watershed that is tributary to the Illinois and Rogue Rivers in SW Oregon.

Table 1

Ownership Boundary	Sucker Creek Watershed	Within USFS
USFS	62,000	42,000
BLM	5,800	
Private	12,000	2,890
State/County	300	
Caves National Monument	500	500

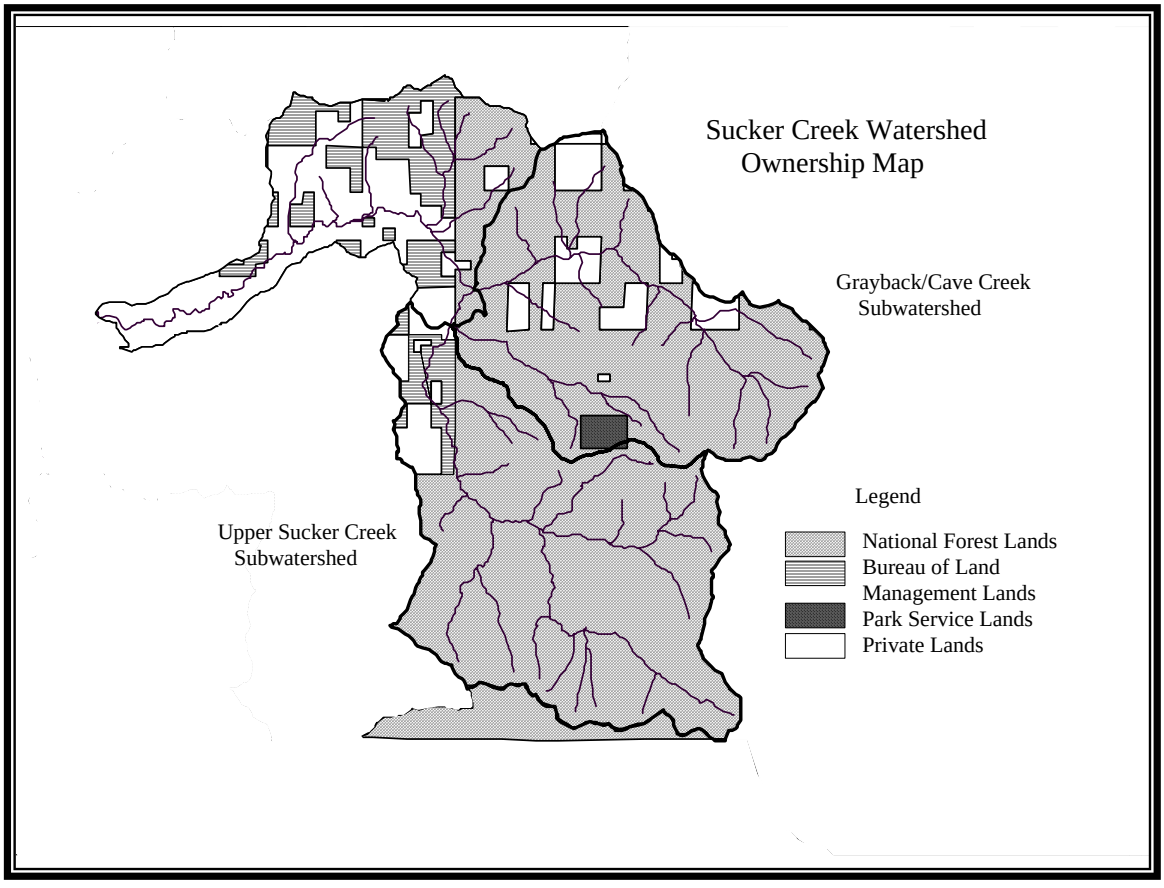

Figure 2. Sucker Creek ownership map.

The area covered by this plan includes land managed primarily by the U.S. Forest Service and BLM. It covers from the headwaters down to just below the confluence of Sucker-Grayback Creek at approximately RM 10.4 of Sucker Creek. This portion of Sucker-Grayback Creek is a key watershed as defined by the President's Northwest Forest Plan (1995, USDA, USDI). There are no point source discharges within the Sucker Creek watershed.

Inherently, Sucker Creek is a high value salmonid fish watershed. It is one of the few watersheds in the Siskiyou Mountains with substantive snowpack most years and good cold water flow. Despite the perturbances caused by mining, timber harvest, and downstream agriculture uses, Sucker Creek has good numbers of Coho salmon, Chinook salmon, and winter steelhead spawning during many years. Sucker Creek is a very high priority for protection and restoration, one of the most important anadromous fish watersheds in the Rogue River basin.

Private land within the area covered by this WQMP is managed under the Oregon Forest Practices Act. A subsequent Water Quality Management Plan will be written by Oregon DEQ to cover the remainder of the Sucker Creek watershed. The Sucker-Grayback WQMP covered in this current document is intended to be adaptive in management implementation. It allows for future changes in response to new information. Information generated during development of the private lands WQMP may cause modifications to this current plan for the federal lands.

Listing Status

Beneficial uses include domestic water supply, irrigation, livestock watering, industrial (mining), and cold water biota (salmonid). The Oregon Department of Environmental Quality placed this watershed on the 1994/1996 303(d) list for the following parameters identified in Table 3:

Table 2
303d Listing

Location	Parameter
Grayback Creek, Mouth to Headwaters	Habitat Modification
Sucker Creek , Mouth to Bolan Creek	Habitat Modification Flow
Sucker Creek, Mouth to Grayback Creek	Temperature
Lake Creek, Mouth to diversion	Temperature

Stream temperatures exceed the standard on Sucker Creek between June and September from the mouth upstream to the confluence with Grayback for the five years of record (1993-1997). The 1998 303(d) list approved by EPA to modified the temperature listing to read from the mouth of Sucker Creek to Grayback Creek. While the 1998 water quality limited status for temperature is below the Forest Service boundary, this analysis is relevant to answer the question regarding whether lands under Federal management are providing the coolest water possible to downstream uses. This document will show to what extent water is being warmed, and what factors are contributing to that warming.

Table 3
Grayback/Sucker Temperature Summary
Summer Water Temperatures Only - June to September

Water Quality Station	Years of Record	Average 7-Day High All Years	Average 7-Day High 1994 - 1997
Sucker Ck. @ Mouth Elevation 1360’	1993 -1997	71.9 F	72.3 F
Sucker Ck. blw. Little Grayback	1993 -1997	66.9 F	65.7 F
Sucker Ck. @ Bolan Ck.	1994 -1997	59.9 F	59.9 F
Sucker Ck. @ Tannen Ck.	1994 -1997	58.3 F	58.3 F
Grayback Ck. @ Mouth (1,840 feet elevation)	1991 -1997	61.9 F	61.6 F
Grayback Ck. below Mossback	1994 -1995	59.5 F	NA
Cave Ck. near Mouth	1977, 1980, 1994	62.9 F	NA
Bolan Ck. @ Mouth	1978-81,94-97	57.9 F	57.2 F
L.F. Sucker Ck. @ Mouth	1992-1997	58.9 F	59.0 F

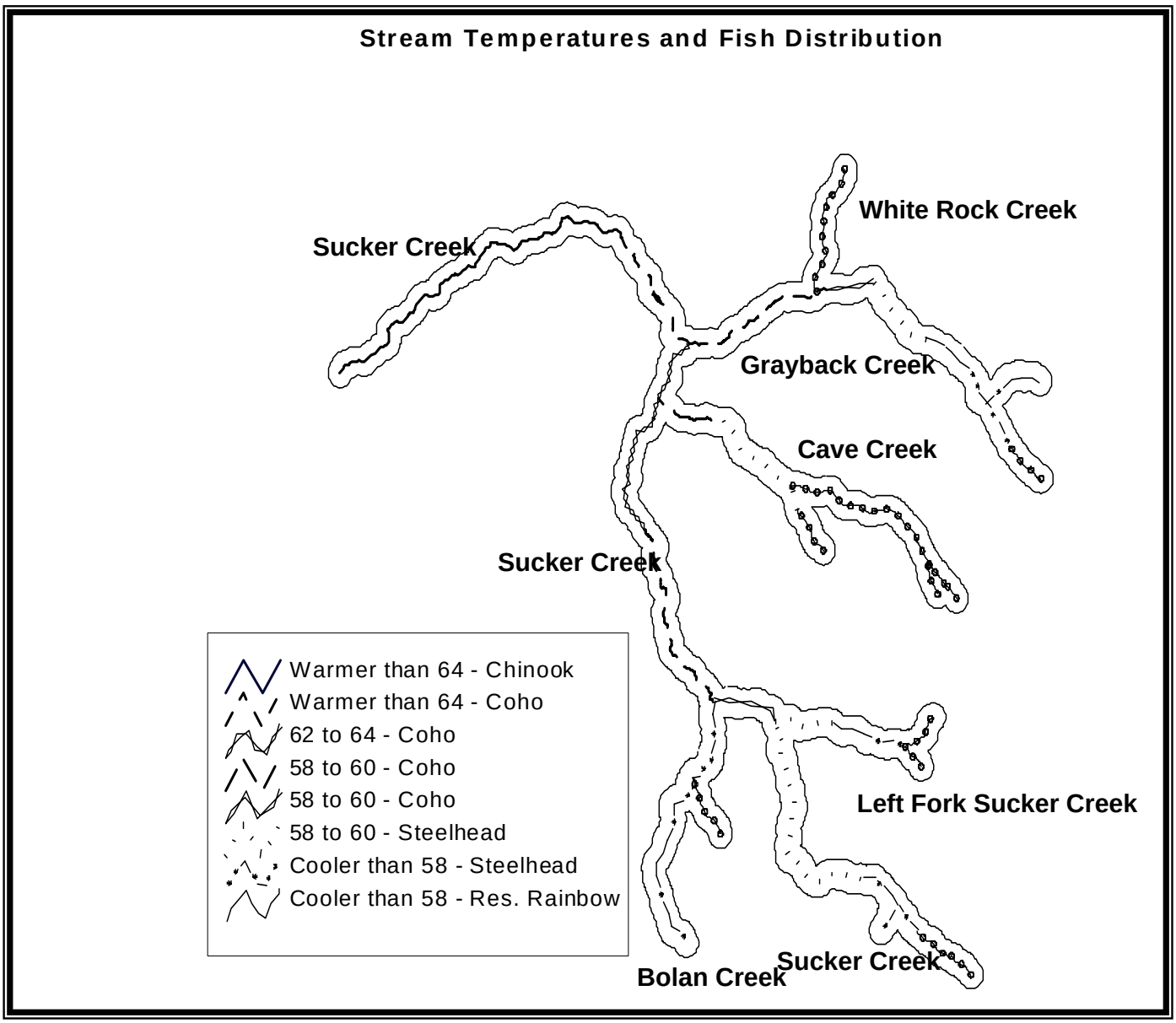

Figure 3. Stream Temperature and Fish Distribution

SEASONAL VARIATION IN TEMPERATURE AND FLOW

Section 303(d)(1) requires the TMDL's "be established at a level necessary to implement the applicable water quality standard with seasonal variations." Both stream temperature and flow vary seasonally and from year to year. Water temperatures are cool during the winter months, and only exceed the State standard between the summer months of June and September when stream flows are lowest and solar radiation is the highest.

Stream Flow

The 7-day low flows for the gage at Little Grayback Creek for the period of record from1942 to1990 have varied from 13 cfs in 1975 to 35 cfs in 1983. Low flows generally reflect annual precipitation levels with higher low flows in wetter years and lower summer flows in drier years. Variation in low flow from year to year is typical for this stream system.

Table 4
Stream Temperature

Name	Period of Record	7 Day Max (F)	7 Day Max Range for Period of Record (F)	Day Over 64 F	Diurnal Flux (F)
Sucker Creek at Forest Boundary	**1992**	**63.3**	**No range (data for 1992 only)**	**0**	**5.5**
Grayback Creek at Mouth	**1991 to 1997**	**61.9**	**4.2**	**0**	**6.0**

Responsible Parties

Participants in this plan for Federal lands include DEQ, BLM, and the USFS. The USFS is the lead agency in this plan, due to the large percentage of land in this watershed under Forest Service management. Federal land managers have worked out schedules for completion of WQMP's required on Federal lands. During those scheduling discussions, the Federal land managers agreed that the largest Federal landowner within the watershed would be the lead agency for plan completion, implementation, and management for the Federal lands.

A subsequent WQMP for the remainder of the watershed will be developed by DEQ and the Oregon Department of Agriculture. That WQMP will deal with private lands, including private forest lands within the Federal boundary, as well as non-resource lands and agricultural lands. The Agricultural WQMP is scheduled for completion in the fall of 1999. The private lands under DEQ responsibility are also scheduled to be completed in 1999.

The Oregon Department of Forestry (ODF) is the Designated Management Agency (DMA) for regulation of water quality on non-Federal forestlands. The Oregon Board of Forestry in consultation and with the participation and support of DEQ has adopted water protection rules in the form of BMP's for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. ODF and DEQ will jointly demonstrate how the FPA, forest protection rules (including the rule amendment process) and BMPs are adequate protection for water quality.

Oregon Water Resources Division (WRD) is a participant within the implementation and monitoring components of this plan. WRD will be doing flow measurements, and will also be trying to identify opportunities for converting consumptive uses to instream rights.

The Oregon Department of Geology and Mineral Industries (DOGAMI) is also a participant with respect to mining impact assessment and permit modifications. DOGAMI covers mining operations which exceed 1 acre of disturbance or 5000 cubic yards of production within a 12-month period. Operators are required to obtain an operating permit if they are located above the 2-year floodplain of creeks and rivers.

Public Involvement

This WQMP is a procedural step that focuses on Water Quality using elements of the Northwest Forest Plan (NWFP). It tiers to and appends the Grayback Sucker Watershed Analysis. Watershed analyses are a required component of the Aquatic Conservation Strategy under the NWFP. The Record of Decision (ROD) for the NWFP was signed in April of 1994, following extensive public review.

Public involvement was integrated into the development of the Grayback-Sucker Restoration Prioritization Plan (See Appendix A). This was a cooperative effort by the Illinois Ranger District to work with private citizens and watershed councils to restore lands in a multi-ownership watershed. Some of the restoration projects identified in the WQMP will be required to go through the NEPA process. These projects will require further public involvement.

In addition to ongoing communication with the Illinois River Watershed Council and the Illinois Valley Soil and Water Conservation District DEQ held a public hearing on this proposed WQMP on December 9, 1998. Public comment was solicited through a notice of public hearing issued by DEQ on November 24, 1998. Interested parties had the opportunity to submit comments through January 15, 1999.

Chapter 2 - Condition Assessment/Problem Description

PARAMETER 1. STREAM TEMPERATURE **(See Also Appendix G)**

For the listed parameter stream temperature, the beneficial uses affected are: Resident Fish & Aquatic Life, Salmonid Fish Spawning & Rearing. The standard for the Illinois Basin requires that the seven (7) day moving average of the daily maximum shall not exceed 64 degrees Fahrenheit. A stream is listed as Water Quality Limited when the rolling seven (7) day maximum average exceeds the standard.

Stream temperature is driven by the interaction of many variables. Energy exchange may involve solar radiation, longwave radiation, evaporative heat transfer, convective heat transfer, conduction, and advection (e.g., Lee 1980, Beschta 1984). While interaction of these variables is complex, certain of them are much more important than others (Beschta, 1987). For a stream with a given surface area and stream flow, any increase in the amount of heat entering a stream from solar radiation will have a proportional increase in stream temperature (Brown, 1972). Solar radiation is the singularly most important radiant energy source for the heating of streams during daytime conditions (Brown, 1984, Beschta, 1997) (See Appendix G).

Management activities can increase the amount of solar radiation entering a stream by harvesting riparian shade trees and through the introduction of bedload sediment resulting in increases in the stream's surface area. In addition to increases in solar radiation, water withdrawals during summertime may exacerbate maximum temperatures as demonstrated by Brown's equation (Brown, 1972). The Grayback/Sucker Water Quality Management Plan was developed addressing stream shade, changes in channel form, and flow as the three management factors contributing to water temperature problems.

Disturbance of the riparian area and stream channel from wild fires and storms can also lead to increases in summer stream temperatures. This is considered part of the natural processes, and are expected change agents considered in the Aquatic Conservation Strategy (FEMAT, 1993). Sucker Creek has a frequent fire history with return interval averaging 18 years (J.Agee, 1993, T. Atzet, 1988). Recovery of riparian vegetation in areas disturbed by fire and flood will most likely be offset by future events. The gain and loss of riparian vegetation by natural process will fluctuate within the range of natural variability for this watershed and is outside the scope of this assessment. This WQMP focuses on areas where Federal management activities have exacerbated natural disturbance and affected water quality.

TEMPERATURE FACTOR 1. Stream Shade

Without riparian shade trees, most incoming solar energy would be available to heat the stream. Riparian vegetation can effectively reduce the total daily solar heat load. The stream shade assessment determined where stream shade has been reduced by timber harvest and placer mining and calculated the resulting increase in total daily solar heat loading. To determine where shade problems exist and the magnitude of the problem, the stream network of both Sucker and Grayback Creeks were broken down into sections consisting of the main stem and its tributaries.

Tributaries contributing 5% or more of stream flow to the main stem, as measured at the point of confluence, were considered to significantly influence main stem temperatures and were included in the assessment. Shade values were estimated using shade curves generated from the shade model "SHADOW", see appendix B.

Target shade values represent the maximum potential stream shade in harvested or mined areas. This is a calculated value based on reaching site potential tree height and the resulting shade, given the stream channel characteristics for that area. Table 5 displays the existing and target shade values for the main

stem Sucker Creek and its tributaries. Summarized values for Sucker Creek and its tributaries are shown in Table 6.

Table 5
Sucker Creek and its tributaries - current shade conditions and potential recovery

Location (2)	% Flow of Main Stem (1)	%Existing Shade	% Target Shade	Shade Loss	Type of Disturbance	Years to Full Site Potential Recovery
Main Stem		52 52	65 53	-13 -1	Mining Harvest	100 60
Tannen Ck	30	86	89	-3	Harvest	10
Deadhorse	15	77	86	-9	Harvest	45
Grizzly Ck	17	82	89	-7	Harvest	35
LF Sucker	**30**	**69**	**85**	**-16**	**Harvest**	**50**
Limestone	6	68	89	-21	Harvest	50
Bolan Ck	20	76	81	-5	Harvest	35
Cohen Ck	**5**	**40**	**88**	**-48**	**Harvest**	**50**
Yeager Ck	7	73	89	-16	Harvest	35
Cave Ck	**20**	**73**	**85**	**-12**	**Harvest**	**50**

Larger font and underline indicates areas of highest priority for recovery.

Note:
1. "% Flow of main stem" is at the point of confluence between the tributary and Main Stem. This represents of how much influence the tributary has on main stem temperatures.
2. Tributaries are listing in order starting from the headwaters down.

Table 6
Total shade values for Sucker Creek and its tributaries

Type of Disturbance	**% Existing Shade**	**Shade Loss by Disturbance**	**% of Target Shade**	**Years to Full Site Potential Recovery**	**Proposed Treatment**
SUMMARY Harvest & Mining	**68**	**-13**	**81**	**100**	**Silvicultural Work to Plant Trees, Increase Tree heights and Canopy Density -Increase Stand Vigor**

On the main stem of Sucker Creek, mining is responsible for the greatest reduction of stream shade. Mining operations include placer mining within the channel and floodplain of Sucker Creek. For the tributaries of Sucker Creek, the greatest loss of shade from management is due to harvest of trees in the riparian area. Considering both percent flow contribution and shade loss, the Left Fork Sucker, Cohen Creek and Cave Creek are highest priority to reach target shade values. Based on Brown's findings that an increase in solar radiation entering a stream (loss of stream shade) will have a proportional increase in stream temperature, a 13% loss of shade from human disturbance has had a small-to-moderate effect on increasing stream temperature on Sucker Creek above its confluence with Grayback.

Grayback Creek

Tables 7 and 8 display the existing and target shade values for main stem of Grayback Creek and its tributaries, and an overall summary for Grayback Creek.

Table 7
Grayback Creek and its tributaries - current shade conditions and potential recovery

Location (2)	**% Flow of Main Stem** (1)	**%Existing Shade**	**% Target Shade**	**Shade Loss**	**Type of Disturbance**	**Years to Full Site Potential Recovery**
Main Stem		44	57	-13	Harvest	45
Fan Ck	**20**	**41**	**86**	**-45**	**Harvest**	**45**
Little Ck	**30**	**30**	**86**	**-56**	**Harvest**	**45**
Jenny Ck	**30**	**53**	**79**	**-26**	**Harvest**	**50**
Windy Ck	25	65	78	-13	Harvest	50
Four Mile Ck	**27**	**27**	**58** (3)	**-31**	**Harvest**	**45**
White Rock	**15**	**63**	**86**	**-23**	**Harvest**	**50**
LostCanyonCk	5	54	69(4)	-15	Harvest	50

Bold and underline indicates areas of highest priority for recovery. Note:

1. "% Flow of Mainstem" is at the point of confluence between the tributary and mainstem. This represents how much influence the tributary has on mainstem temperatures.
2. Tributaries are arranged in order starting from the headwaters down.
3. The lower weighted target shade value for Four Mile Creek reflects damage to riparian areas from the December 1996 flood. USFS harvest units located on Four Mile Ck have a target shade value of 86%.
4. The lower weighted target shade value for Lost Canyon Ck is due to harvest on private land. USFS harvest units located on Canyon Ck have a target shade value of 86%.

Table 8
Total shade values for Grayback Creek and its tributaries

Type of Disturbance	**% Existing Shade**	**% Shade Loss by Disturbance**	**% Target Shade**	**Years to Target Shade**	**Proposed Treatment**
Harvest (USFS)	**49**	**-22**	**71**	**50**	**Silvicultural Work to Plant Trees, Increase Tree Heights and Canopy Density - Increase Stand Vigor**

For Grayback Creek, the greatest loss of shade from management is due to harvest of trees in the riparian area which caused a 22% increase in solar exposure. Grayback contributes 36% of the stream flow at the confluence of Sucker Creek. Considering flow and the amount of shade loss, Grayback does contribute to increases in stream temperature on Sucker Creek. For the tributaries of Grayback Creek, the highest priority to reach target shade values are Fan Creek, Little Creek, Jenny Creek, Four Mile Creek and White Rock Creek. Shade recovery on these tributaries will reduce summer temperature on the lower main stem of Grayback Creek.

Within the Forest boundary, 7% of the land is under private management. Because of different forest practices guidelines on Federal and private lands and the lack of information on future private management, target shade values do not include recovery of riparian vegetation on units under private management. (See appendix F and Margin of Safety, Timber Harvest on Private Land).

Summary and WQMP Targets

Table 9
Total shade values for Sucker Creek including Grayback Creek

Type of Disturbance	% Existing Shade	Shade Loss by Disturbance	% Target Shade	Years to Full Site Potential Recovery	Proposed Treatment
Harvest	**60**	**-14**	**74**	**60**	**Silvicultural Work to Plant Trees, Increase Tree Heights and Canopy Density. Increase Stand Vigor**

For Sucker Creek, including Grayback at the Forest boundary, management activities have increased solar exposure 14% by the removal of shade trees (Table 9). The highest priorities for shade recovery are four tributaries of Grayback Creek: Fan Creek, Little Creek, Four Mile Creek and White Rock Creek. Target shade value (or optimum shade recovery in managed areas) is expected to occur in a 60-year time period, much of the gain will be achieved by 2013. Shade gain over time is displayed in the Recovery Plan Section (Figure 8). Natural disturbance such as floods and wildfire can remove large areas of stream shade and offset any shade recovery in managed areas, as well as areas of past natural disturbance.

Solar energy is directly related to shade and can be used to give numeric value for a Total Daily Maximum Load (TMDL). A load value has been calculated based on existing and predicted shade values. While this loading does not have direct value to guide management strategies for temperature recovery, it is needed to satisfy 303(d) requirements as interpreted by EPA and DEQ. Table 10 displays the overall existing and target loading for the watershed within the Forest Service Boundary. Existing and target loading for each tributary and the main stem can be found in Table 5 of appendix G.

The target value is the load capacity (TMDL), and provides a reference for calculating the amount of pollutant reduction needed (solar energy). Target loading capacity is the average stream heat load value projected for site potential trees in managed stands.

Table 10

Target Solar Loading or TMDL

Existing Solar Loading	Target Solar Loading or TMDL	Reduction Needed
976 BTU/ftsq/day (3.07 Kwh/sqm/day)	**634 BTU/ftsq/day** (2.0 Kwh/sqm/day)	**342 BTU/ftsq/day** or 54% (1.07 Kwh/sqm/day)

TEMPERATURE FACTOR 2. **Channel Form**

Changes in sediment input and discharge can lead to a change in channel form (Leopold, et al., 1964; Megahan, et al., 1980). When sediment input increases over the transport capability of the stream, sediment deposition can result in channel filling, thereby increasing the width-depth ratio. An increase in channel width will increase the amount of solar radiation entering a stream. A wide, shallow stream will heat up faster than a narrow, deeper stream with the same discharge (Brown, 1972). During storm events, management-related sources can increase sediment inputs over natural, and contribute to channel widening and stream temperature increases.

The classification of rivers is an organization of data on stream features into discreet combinations (Rosgen, 1994). Rosgen stream classification system has eight stream types. For each stream type, a "most frequent range" of values is given for morphological descriptions, such as width-depth ratio. Rosgen's stream classification system and width-depth ratios ranges by channel type can be used as an indicator of where increased stream width may result in increased solar radiation. Sucker and Grayback creeks were surveyed in 1997 using the Region 6, US Forest Service, Level II Stream Survey method. The stream survey collected width-depth ratios and did Rosgen stream typing. Figures 4 and 5 display the results of where channel widening may contribute to increases in solar radiation entering Sucker and Grayback creeks.

There has been considerable channel widening on Sucker Creek in the mining areas upstream of Grayback Creek to Yeager Creek. A meandering pool/riffle stream with connectivity to adjacent floodplains is characterized as a Rosgen "C" channel and is the expected channel form of this

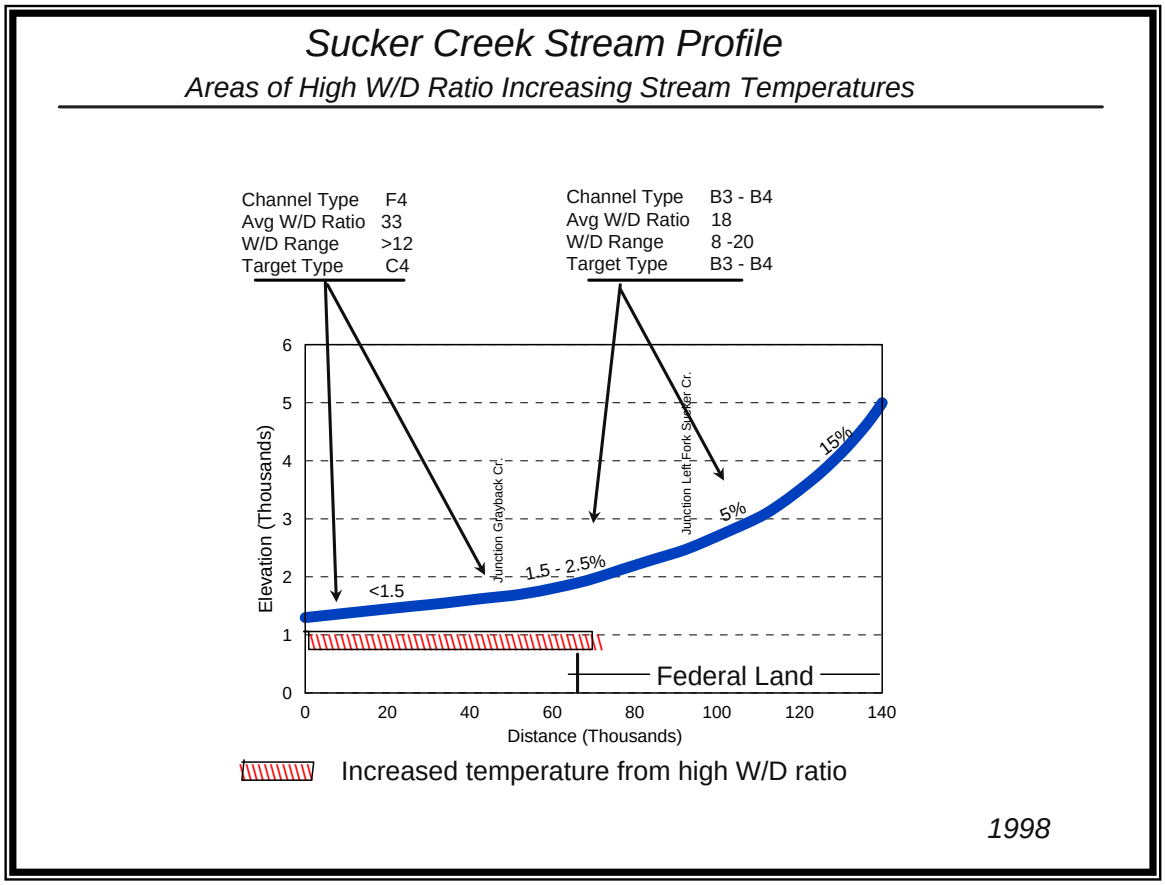

Figure 4. Longitudinal profile of Sucker Creek showing areas where channel widening has occurred.

stream segment. Aside from inclusions of more confined channel types, the dominant existing channel type is a "F4". F4 channels are entrenched, meandering riffle/pool. An "F4" channel is extremely sensitive to disturbance and has a poor recovery potential (Rosgen, 1994). Changes in the channel probably occurred from natural disturbance, mining, and sediment sources in this stream segment. No other areas on Sucker Creek appear to have a channel width greater than expected.

The additional width has increased solar radiation in the "F4" stream section by 15%. The increased channel width is already figured into the existing shade values. The shade curves in Appendix B were used to estimate shade values in the WQMP. To estimate shade requires knowing the tree height and wetted stream width for each stream reach. Existing wetted widths are either measured or estimated from aerial photos and then used to determine stream shade. This method incorporated existing widths, which includes channels that are wider than expected because they are aggraded from sediment, into the shade section, and TMDL value.

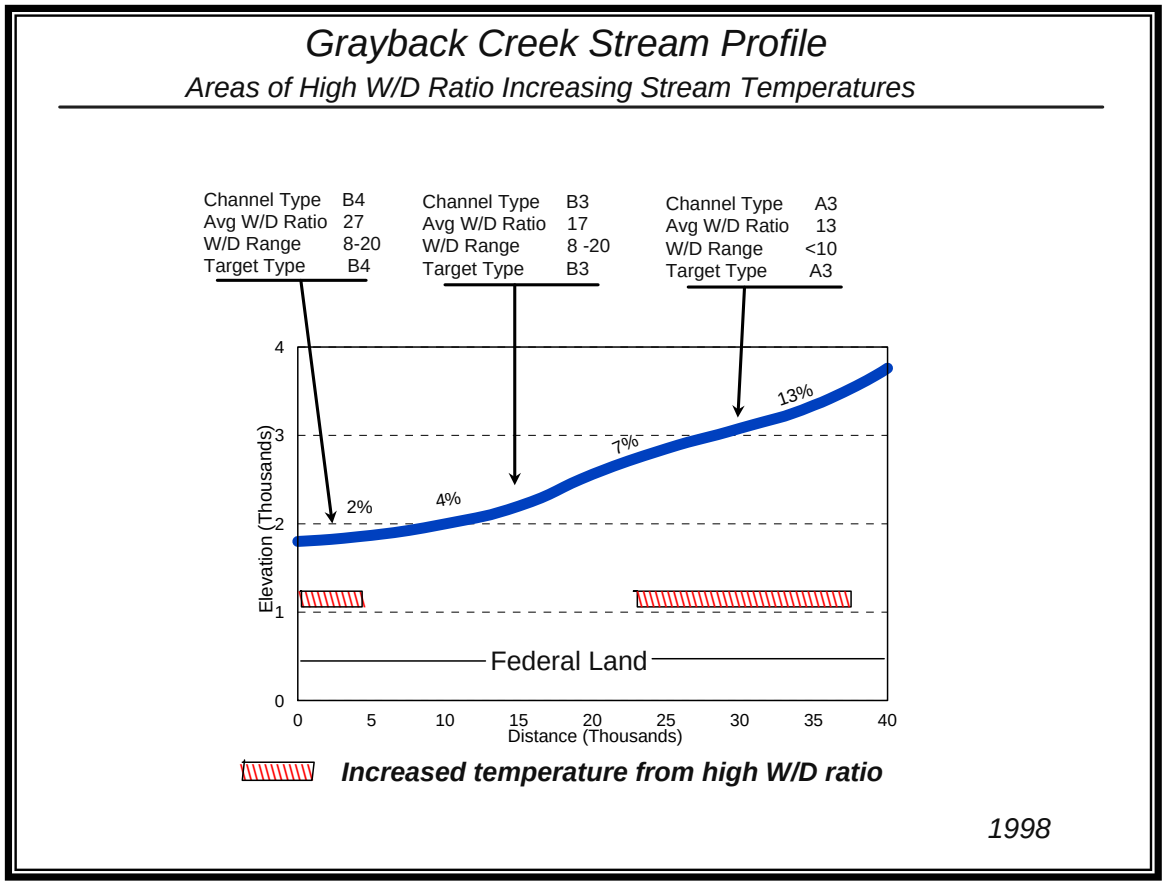

Figure 5. Longitudinal profile of Grayback Creek showing areas where channel widening has occurred.

On Grayback Creek there are two areas where channel widening may have occurred. In the upper reach from river mile 4.7 to 7.1, the channel is an "A3" steep, cascading step pool. In this area the w/d ratio exceeds expected by 3 units. The width-depth ratio values can vary by +- 2 units without showing a different morphology (Rosgen, 1994). During the storm of 1996, large amounts of sediment were introduced into the stream from natural and harvest-related landslides as well as road failures. Some widening may have occurred. The vegetation is of sufficient height in this area such that a small increase in stream width will not result in increases in solar radiation.

On Grayback Creek, from the confluence with Sucker Creek to river mile 0.75, stream widening is contributing to increases of solar radiation to the stream. The channel has increased in width approximately 10 feet from increases in flow and sediment. A "B4" channel is moderately sensitive to disturbance, and has an excellent recovery potential (Rosgen, 1994). The additional width has increased solar radiation to the lower 0.75 miles of stream by 7 percent. The increased channel width is already figured into the existing shade values as described in the Sucker Creek discussion.

Sediment Sources Potentially Contributing to Channel Widening

There are both natural and management related sources of sediment; these occurrences are episodic. In Sucker and Grayback creeks, sediment supplied during the January 1, 1997 storm has two primary sources: slope failures and road failures. The 1998 Forest Flood Assessment Report found that sediment supply from roads is greatest when culverts plug, and the flow is diverted outside of the original stream channel, figure 6. This is clearly demonstrated by the 63,000 cubic yards supplied to Grayback Creek as a result of the road diversion at Windy Creek.

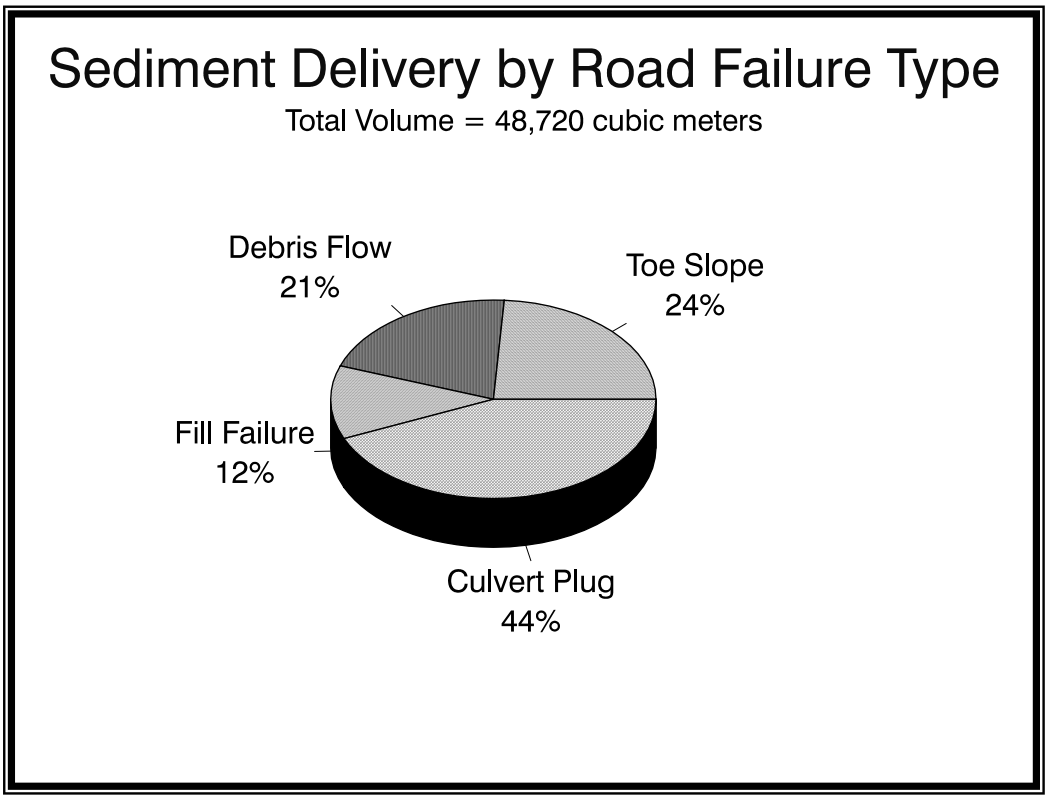

Figure 6. Sediment delivery by road failure type.

Secondly, large hillslope failures can contribute high amounts of sediment. Slope failures are observed to occur in both natural and created openings, sites which often lack large wood (USFS, IVRD, 1998). The effects of sediment delivery are less if large wood is simultaneously delivered to the channel. The principal processes that deliver sediment have been identified as slope failures, road failures, and streambank failures as the result of placer mining.

Volumes of sediment delivered during major storms provide an order of magnitude estimate. Review of air photos indicates that sediment pulses are linked to the 100-year recurrence interval: 1964 storm (280,000 cy) and the 25-year recurrence interval 1997 storm (214,000 cy). The relationship between large pulses of bedload sediment and channel widening are well- documented (Hagans and Weaver, 1987; Lisle, 1981; Kelsey, 1980).

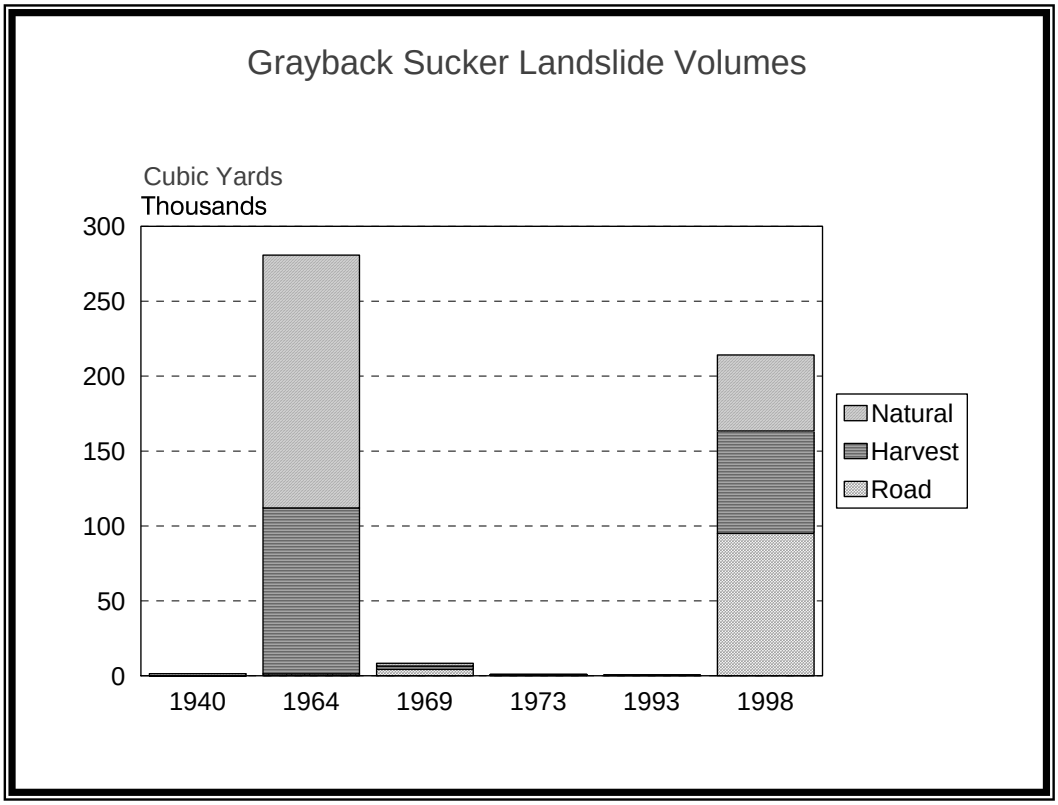

Figure 7. Grayback Sucker landslide volumes summary.

For the recent storms of 1996, the plugged culvert on Windy Creek accounted for 66% of the total sediment from roads. The Not You slide in the headwaters of Sucker Creek accounted for 50% of the total sediment from harvest units. It is not known if a 1980's shelterwood harvest unit triggered the Not You slide or if it was a natural occurrence.

In an attempt to understand the relationship between changes in sediment supply, sediment transport, and storage, changes in length of unvegetated bars adjacent to the channel were measured. In Sucker Creek above its confluence with Grayback, there has been a three-fold increase in the length over the photo period (1940 to 1997). Additionally, measured changes in sinuosity have declined from 1.22 to 1.08. In this same reach, there has been a decrease in riparian cover, especially conifers. An increase in unvegetated bars and loss of sinuosity supports the argument that there has been more sediment in the stream in recent decades.

The reduction of sediment supplied by management sources is critical for channel recovery on Grayback Creek, and can only help recovery on Sucker Creek. While linear recovery of channel form is possible, it is more likely to occur in association with channel changing storms whose recurrence interval is 25 years or more. Existing channel conditions will affect recovery rates.

Channel recovery on Sucker Creek near Cave Creek where mining is occurring will not begin until current mining practices are changed or stopped. Even then, channel recovery in an unstable "F4" channel type could begin or be set back in a storm event. Considering the poor recovery potential of the channel and the need for mature conifers to provide shade in this wide section, channel recovery could take over 100 years.

On lower Grayback Creek, there is good potential for recovery in the "B" channel type. With a reduction of management related sediment input, recovery could reasonably be expected over a 25- to 50-year time period

One mining claim, which makes up a small section of the mined reach on Sucker Creek, is no longer valid and is back under BLM management. BLM is in the beginning stages of planning a stream restoration project for this area. A cooperative effort between BLM, Forest Service, State agencies, Illinois Valley Watershed Council and interested public is underway.

DEQ works with current miners on water quality issues, (including fish passage, instream activities, riparian protection, and bank stability) under a permitting system. General permits for suction dredge operators and for small-scale mining operations are issued for a period of five years. Modifications to those general permits occur during the renewal process. (The general permit for suction dredge operators is currently under modification due to court action.) Modifications through the normal process are typically in response to issues and concerns that are identified during the life of the general permit. The modifications could include additional conditions addressing channel impacts. The next opportunity for modification occurs in the spring of 2002. DEQ also tries to educate miners individually as the permits are issued. DEQ and DOGAMI staff have a joint annual meeting to discuss coordination issues and whether any modifications to general permit conditions are warranted.

Individual permits for mining activity processing greater than 10,000 cubic yards of material can also be issued by DEQ. These types of permits are tailored to the individual site and operation. There are currently no DEQ individual mining permits on record for the Sucker/Grayback system.

TEMPERATURE FACTOR 3. **Flow**

The temperature change produced by a given amount of heat is inversely proportional to the volume of water heated or, in other words, the discharge of the stream (Brown, 1984). A stream with less flow will heat up faster than a stream with more flow given all other channel and riparian characteristics are the same. Sucker Creek is listed as water quality limited by Flow Modification. The specifics of water withdrawal are addressed in the Flow Modification Section, *Parameter 3*. This analysis identified no Federal water withdrawals that are affecting stream temperature on Sucker or Grayback creeks. The issue of water rights is complex and outside of Forest Service and BLM authority. Both agencies are working in cooperation with DEQ, Water Resources Department, and private land owners to improve summer stream flows.

Temperature Findings

TMDL targets for temperature are based on a two-pronged approach to the temperature issue: shade and channel form. Temperature goals with this plan are to produce the coolest water possible in the shortest amount of time. Shade effects from historic harvest will largely recover in the next 15 years, but there are sites that will take considerably longer (100 years). The sites that have a 100-year target for shade recovery are also affected by changes in channel form. It is difficult to set an exact recovery path for channel form when the recovery process is storm dependent. Chapter 3, Recovery Goals and Plan details USFS expectations in this area.

PARAMETER 2, HABITAT MODIFICATION

The beneficial uses affected by Habitat Modification include Resident Fish & Aquatic Life, Salmonid Fish Spawning & Rearing. The standard that applies is: The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life, or affect the potability of drinking water, or the palatability of fish or shellfish shall not be allowed; or: Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities. A stream is listed as water quality limited if there is documentation that habitat conditions are a significant limitation to fish or other aquatic life.

No formal Load Allocation is proposed for the habitat modification parameter under discussion here. Habitat modification is not viewed as a water quality pollutant under the Clean Water Act although it is recognized that habitat modifications may cause Water Quality impairments which could lead to exceedance of WQ criteria. Measures to address the listed parameter causes are detailed in the goals and objectives portion of this document.

Determining overall channel conditions and the biological potential of fish-bearing stream segments from stream survey data has been ongoing for several decades in the Pacific Northwest. Analyzing stream survey data for the Sucker Creek Water Quality Management Plan concentrated on five attributes at the stream reach scale: riffle width, pool frequency, pool area, large wood, and riparian forest seral stage.

Except for riparian forest seral stage, the other attributes have been agreed to by Federal and State teams in Oregon as core attributes needed to assess stream conditions. These parameters are included on the "Interagency Aquatic Database and GIS," which is a compilation of stream surveys from various agencies in Oregon. These attributes are inventoried by the Forest Service, Bureau of Land Management, and the Oregon Department of Fish and Wildlife (ODFW) by protocols that are comparable. It was decided to include riparian forest seral stage in this discussion because of important relationships between aquatic and riparian functions.

To rate the five attributes as Poor, Fair, and Good, the ODFW benchmarks developed from hundreds of miles of stream surveys in Western Oregon were employed. These benchmarks are included in Appendix C as "Habitat Benchmarks, Table 1" and following the individual attribute discussion. Additionally, monitoring and watershed analysis information for these attributes on the Siskiyou National Forest was used to accommodate the unique stream and riparian conditions found in Klamath Mountain geology. The Poor, Fair, and Good ratings should be viewed as relative, with the diversity of conditions in Sucker/Grayback Creek, and helpful for a reference to compare across watersheds with similar ecological conditions. Table 11 shows the numeric values for the stream segments discussed in the Sucker Creek watershed.

The Sucker/Grayback Watershed Analysis documents human effects on instream and riparian habitat conditions. Placer gold mining started in the 1860s in mainstream Sucker Creek above Grayback Creek, and has continued to varying degrees since. This watershed is capable of growing large conifers; timber harvest and associated road development is widespread. Aquatic and riparian habitat has been greatly influenced by these activities, both directly and by the synergistic effects of human and natural events.

Individual Attribute Discussion:

Riffle Width: This attribute is the average wetted riffle width of the stream reach surveyed. Stream reaches in the USFS stream survey protocol range from ½ to 3 miles. Less observer bias is associated

with wetted width than bankfull width per stream survey quality control monitoring. Riffle width was used here to calculate pool frequency.

Pool Frequency: Pool frequency was calculated by dividing the number of pools in the reach by the number of riffle widths in the reach length. Therefore, a pool frequency of 1/10 or 0.1 would translate to one pool per ten (10) wetted widths. A pool frequency of 0.1 or higher would be expected in a functioning low gradient reach (<3% gradient) with pool/riffle morphology. Some allowance was made in transport reaches where step/pool morphology forms more frequent and shorter pools.

Pool Area: Pool area is calculated by dividing the surface area of pool habitat by the total surface area of wetted habitat surveyed. Similarly to the discussion for pool frequency, some allowance must be made for the different morphologies of pool/riffle and step/pool stream reaches.

Large Wood Material: Large wood is included in this rating only if the dimensions are large enough to serve as a key piece to collect smaller pieces of wood in complexes. Diameters of these key pieces are equal to or greater than 24 inches, and the length is 50 feet or twice the bankfull width.

Riparian Forest Seral Stages: ODFW, BLM and Forest Service stream surveys measure the relative size of trees in the riparian zones along fish-bearing streams. The outer riparian zone, twenty-five feet (25') from the bankfull edge to one hundred feet (100') from the bankfull edge, was used here for rating the health of the riparian zones. The outer riparian zone is generally beyond the alder and hardwood buffer, as many stream channels have in Sucker/Grayback Creek. One would expect to find a large component of mature conifers and some hardwoods in this portion of the riparian zone. For comparative purposes, the expected condition of seventy-five percent (75%) large trees greater than twenty inches (20") diameter are designated as LT. Trees less than twenty inches in diameter are designated as small trees or ST. Sucker Creek watershed generally is a high site for conifer tree growth, capable of producing very large trees in most floodplains and terraces.

Below is an adaptation of ODFW's benchmarks for Sucker Creek and Grayback Creek:

Benchmarks for Evaluating Stream Survey Data
Sucker Creek – Siskiyou National Forest

	Poor	Good
Pools		
Pool Area (% of total surface area)	< 10%	> 30%
Pool Frequency (pools per channel width)	0.05	0.12

Source of Values: ODFW Benchmarks (1992/93), Siskiyou National Forest Monitoring
Source of Data: Interagency Aquatic Database and GIS CD, Stream surveys, monitoring surveys.

Large Wood Material		
Wood Key Pieces/Mile (24 inches diameter X 50 feet in length or twice the active channel width in length)	<5/mile	20/mile

Source of Values: Applegate Sub-basin Assessment (1995), Siskiyou Mtns. Matrix of Factors and Indicators (1996), Siskiyou National Forest Monitoring.
Source of Data: Interagency Aquatic Database and GIS CD, Stream surveys, Monitoring surveys.

Riparian Vegetation		
Percent of Trees in Seral Stage by Age Class (Small Tree, Large Tree)	<25% LT	75% LT
Outer Riparian Zone (Zone 2), Vegetation 25 feet to 100 feet from active channel margin. (Small Tree = <20 inches diameter, Large Tree = >20 inches diameter)		

Source of Values: Siskiyou National Forest Monitoring, Professional judgment
Source of Data: Forest Service, BLM and ODFW stream surveys, air photo interpretation, forest stand surveys.

Table 11

Key Stream Channel and Fish Habitat Attributes of Sucker/Grayback Creek – 1997 Stream Surveys

Stream Name	Reach No. & Function	Length (Miles)	Avg. Riffle Width	Pool Frequency – Pools per Riffle Width *(expected condition ≥ 0.1)*	Percent of Surface Area – Pools *(expected condition ≥30%)*	Wood Key Pieces ≥24 inches diameter/ Mile *(expected ≥25 /mile)*	Riparian Forest Seral Stage in Outer Rip. Zone (25 ft. – 100 ft.)
Sucker Creek	1 (low gradient)	14.0 miles	35 feet	0.06	11.5%	3.1	Pvt. = 100% small tree (ST); Public Lands = 43% ST, 57% large tree (LT)
Sucker Creek	2 (high gradient)	10.6 miles	25 feet	0.1	19.1%	5.1	30% ST 70% LT
Grayback Creek	1 (low gradient)	2.9 miles	20.2 feet	0.07	16.5%	3.1	44% ST 56% LT
Grayback Creek	2 (high gradient)	4.7 miles	17.9 feet	0.08	15.8%	7.5	74% ST 26% LT
Grayback Creek	3 (high gradient)	6.5 miles	12.2 feet	0.06	11.9%	4.6	36% ST 64% LT

In the upper stream reaches of both Sucker and Grayback Creek, the riparian and aquatic habitat are generally in fair to good shape. The exception is Reach 2 in Grayback Creek, where the riparian zone is in a very young seral stage and rated POOR. The low gradient response reaches, potentially high for biological productivity, are among the most altered by mining, harvest and flood repair work from past storm events. The aquatic habitat is considerably less than optimum for production of salmonids, particularly coho salmon, which require the full suite of freshwater habitat components. Coho salmon tend to inhabit low gradient stream reaches.

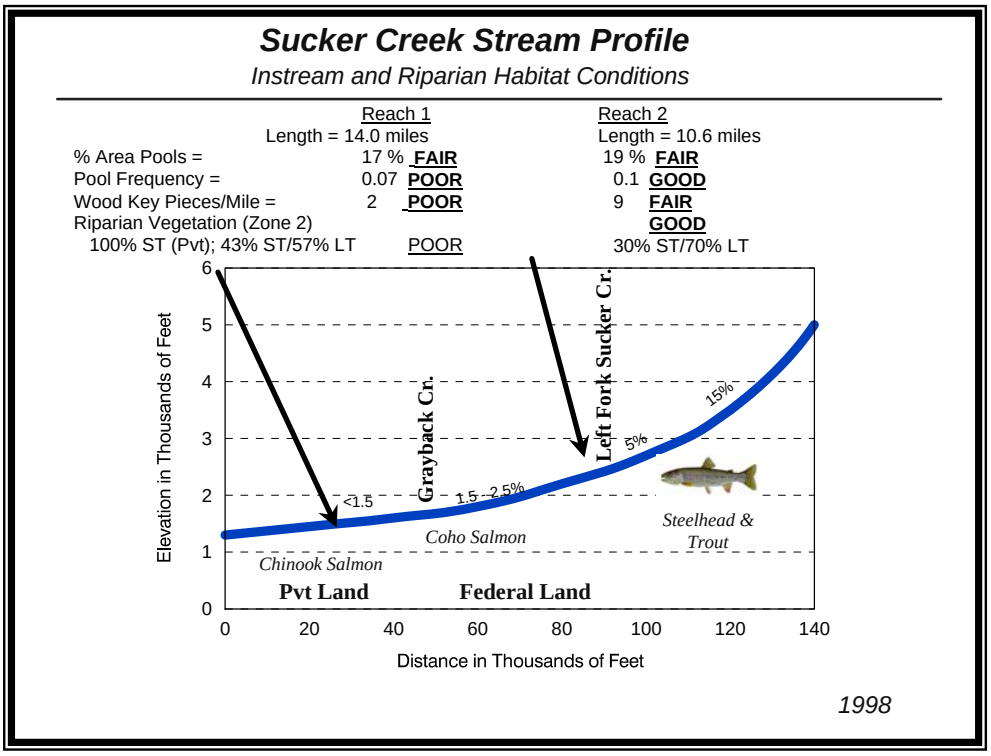

Figure 8. Habitat condition of Sucker Creek.

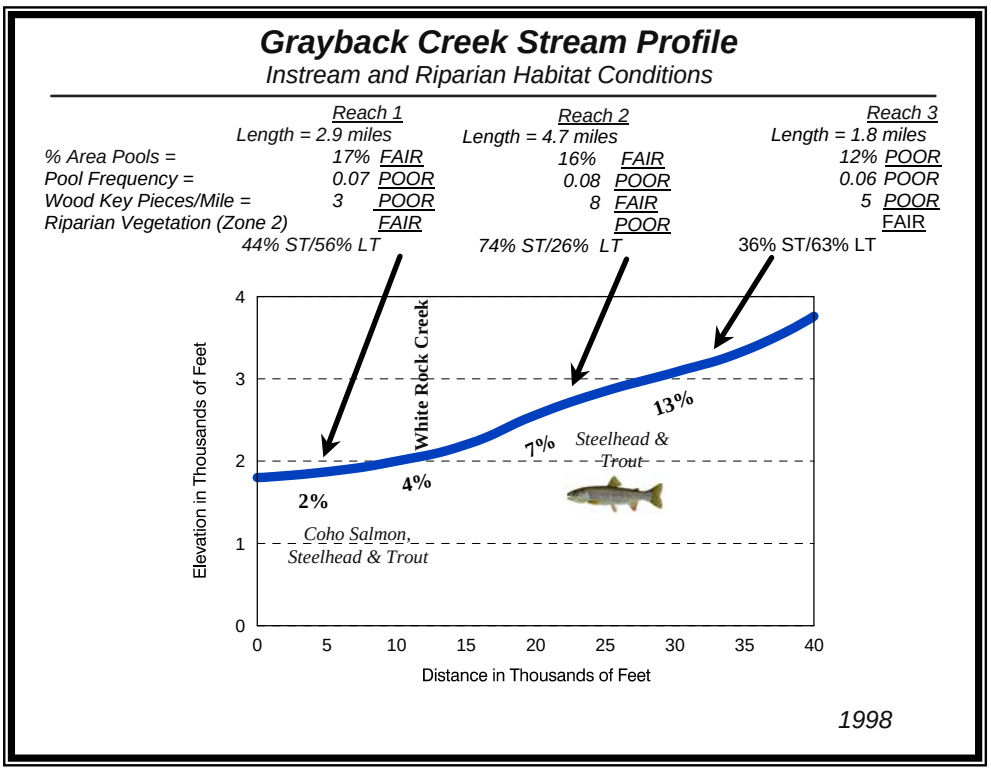

Figure 9. Habitat condition of Grayback Creek.

PARAMETER 3. FLOW MODIFICATION

Again, Resident Fish & Aquatic Life; Salmonid Fish Spawning & Rearing are the beneficial uses affected. Standards applicable are: The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish shall not be allowed; or, waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities. A stream is listed as Water Quality Limited if flow conditions are documented that are a significant limitation to fish or other aquatic life. Flow modification is not considered a WQ pollutant but it is recognized that flow modifications may cause WQ impairments which could lead to exceedance of WQ criteria.

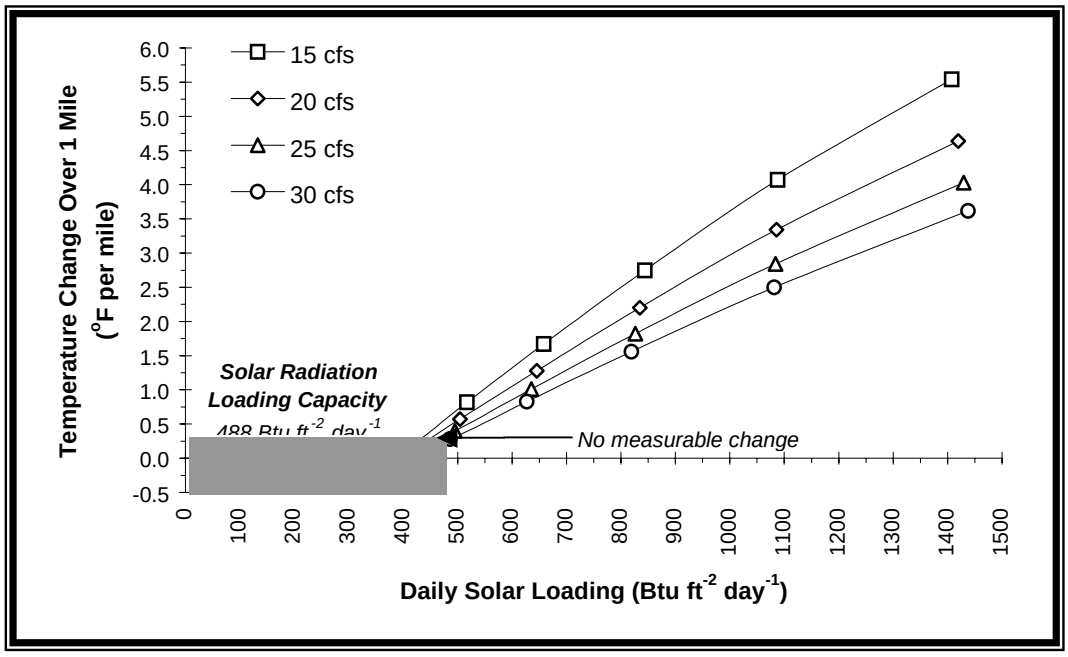

Figure 10. The effects of loss of flow on increasing stream temperature.

Summer low flow has been a long-term problem in the Sucker Creek watershed. Coho populations are depressed, and winter steelhead are declining as identified by Oregon DEQ 1994/1996 (Draft 1998), 303(d) lists of Water Quality Limited Water Bodies. Low flows due to water withdrawals have been identified as a water quality-limiting factor (ibid). Existing instream water rights are not often met at USGS gage 14375100 (located on Sucker Creek immediately below Little Grayback Creek). Low flows also have a direct affect on the temperature of streams. Stream temperatures tend to increase as flows decrease. The temperature listing issues for this system are discussed earlier in this document. Water rights were issued from 1853 until 1934, when the system was withdrawn from further consumptive use rights due to insufficient flow. Rights were still issued for mining and other non- consumptive uses, as well as for domestic use. Domestic uses fall in several categories, each providing for a slightly different use allowance. Approximately 113 cfs has been allocated on the main stem of Sucker Creek and its tributaries; a little over 50 cfs is for consumptive use.

While mining is considered a non-consumptive use, the mining water rights do allow for withdrawal. Current Department of Environmental Quality mining permitting requirements for small scale operations processing no more than 10,000 cubic yards of material per year do not allow for discharge of mining waters to a stream (General Permit #600). Off-stream placer mining is allowed under this general permit, as long as all wastewater is disposed of by evaporation and/or seepage with no readily traceable discharge to groundwater or surface water. Water withdrawn from streams is typically reused through holding ponds. The flow loss to the watershed system comes from evaporation at the holding ponds and during use. There are currently four operations on Sucker/Grayback under the #600 general permit. DOGAMI currently has three operating permits in their over 1-acre or 5000 cubic yards category (placer) within the Sucker Creek drainage. None of these three permits have been very active for the last year or so.

Individual permits for mining activity processing greater than 10,000 cubic yards of material can also be issued by DEQ. They can allow for discharge of water, but water quality requirements must be met. There are currently no DEQ individual mining permits on record for the Sucker/Grayback system.

Normally, in drier summers, water rights are cut back to the late 1800s. For instance, in 1994, a dry year, the water rights were cut back to 1865 priority date. This priority date allowed withdrawals of approximately 15 cfs (30% of the total consumptive rights allocated). Average summertime flow, according to the Josephine County Watermaster's office, is approximately 2 cfs at the lowest flow point, near river mile 2.6.

Minimum stream flows were identified for some Rogue Basin streams by the Oregon Department of Fish and Wildlife (ODF&W) beginning in 1959. In 1987 a new statute, ORS 537.346, was adopted by the State of Oregon, which converted all minimum perennial stream flows established on any waters of the State to in-stream rights. The Sucker/Grayback system did not have minimum flows adopted at that time, so none were converted to instream rights. Minimum stream flows, according to ODF&W, are flows necessary for fish passage.

The ODF&W applied for instream water rights for Sucker Creek from the confluence of Grayback to the mouth. From May 16 through June 30, the right is 80 cfs; July 1 through Oct. 31 the right is 54 cfs; November 1 through May 15 have a right of 135 cfs. The rights carry a 1989 priority date, so are relatively late, and cannot be considered to be protective of fish during dry years. There are also instream rights on Grayback creek from Windy Creek down to RM 2.6. The right varies monthly throughout the year, ranging from 9.8 cfs in July to 4.2 cfs in September. The Grayback rights have a 1991 priority date, and are also too new to provide much protection during dry years. As stated earlier, the instream rights are not often met.

Recommended optimum flows for fish life in the Rogue Basin were identified by ODF&W in 1972 (Lauman 1972). The instream rights allocated to ODF&W do not meet the optimum flows on Sucker Creek for September and October. On Grayback Creek, they fail to meet the optimum flows for June through November. Instream rights are only issued for flows up to the natural flow of the stream that is present 50 percent of the time. Optimum flows are those deemed adequate to maintain fish life at current levels and prevent further degradation.

Oregon Water Trust, a nonprofit private group that works to convert consumptive rights to instream rights, has permanent rights from the mouth of Sucker Creek to river mile 2.6 for 0.16 cfs. They also have a 0.16 cfs right on annual renewal, and 0.26 cfs on a two-year renewal at river mile 2.6. These rights have an 1857 priority date, so should be available even during drier years.

Table 12 provides a summary of water rights by use for the Sucker Creek watershed. Streams where the right is on Federal lands are indicated in bold type, as well as the portion of the right that is consumptive use.

Table 12

SUCKER	GRAYBACK	WATER	USE
STREAM SEGMENT	**USE**	**CFS ALLOTMENT**	**TOTAL**
Sucker Creek to E Fk Illinois	Irrigation Fish/Wi Agriculture Industrial Domestic	48.30 0.18 0.01 16.99 0.04	65.52
Bear Creek to Sucker Creek	Irrigation	1.37	1.37
Green Creek to Bear Creek	Irrigation	0.31	0.31
Nelson Cr to Sucker Cr	Irrigation	0.02	0.02
Unnamed Str to Sucker Cr	Domestic	0.01	0.01
Little Grayback to Sucker Cr	Domestic	0.02	0.02
Unnamed Str to Sucker Cr	Domestic	0.01	0.01
Lake Cr to Sucker Cr	Domestic	0.18	0.18
Grayback Cr to Sucker Cr	Irrigation Industrial	1.12 1.00	2.12
Little Jim Cr to Sucker Cr	Industrial	0.80	0.80
Cave Cr to Sucker Cr	Irrigation Industrial Recreation	0.05 11.50 0.01	11.56
Panther Cr to Lake Cr	Domestic	0.01	0.01
Johnson Cr to Sucker Cr	Industrial	4.00	4.00
Yeager Cr to Sucker Cr	Industrial	2.00	2.00
Mule Cr to Sucker Cr	Industrial Domestic	8.00 0.01	8.01
STREAM SEGMENT	**USE**	**CFS ALLOTMENT**	**TOTAL**
Unnamed Str to Sucker Cr	Industrial Domestic	7.99 0.01	8.00
Bolan Cr to	Industrial	8.00	8.00

Sucker Cr			
E Fk Bolan Cr to Bolan Cr	Industrial	2.00	2.00

TOTALS BY USE

Irrigation	**Fish/Wild**	**Agriculture**	**Industrial**	**Municipal**	**Domestic**	**Recreational**
51.17	0.18	0.01	62.28	0.00	0.29	0.01

Consumptive uses include irrigation, domestic, and recreational. On the Federal lands there are consumptive rights totaling 1.42 cfs (includes the unnamed stream rights).
Priority dates on the rights on Federal lands range December 31, 1907 to June 27, 1983.

Total cfs allocated by water right for the basin: 113.94 (approximately 51.5 consumptive).
Total cfs from Federal lands: 46.72 (approximately 1.42 consumptive).

See Appendix E for Individual Water Rights Information

Chapter 3 - Recovery Goals, Objectives and Restoration Plan (*Site Specific Restoration Plan - see Appendix A)*

All recovery goals and plans are strongly linked to the philosophy of maintaining those components of the ecosystem that are believed to be currently functioning, and to improving those sites that show the greatest potential in the shortest time frame. This philosophy maximizes recovery while minimizing expensive, extensive, and risky restoration treatments.

The objective of this plan is to eventually meet water quality standards by correcting through appropriate management practices the anthropogenic causes of water quality violations within this watershed. Those standards when met will protect the beneficial uses identified for the Rogue Basin under Oregon Administrative Rules (OAR) 340-41-362.

The recovery of habitat conditions in Grayback Creek and Sucker Creek will be dependent on implementation of the Siskiyou National Forest Land and Resource Management Plan and BLM Medford Resource Management Plan, as amended by the Northwest Forest Plan (NWFP). Paramount to recovery is adherence to the Standards and Guidelines of the NWFP to meet the Aquatic Conservation Strategy (ACS). This includes protection and culture of riparian areas as reserves and some silvicultural work to reach vegetative potential most rapidly. Some instream large tree placement may be beneficial where there exists conducive channel and riparian conditions.

Recommended Restoration Plan - *Proposed Management measures*:

The following standards and guidelines from the NWFP will be used to attain the goals of the Grayback-Sucker Water Quality Management Plan:

Stream Temperature - SHADE

Aquatic Conservation Strategy - B-9 to B-11, C-30
Standard and Guidelines for Key Watersheds - C-7
Riparian Vegetation - B-31
Riparian Reserves - B-12 to B-17 and ROD 9
Watershed Restoration - B-30

Stream Temperature - CHANNEL FORM

Aquatic Conservation Strategy - B-9 to B-11, C-30
Standard and Guidelines for Key Watersheds - C-7
Riparian Vegetation - B-31
Riparian Reserves - B-12 to B-17 and ROD 9
Watershed Restoration - B-30
Roads - B-19, B-31 to B-33

Flow Modification

Aquatic Conservation Strategy - B-9 to B-11, C-30
Roads - C-32

Habitat Modification

Aquatic Conservation Strategy - B-9 to B-11, C-30
Standard and Guidelines for Key Watersheds - C-7
Riparian Vegetation - B-31
Riparian Reserves - B-12 to B-17 and ROD 9
Watershed Restoration - B-30
Roads - B-19, B-31 to B-33
In-stream Habitat Structures - B-31

Adaptive Management, Review, Prioritization and Revision

Monitoring will provide information as to whether standards and guidelines are being followed, and if actions prescribed in the WQMP are achieving the desired results. In addition to the monitoring identified in the WQMP, Forest Plan monitoring occurs annually to assess implementation of standards and guidelines. Information obtained from both sources of monitoring will ascertain whether management actions need to be changed. The monitoring plan itself will not remain static, but will be evaluated periodically to assure the monitoring remains relevant, and will be adjusted as appropriate.

Maintenance of Effort Over Time

In the 1994 Record of Decision, the Secretary of Agriculture amended current land and resource management plans with additional land allocations and standards and guidelines of the NWFP. The Siskiyou National Forest Land and Resource Management Plan is included in the Land and Resource Management Plans. A revision of the Siskiyou Forest Plan will occur in the future, in which the standard and guidelines of the NWFP will be incorporated.

Assessing Potential for Recovery - Properly Functioning Condition Methodology

Recovery of riparian areas, stream channels, and aquatic habitat requires a base condition with adequate vegetation, channel form, and large woody debris to dissipate stream energy associated with high waterflows. The BLM/USFS methodology known as Properly Functioning Condition (PFC) assesses the physical capability of streams to withstand 30-year return interval storm events. This quick, interdisciplinary method is the first step in determining the feasibility of restoration and recovery. Representative sections of Grayback, the Left Fork of Sucker Creek, and Sucker above Grayback were surveyed in the spring of 1998.

Table 13
PFC Assessment for Sucker Grayback within the Forest Boundary

Location	Miles	Properly Functioning	Functioning at Risk	Nonfunctional
Sucker Creek (near Cave Creek)	2.0			**X**
Sucker Creek (above Johnson Gulch)	121	**X**		
Grayback Creek	69	**X**		

The entire system, exclusive of the Sucker above Grayback reach, meets the minimum requirements of the PFC methodology for restoration and recovery. Until there is adequate vegetation, channel form, and large woody debris to dissipate stream energy associated with high flows, the lower reach of Sucker Creek above the Forest boundary will remain unstable, and the recovery time is uncertain. PFC does not address biological or physical potential.

Restoration in Sucker Creek and Grayback Creek will be both active and passive. Growth of vegetation on floodplains is integral to recovery. The overall goal is to move the attributes considered in this assessment: pool/riffle ratio, pool frequency, large wood, and riparian forest conditions from the present "poor" and "fair" ratings to "good" and "fair", per ODFW benchmarks. These attributes are used to measure if and when the stream is nearing its biological potential for supporting dependent aquatic and riparian species, including anadromous fish. Natural variation will cause changes in stream and floodplain conditions and make allowance for some attributes being rated "fair". These attributes and benchmarks should be validated with subsequent inventory and monitoring work in the watershed, refining them to suit the range of conditions expected in the Sucker Creek as we learn more about the watershed.

Table 14
Recovery Goals - Active and Passive Restoration
(Detailed restoration plans are contained in Appendix A and in Tables 15 and 16)

Element	Goals	Passive Restoration	Active Restoration
Temperature *Shade Component*	Achieve maximum value possible per segment. Reduce BTU loading by 342 per sq.ft. per day in 60 years. Margin of Safety: Recognize wildfire and flood effects to riparian vegetation.	Let riparian vegetation grow to reach target value. See stream reaches highlighted in Fig. 2.	1. Rx's that increase growth rates. 2. Rx's that insure long term health.

Element	Goals	Passive Restoration	Active Restoration
Temperature *Channel Form Component*	Return channels to Rosgen type that existed historically, focusing on width-to-depth ratios. Decrease bedload contributions to channels during large storms. Increase wood-to-sediment ratio during mass failures.	Allow natural channel evolution to continue. Time required varies with channel type. Allow historic failures to re-vegetate. Follow Standards and Guidelines in the NW Forest Plan for Riparian Reserves, and unstable lands.	Rx's that actively manipulate form, only one location proposed at this point in time (Mined flat abv. Cave Creek, BLM lands). 1. Treat roads, esp. sites with Diversion Potential - See Appendix D 2. Minimize future failures through stability review and land reallocation if necessary. 3. Insure that unstable sites retain large wood to increase wood-to-sediment ratio. 4. Maintain and improve road surfacing. 5. Increase pipe sizes to 100-year flow size and/or provide for overtopping during floods.

Element	Goals	Passive Restoration	Active Restoration
Flow Modification W*ithdrawals*	Maintain optimum flows for fish life. Maintain minimum flows for fish passage.		1. Purchase/lease water rights with a focus on high consumptive use and old priority date. 2. Improve efficiency of withdrawal systems (ditch to pipe) 3. Enforce existing regulations, including monitoring 4. Purchase/lease flood plain easements. 5. Educate water users on effective use and conservation
Habitat Modification	Increase size and number of wood pieces in channel. Increase depth, volume and frequency of pools. Restore connection of channel and floodplain, particularly in lower Grayback and Sucker above Grayback.	Allow large wood to remain in channel (no longer salvage).	1. Riparian Rx's that increase growth rates and vegetation diversity. 2. Place wood in channels where appropriate.

Table 15 further describes management measures and the restoration targets (Load Allocation) proposed with respect to specific sites and the specific factor affecting the limiting element.

Table 15

TMDL Organization in Grayback-Sucker WQMP					
Element	**Assessed Factors**	**Loading Capacity**	**Sources[1]**	**LA**	**Mgmt. Measures**
Temperature --Lack of shade--	Shade (%)	Solar loading 634 BTU/sf/dy	Harvest, gov. Mining Natural (65% BTU's)	Decrease current solar loading by 35 %	Treatments to increase growth and insure long term health in riparian areas
Temperature --Channel Form A3--	Rosgen type (W/D)	0 %	Harvest, gov. Road failures Natural background	NA – Maintain current condition	Upland sediment abatement.
Temperature --Channel Form B4 (0.75 stream miles)--	Rosgen type (W/D)	Decrease 7 % of BTU input by improving from B4 to B3 (Decrease W/D ratio)	Harvest, gov. Road failures Natural Background	Reduce width by 10'	Upland sediment abatement Introduction of Large Woody Debris
Temperature --Channel formF4 2.3 stream miles-	Sinuosity Rosgen type (W/D)	Decrease 15 % of BTU input by improving F4 to C4 (Decrease W/D ratio)	Mining Harvest, gov. Road failures Natural Background	Reduce width by 15-20'	Upland sediment abatement, mining permit modifications. Mining site reclamation, site manipulation
Temperature –Flow--	Federal withdrawals Seniority Dates Flow information	No effect (1.42 cfs+Fire)	Recreation (Campground & National Monument) Fire Protection Irrigation & Domestic	Maintain current condition. (Current consumptive uses on Fed. lands are not significant.)	Education of users regarding conservation. Enforcement of water rights laws.

Element	Assessed Factors	Loading Capacity	Sources	LA	Mgmt. Measures
Habitat modification --Lack of Channel Complexity--	Pool riffle ratio Pool area % Large Wood Pieces/mile Large riparian trees (%)	ODFW Benchmarks and Siskiyou NF Riparian Goals (Ref. 1998 Siskiyou WA)	Harvest, gov. Mining Flood damage Road Failures Natural	Move assessed factors from "poor and fair" ratings to "good and fair" per ODFW benchmarks.	Treatments to increase growth and insure long term health of riparian forest. Placement of wood in channel Upland sediment abatement, mining permit modifications. Mining site reclamation, site manipulation
Flow modification --Low flow condition--	Withdrawals Seniority Dates Flow information ODFW ISWR ODFW (Optimum Flows)	ODFW Instream flow expectation at forest boundary is 54 to 80 cfs during summer months.	Mining (0%) Domestic (17%) Irrigation (82%) Recreational (1%)	Increase summer flows by opportunity. (Consumptive uses within Federal lands accounts for only 2% of withdrawals from the watershed)	Seek to secure early priority consumptive rights for instream water rights. Educate users on conservation. Enforcement of existing water laws.

[1]Reserve and Margin of Safety were not discussed in terms of sources or allocations.

Restoration Prioritization and Funding

The amount of restoration funds distributed to the Forest depends on the amount of money appropriated each year by the Regional Office. The Siskiyou National Forest receives about a one million-dollar budget a year for watershed restoration. Annually, each of the five ranger districts submits a list of restoration projects prioritized by high, medium, and low to the Forest. The districts prioritize the projects based on if they are located in a key watershed and the benefits to the resources the project provides. The Forest evaluates the submitted projects, and then prioritizes the total group of projects at the Forest level using similar criteria. The amounts of funds distributed to the districts are based on priority. In addition to the appropriated restoration funds, timber sales provide restoration funds from the Knudsen-Vandenburg (KV) program. The Forest this year received a quarter of a million dollars from the KV program for watershed restoration. The limitation on this money is that it must be spent in the timber sale area that it was collected from.

The Sucker/Grayback watershed is a key watershed under the NWFP, and is therefore a high priority. Siskiyou National Forest will seek necessary funds for the implementation and monitoring components of the Sucker/Grayback WQMP as a high priority. However, due to the limitations of the Federal budget process, these funds cannot be guaranteed.

As part of the Clean Water Action Plan, Oregon has begun an interagency effort that identifies high priority watersheds in need of restoration and protection as part of the Unified Watershed Assessment. The Illinois sub-basin has been identified as a high priority watershed. It is possible that funding associated with the Clean Water Action Plan could be accessed to carry out protection and restorations actions in the Sucker Creek watershed

Recovery to Full Physical and Biological Potential

The present condition of stream and riparian habitat in Grayback Creek and Sucker Creek is discussed in previous sections. Generally, in transport or steeper reaches of both streams, the aquatic and riparian habitat are generally in fair to good shape in both these streams. These reaches are located mostly on National Forest lands. Downstream, in lower gradient stream reaches in both streams, aquatic and riparian habitat is in poor to fair condition. In Grayback Creek, these low gradient reaches are on National Forest land, and in Sucker Creek, these reaches are located on National Forest, Bureau of Land Management, and private lands.

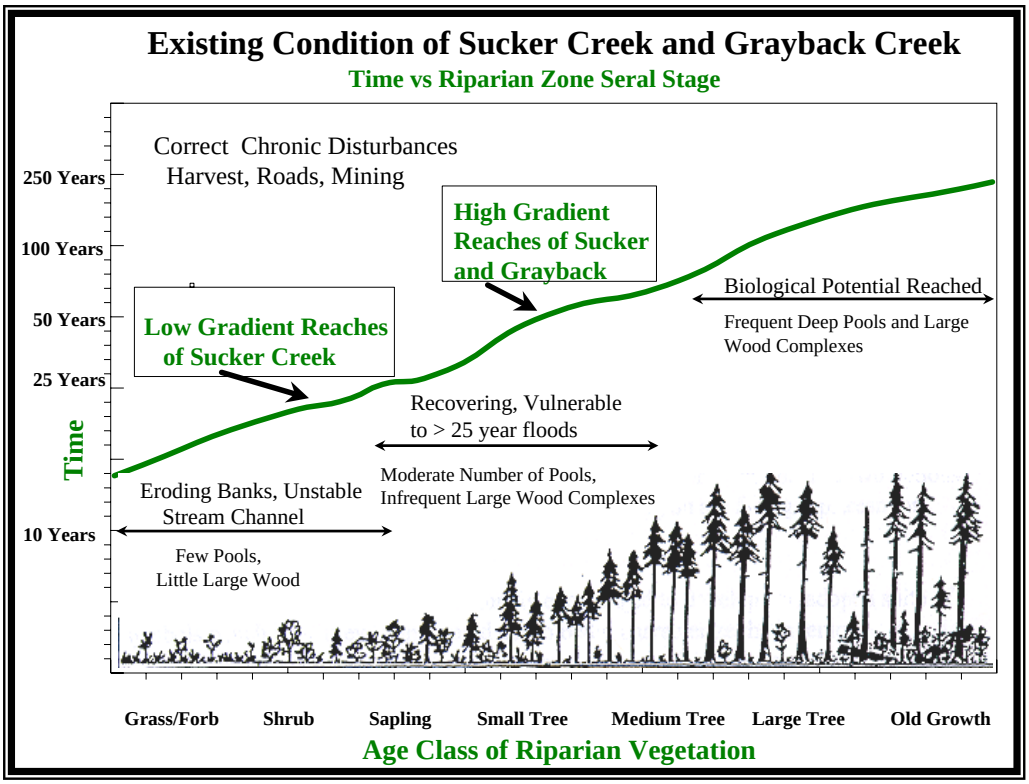

Figure 11. Existing condition of Sucker and Grayback Creek.
Most low gradient stream reaches in Sucker Creek are on private lands. Figure 11 shows the relative conditions of reaches in Sucker Creek as these areas move in a recovery direction.

Recovery of habitat conditions in Grayback Creek and Sucker Creek, to full biological potential, will take from 100 to 250 years. This time estimate accounts for some variability in recovery with

"resetting" of aquatic and riparian conditions during floods. Where conditions are recovering as shown in Figure 12, e.g., transport reaches or headwater areas primarily on National Forest lands, recovery will take time.

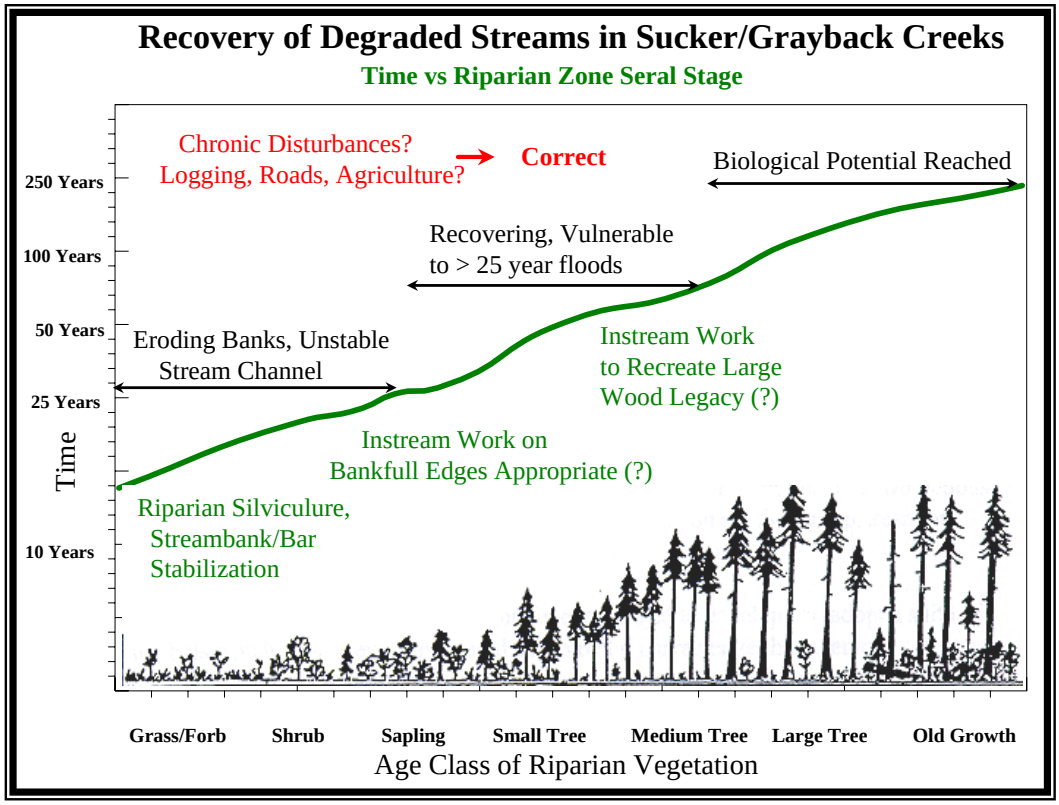

Figure 12. Recovery of Sucker and Grayback Creeks.

Interrelationships between riparian/floodplain vegetation, summer stream temperatures, sediment storage and routing, et cetera, and the complexity of habitats in the Sucker Creek watershed are many. It should be mentioned here that large mature conifers or hardwoods would continue to be rare on private lands, particularly agricultural lands, within the watershed unless major changes in land uses or land use regulations occur. This translates to a continuance of unrecovered conditions on private lands, largely due to agriculture activities. These low gradient areas have high biological potential for salmon as "grubstake habitat" (Frissell, 1993). In addition, recovery of large tree components on upstream public lands will not greatly benefit these habitats on private lands if these large tree lengths are not allowed to remain in the stream channel on private lands. An exception will be the anticipated decrease in sediment, fine and coarse. Less sediment production upslope and upstream may benefit these downstream aquatic and riparian habitats on private lands. Given these conditions, most high-quality salmonid habitat will be located on public lands in response reaches or headwater streams. These upstream areas will benefit certain species of salmonids, e.g., trout and steelhead, more than others, e.g., Coho and Chinook salmon.

Stream shade recovery will be realized more quickly than habitat recovery with the growth of hardwoods, e.g., alder, maple, ash, and cottonwood. Habitat recovery and associated sediment storage/routing in the channel will only recover to an optimum range of conditions with the recovery of riparian conifers to mature size. This will afford some added shade as these trees reach more height.

Additionally, a mature riparian forest will increase bank and channel stability, cause the channel to narrow, and result in deeper pools in these sediment-rich channels of Grayback and Sucker Creeks. Lower summer water temperatures and creation of quality habitat conditions for trout and salmon are anticipated with maturation of riparian forests in these watersheds, addressing road-related problems in the watershed, and reduced timber harvest under the NWFP. Harvest related slope failure issues will be addressed through the adaptive management measures within the NWFP.

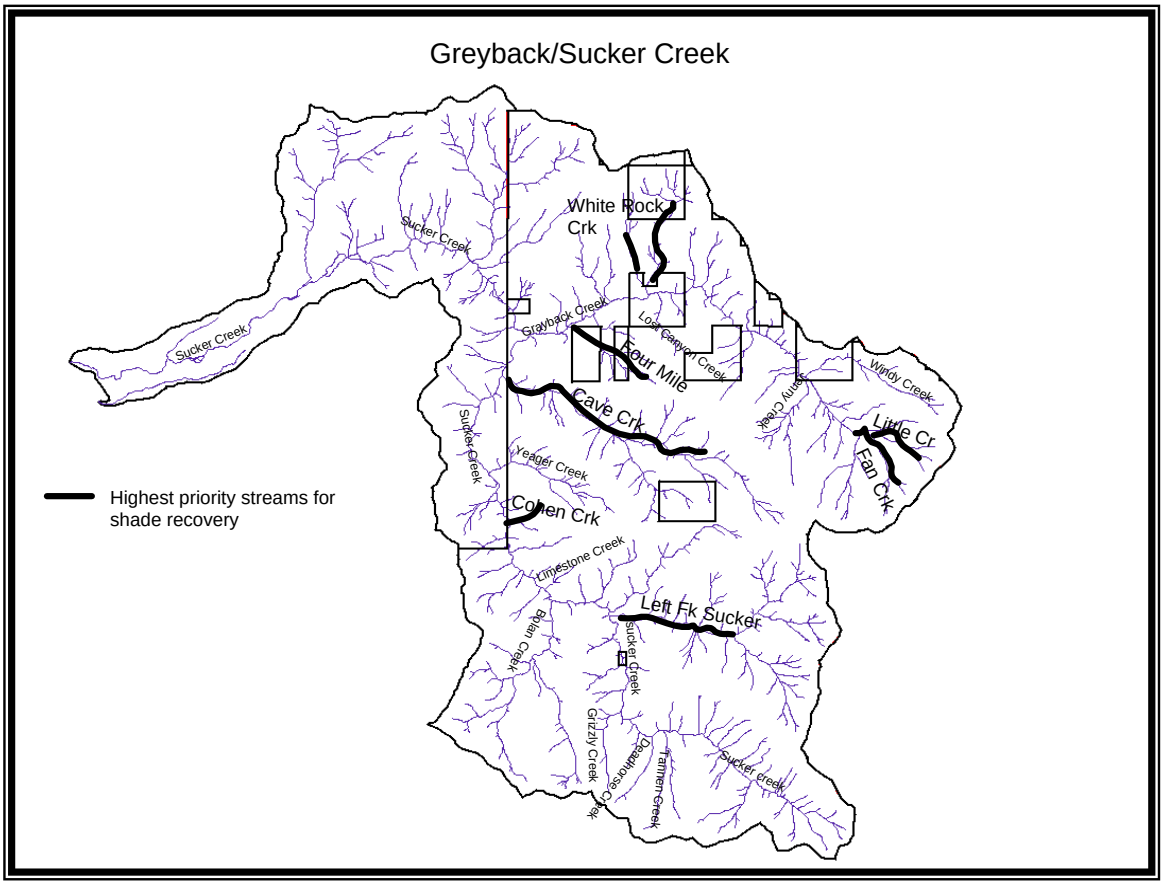

Figure 13. Highest priority streams for recovery.

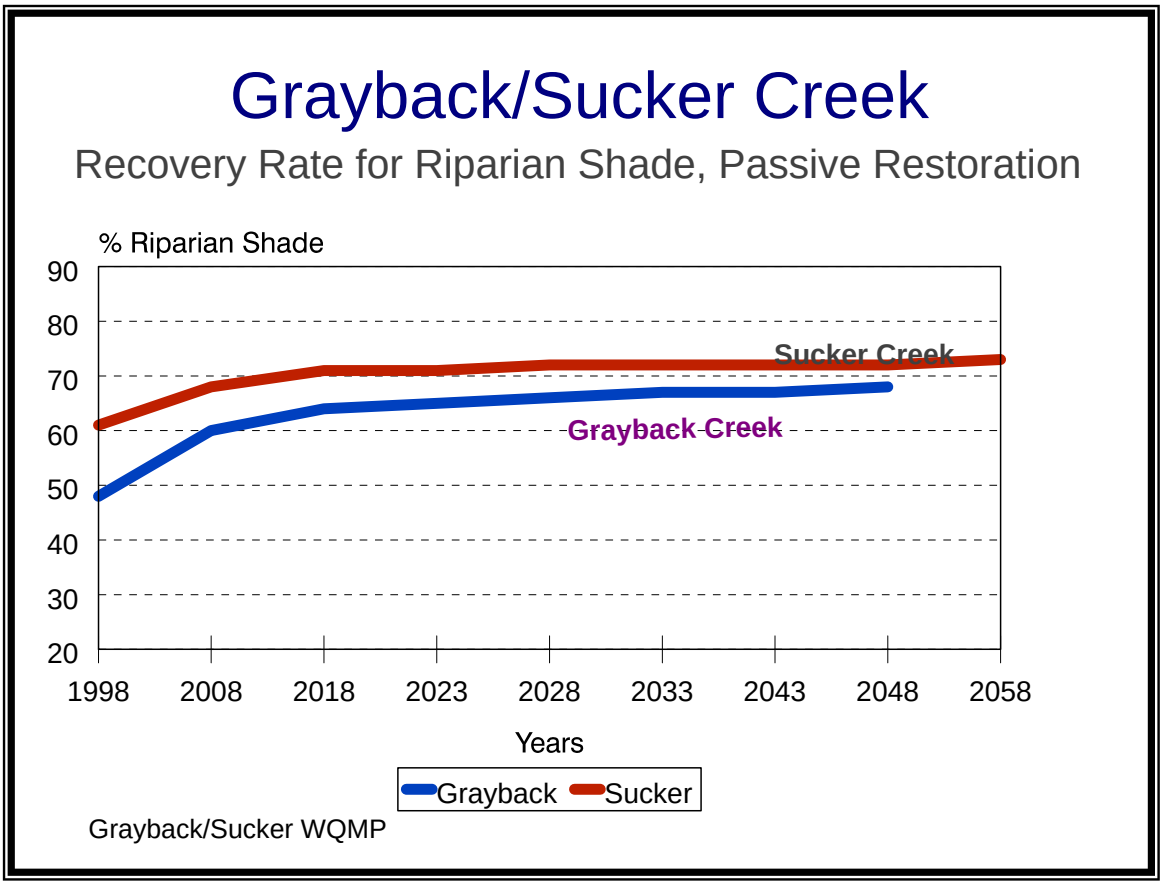

Figure 14. Shade recovery over time on Sucker and Grayback Creek.

MARGIN OF SAFETY

The Clean Water Act requires that each TMDL be established with a margin of safety (MOS). The statutory requirement that TMDLs incorporate a margin of safety is intended to account for uncertainty in available data, or in the actual effect controls will have on loading reductions and receiving water quality.

Assumptions

Natural Fire Disturbance - Sucker Creek has a frequent fire history with return interval averaging 18 years (J.Agee, 1993, T. Atzet, 1988). Recovery of riparian vegetation in areas disturbed by fire and flood will most likely be offset by future events. This is a conservative assumption, and does not account for fire suppression as a management tool. Fire suppression over the past decades has effectively reduced the acres burned by wild fire in riparian areas.

Channel Form Recovery - The channel form assessment identified areas on Sucker and Grayback Creek where channel width has increased, and is most likely contributing to stream heating. In projecting shade recovery values, credit is not given for channel recovery. Width/depth narrowing will decrease solar loading. It is also not accounted for in the shade recovery values, but is expected to occur. Through continued improved Federal management and restoration efforts, future sediment input into streams will continue to be reduced. In Grayback Creek, there is a high likelihood that the stream channel will recover in the projected time frame reducing stream heating. Management for

"good" pool frequency condition will help to restore groundwater/stream flood plain connection and bolster groundwater/stream interactions with an expected expansion of cool water refugia. In addition, management for "good" Large Woody Debris conditions will reduce local flow velocity, and reduce local bed/bank shear stress. This can be expected to increase channel stability and bank building processes that will help to restore the desired channel width/depth conditions. Neither the temperature advantages nor the improved channel width component of these two management practices has been included in the shade recovery values. Because of the uncertainty of mining on the .75 mile section of Sucker Creek and the poor condition of the channel, this area is not considered part of the MOS.

Wind Speed - Wind speed is one of the controlling factors for evaporation, which is another cooling process for the stream. The shade recovery targets do not account for any cooling from evaporation due to wind speed.

Riparian Restoration - Riparian restoration will increase storage capacity for subsurface/ groundwater inflow. Benefits not included in the shade recovery values are twofold:

1. Groundwater inflow will cool stream temperatures directly – mass transfer of energy.
2. Groundwater inflow will increase stream flow and further prevent stream temperature change.

Timber Harvest on Private Land - Within the Forest boundary, 7 percent of the land is under private management for timber harvest. Because of the lack of information on private practices, no shade recovery was accounted for on private lands. As referenced earlier, the assessment of private lands in this watershed is underway. The shade recovery expected under current practices will be identified as well as the site potential for recovery. While Federal guidelines offer more protection for stream shade than State guidelines, State guidelines do offer some stream shade protection for trees that are recovering stream shade. The effect of not calculating any shade recovery for private lands requires a higher level of recovery on the remaining Federal lands. This is in effect a margin of safety for the Federal lands as there will be shade recovery on the private lands. As mentioned earlier, the Sucker-Grayback WQMP is intended to be adaptive in management implementation. It allows for future changes in response to new information. Information generated during development of the private lands WQMP may cause modifications to this current plan for the federal lands.

In addition, a statewide demonstration of FPA effectiveness in protection of Water Quality will address the specific parameters generally accepted to be affected by forest management practices (temperature, sediment and turbidity, aquatic habitat modification, bio-criteria). The schedule and other requirements for addressing these parameters are included in the DEQ/ODF Memorandum of Understanding (MOU) of May 16, 1998. For other requirements of the MOU, such as monitoring or watershed specific rules, see Appendix F.

The requirement on Federal lands to maintain two "site potential trees" for riparian reserve widths on fish bearing streams is based on protection of fish habitat and protection of other riparian dependent species and resources. The additional protection for the other species and resources provides an additional margin of safety for fish/stream protection.

Load allocations for private lands within the Sucker Creek Watershed are scheduled to be developed by the spring of 1999. Funding is in place, and assessment work is targeted for completion by the end of 1999. The Agricultural WQMP is also scheduled for completion in 1999.

Chapter 4 - Monitoring Plan

Reasonable Assurance of Implementation

Monitoring will provide information as to whether standards and guidelines are being followed, and if actions prescribed in the WQMP are achieving the desired results. In addition to the monitoring identified in the WQMP, Forest Plan monitoring occurs annually to assess implementation of standards and guidelines. Information obtained from both sources of monitoring will ascertain whether management actions need to be changed. Funding for annual monitoring is given as a percentage of the appropriated dollars allocated to each district or zone.

If changes are required, the District Hydrologist will present the problem to management for determination of appropriate actions. The monitoring plan itself will not remain static, but will be evaluated periodically to assure the monitoring remains relevant, and will be adjusted as appropriate.

Monitoring data will foster changes in management activities in three ways:

1. Iterative watershed analysis
2. Next revision of the Siskiyou Forest Plan/Decision memo process in the watershed
3. Independent issues raised

Temperature

The Siskiyou National Forest, with our cooperators, will continue to monitor stream temperatures throughout the Illinois River watershed and in Sucker-Grayback, specifically. We monitor to meet a variety of objectives, so site locations will vary over time. Our objectives are to monitor long-term temperature recovery, better understand the natural temperature variability, and to track potential project effects. There are five locations that are monitored annually during the summer months to establish long term records. The sites are:

Sucker Above Bolan
Bolan Creek
Left Fork at Mouth
Grayback at Mouth
Sucker at the gage below Little Grayback.

This program will be administered by the Illinois Valley Ranger District, principally the District Hydrologist. The estimated annual cost for these five stations is $1,500.

Temperature, Shade Component

Streamside shade will be directly monitored in the headwaters of Grayback Creek just downstream of the Fan, Elk, Little confluences, and on Sucker Creek near its confluence with Johnson Gulch (BLM lands). We will use a solar pathfinder to establish existing shade. Measurements will be taken every five years, beginning in 1998. This work will be used to track the interim shade goals. Estimated costs for these two stations is $250.

It is very likely that over the next few years the District will prescribe riparian stand treatments in stands located adjacent to perennially flowing water (active restoration). These stands will be surveyed using existing regional standards prior to and following treatment. Data should confirm that

prescriptions are accelerating growth rates and/or maintaining stand health such that shade and large wood supply objectives are met.

Future iterations of watershed analyses will also provide a basin-wide context for the health of riparian stands such that our ability to maintain and/or improve shading and large wood supply is addressed.

Temperature, Channel Form Component

Channel form will be directly measured through the use of channel cross-sections and pebble counts (Potoyondy and Hardy, 1994; Bevenger and King, 1995). Cross-sections will be re-surveyed every three to five years, or following large, channel forming events. Cross-sections will be, or have been, established at the following locations:

Left Fork Sucker Creek (established 1997)
Sucker above Bolan (established 1997)
Grayback near Mouth (established 1995)
Sucker near Johnson Gulch (proposed for 1998)
Sucker at the gage below Little Grayback (established 1997)

Work will be administered by the Illinois Valley Ranger District at an estimated cost of $250 per cross section.

Bedload sediment storage and transport is reflected as channel form. Our efforts to reduce the anthropogenic sources of bedload will focus on reducing the number and effects of road failures, and in increasing the proportion of wood to sediment delivered during mass failures. We will monitor and report the miles of road decommissioned and the number of pipes treated for diversion potential on an annual basis. Because watershed restoration is an evolving science, we anticipate that other techniques will be introduced during the recovery period that this plan covers. Those new techniques will be included in this plan as appropriate. Bankfull width-to-depth and general Rosgen classification will be monitored on a 10-year basis with stream surveys.

Changes in channel form are anticipated as a result of road treatments. In general, reductions in road-derived sediment will result in narrower and deeper channel cross-sections over time.

Habitat Modification

Standard Level II and III stream surveys will be conducted on a recurring basis to document changes in channel morphology, distribution of fish habitat units, and pieces of large wood in our channels. Stream surveys will also monitor approximate densities of juvenile salmonids and riparian vegetation. Extensive surveys will survey whole watersheds or sub-watersheds during a summer (Level II surveys), with an average seven-year cycle.

More intensive surveys (Level III) will be done in low-gradient and less confined stream segments. These are anticipated to have measurable responses to changes in watershed conditions.

Sites to be monitored include:

Left Fork of Sucker (lower ½ mile)
Sucker above the FS Boundary (near Mule/Cohen Creeks)
Grayback Creek (lower ½ mile)

Flow Modification

US Geologic Survey has discontinued the Sucker Creek stream gauge because of lack of funding. The Oregon Department of Water Resources is currently operating the gauge, and takes additional flow readings at three additional sites in the watershed during dry months. The Oregon WRD will report any changes in water rights and uses to the Medford DEQ office.

Properly Functioning Condition **(PFC)**

The BLM/USFS methodology known as Properly Functioning Condition (PFC) assesses the physical capability of stream to withstand 30-year return interval storm events. Representative sections of Grayback, the Left Fork of Sucker Creek, and the Sucker above Grayback were surveyed in the spring of 1998. These reaches will be reassessed if there are changed conditions in the Sucker Creek watershed.

Table 16 connects monitoring goals, frequencies, and interim benchmarks identified in this WQMP, with management measures and elements from Table 15.

Table 16

Interim Benchmarks and monitoring frequencies for Grayback-Sucker WQMP					
Element	**Site Identification**	**Management Measure**	**Interim Benchmarks**	**[1]Monitoring Parameter**	**Monitoring Frequency**
Temperature --Lack of shade--	See streams identified in Figure10	Passive – no treatment	Established stands continue to grow 10-50 years (See shade curves in Figure 11)	Shade % w/ solar pathfinder 2 Continuous temperature monitoring sites (dry weather)	Begin 1998 then @ 5 yr. Intervals Annually
Temperature --Lack of shade--	Sucker Creek Tribs.	Passive plus treatments to increase growth and insure long term health	2013 – solar radiation reduced by 10% 2043 – solar radiation reduced by 13 %	Stand surveys (growth and health) 2 Continuous temperature monitoring sites (dry weather)	Pre and post treatment 1998-2013 Annually

[1] QA/QC: DEQ protocol will be followed as close as possible where applicable (e.g. temperature monitoring). Region 6 Stand Examination Standards will be followed for stand surveys, and appropriate published protocol for Solar Pathfinder, Rosgen stream assessments, etc.

Element	Site Identification	Management Measure	Interim Benchmarks	Monitoring Parameter	Monitoring Frequency
Temperature --Lack of shade--	Grayback Creek Tribs.	Passive plus treatments to increase growth and insure long term health	2013 – solar radiation reduced by 10 % 2058 – solar radiation reduced by 14 %	Shade % w/ solar pathfinder Stand surveys (growth and health) Continuous temperature monitoring (dry weather)	Begin 1998 then @ 5 yr. Intervals. 1998–2013 Pre and post treatment Annually for main stem, intermittent for tribs.
Temperature --Channel Form A3--	Grayback RM 4.7-7.1	Upland Sediment Abatement	After two 25-year magnitude storm events (minimal impact on solar radiation)	Rosgen type (W/D) Miles road decommission Potential diversions corrected High priority road upgrades, decommission and stormproofing	Following large storms (25 yr magnitude) Annually
Temperature --Channel Form B4 (0.75 stream miles)--	Grayback (confluence w/Sucker to RM 0.75)	Upland Sediment Abatement	After two 25-year magnitude storm events Reduce solar radiation by 7 %	Rosgen type (W/D) Miles road decommission Potential diversions corrected High priority road upgrades, decommission and stormproofing	1 site @ 3-5 year intervals Annually
Temperature --Channel form F4 = 2.3 stream miles--	Sucker Creek u/s of Grayback to Yeager	Upland Sediment Abatement 2000 – DEQ, DOGAMI and USFS assess mining impacts. 2002 Address significant issues in 0600and 0700 NPDES and 401 certifications	100-year magnitude storm event[2] Alterations to mining general permits - 2002 401 certifications issued, changes in conditions.	Riparian Stands Rosgen type (W/D) NPDES permit modifications. Certifications issued, change in conditions	20 year cycle 3-5 year intervals 2002 and then @ 5 year intervals Annual

[2] Changes to historic mining practices and historic laws regulating mining activities will require a lonterm effort before measurable change is observed.

Parameter	Site Identification	Management Measure	Interim Benchmarks	Monitoring Parameter	Monitoring Frequency
Temperature --Channel Form Mining site reclamation--	Flat above Cave Creek	Channel manipulation project	Decrease W/D ratio by amount recommended by BLM interdisciplinary team. 1999	Rosgen type (W/D)	Pre Project Post Project (1999)
Temperature --Flow--	Federal ownership	Educate users regarding conservation	WSC to contact water users by 2000	Federal land Withdrawals Seniority Dates Flow information	Report educational efforts / 2-yr interval Bi-weekly during dry months[3]
Habitat modification --Lack of Channel complexity--	Reach 2 Grayback Creek	Treatments to increase growth and insure long term health 1998 Place wood in channel 1998	2098 – improved from fair to good (ODFW Benchmarks)	Level 2 stream survey Pool freq. (riff w/seg dist) Pool area (%) Large Wood (pieces/mile) Large riparian trees (%)	7-10 year intervals
Habitat modification -- Lack of Channel complexity--	Sucker Creek u/s of Grayback to Yeager	Reduce channel impacts from mining. Riparian forest management. Reduce upland sediment.	2X 25 year storm magnitude 2098 – improved from poor to fair[4]	Level 2 & 3 assessments. Pool freq. (riff w/seg dist) Pool area (%) Large Wood (pieces/mile) Large riparian trees (%) Sediment abatement (Roads decomm., etc.)	7 year intervals Level 3 biannually Annual
Habitat modification --Lack of Channel complexity--	Remaining Federal ownership	Passive – no treatment. ODF&W benchmarks plus Siskiyou Riparian goals	Percent of full biological potential	Level2assess. Pool freq. (riff w/seg dist) Pool area (%) Large Wood (pieces/mile) Lg Riparian trees (%)	7-10 year interval (See ODFW benchmarks in Table 11)

[3] Oregon Water Resources Department

[4]This area is in extremely poor shape and will require much time to recover.

Parameter	Site Identification	Management Measure	Interim Benchmarks	Monitoring Parameter	Monitoring Frequency
Flow modification -- Low flow condition--	Federal ownership	Seek to secure early priority consumptive water rights for conversion into instream water rights Educate users regarding conservation	Identify opportunities for conversion to instream rights. WSC to contact water users by 2000	Withdrawals Seniority Dates Flow information ODFW ISWR ODFW (Optimum Flows)	Report cfs converted to ISWR @ 2 year intervals Report educational efforts/ 2 year intervals

Implementation Monitoring and Adaptive Management

A biennial report outlining progress and tabulation restoration projects will be submitted to Oregon DEQ by the Illinois Valley Ranger District. Should monitoring reveal that interim goals are not on schedule, changes related to this Water Quality Management Plan will be made. These changes might include re-evaluation of assumptions, and/or new restorative treatments.

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