North-Central Coastal Diversity Stratum

This stratum includes populations of steelhead that spawn in watersheds south of the Lost Coast to Big Salmon Creek (inclusive). The division between this stratum and the one that follows reflects the geometry of and interior characteristics of the larger watersheds along this stretch of coast. The large watersheds in this stratum are more consistently affected by coastal climate, whereas those to the south exhibit a much stronger signature of interior climatic conditions. This division also coincides with one of the moderately pronounced breaks apparent in genetic analyses (Bjorkstedt *et al*. 2005).

The populations that have been selected for recovery are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum, followed by the Rapid Assessment of the Supporting populations:

- Big River
- Caspar Creek
- Noyo River
- Ten Mile River
- Usal Creek
- Wages Creek
- North-Central Coastal Diversity Stratum Rapid Assessment
    - Albion River
    - Cottaneva Creek
    - Pudding Creek

NC steelhead North-Central Coastal Diversity Stratum, Populations, Historical Status, Population's Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting.

Diversity Strata	NC winter-run steelhead populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
North-Central Coastal	Albion River	I	Supporting	48.6	6-12	290-581
	Big River	I	Essential	255	20	5,100
	Caspar Creek	D	Essential	12.9	40.4	500
	Cottaneva Creek	I	Supporting	21.9	6-12	129-261
	Noyo River	I	Essential	152.8	21.0	3,200
	Pudding Creek	I	Supporting	23.9	6-12	141-285
	Ten Mile River	I	Essential	171.1	20	3,400
	Usal Creek	I	Essential	27.5	38.4	1,100
	Wages Creek	I	Essential	17.4	39.8	700
	North-Central Coastal Diversity Stratum Recovery Target					**14,000**

NC steelhead North-Central Coastal Diversity Stratum

Big River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North Central Coastal
- Spawner Abundance Target: 5,100 adults
- Current Intrinsic Potential: 255 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

In their 1965 analysis of Big River, the California Department of Fish and Game (CDFG) estimated that Big River provided 137 miles of steelhead trout habitat (CDFG 1965). During the same time period, the California Department of Water Resources (1965) estimated the adult spawning abundance of steelhead to be 6,000 fish. Spence *et al.* (2012) estimates the historical size of the Big River population to be 5,100 adult spawners.

Juvenile salmonid distribution has been documented by private timber companies and resource agencies throughout the watershed in the recent past. State agencies and timber company biologists have documented steelhead trout presence in 51 tributaries and the mainstem of Big River. Various survey methods have been used since the 1980s to assess juvenile salmonid distribution. Current surveys using both electrofishing and snorkeling have shown that steelhead distribution remains relatively good throughout the Big River watershed (35 of 51 tributaries). Downie *et al*. (2006) report stocking hatchery fish in Big River and its tributaries with salmonids for over 100 years. Juvenile steelhead were reportedly stocked in James Creek in 1904; and a 1955 CDFG memo describes a depleted CCC coho salmon population and attempts to establish a Chinook salmon run in the 1940s and 1950s .

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, Pomo Indians utilized the Big River fishery resources. Native Americans also used fire in coastal areas to clear land for tribal activities. Starting in 1852, timber harvest began in the lower Big River area with a mill in the town now known as Mendocino. From the beginning of this timber harvesting in the 1850s to about 1940, logs were either driven down stream channels with the use of splash dams or were taken out with the use of railroad cars. In the 1940s, truck transport of logs began with the use of

tractor yarding and the construction of roads, skid trails and log landings (GMA 2001). By the 1960s, some harvesting of second growth timber had begun, with poor timber harvesting practices continuing in the 1980s, although the Forest Practice Act (1973) has progressively improved road and yarding systems. The majority of the watershed has been harvested more than once, 79 percent of the acres have been harvested twice, 34 percent has been harvested three times, and eight percent has seen harvesting activities four times (Downie *et al.*, 2006).

Roads and railroads associated with timber harvesting have been in the watershed since the 1800s, and in the 1940s railroads were converted to truck roads. Of the 1,242 miles of roads in this basin, 64 percent were built prior to 1979, 32 percent are rocked surface, and less than five percent are paved highways or county roads (Downie *et al*., 2006). Although newer roads tend to generate less surface erosion, USEPA (2001) reports that aerial photo analysis shows that in the last decade roads account for 16 percent of the road surface erosion in the watershed, whereas older roads (1921-1936) account for only one percent of the surface erosion for that period. The sheer number of roads in the watershed today is believed to be the reason for the increased sediment production that currently exists.

Current Resources and Land Management

Due to the remote location and large public ownership of the Big River watershed, a small number of programs and management plans guide land use activities within the basin. Private timber management companies are the largest landowners within the watershed, with Mendocino Redwood Company (MRC) owning 29.4 percent (34,114 acres), Strategic Timber Trust owning 15.4 percent (17,850 acres), and Lyme Redwood Timberlands owning eight percent (9,700 acres) of the watershed. Jackson State Forest accounts for 19.6 percent (22,714 acres) of the watershed, and a new state park, Big River State Park, accounts for 7,342 acres. The majority of the remaining property is owned by 31 property owners (GMA 2001).

Private timberland management varies from maximum sustainable yield on MRC lands to Lyme Redwood Timberlands' goal of sustainable management over time. Jackson Demonstration State Forest management is primarily demonstrating forest management practices, recreation, and environmental conservation.

Salmonid Viability and Watershed Conditions

The following indicators are rated Poor through the CAP process: LWD frequency, shelter rating, primary pools, pool/riffle ratio for juvenile and adult salmonids. Gravel quality for the egg lifestage and stream temperature and canopy cover were rated Poor for summer rearing

juveniles. Indicators for watershed processes that are rated Poor through the CAP process include watershed road densities and riparian road densities.

Due to the low abundance of adult steelhead, the population viability attribute is rated as Poor. Juvenile density was rated as Fair across the watershed, and smolt abundance is estimated as Poor at this time.

Recovery strategies will typically focus on ameliorating Poor habitat indicators although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that were rated as Fair through the CAP process, but are considered important within specific areas of the watershed, include gravel quality for eggs, conditions for summer rearing and the estuary, and physical barriers.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Big River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Habitat Complexity: Large Wood and Shelter

Data from the Coastal Watershed Planning Assessment (Downie *et al.*, 2006) show that one of 58 streams meet target values for shelter. Past splash damming and timber harvest activities have reduced large woody debris loading instream reaches across this watershed. Forest canopy has begun to recover with most stream reaches in the watershed approaching or meeting target values, however, current riparian conditions are unlikely to deliver woody debris to provide high quality habitat in the near future. Poor habitat complexity and low LWD volume are expected to limit salmonid rearing and migration habitat by reducing cover and velocity refuge required during freshwater residency.

Water Quality: Temperature

Water temperature in much of the upper mainstem Big River is unsuitable for steelhead rearing during the summer period. Downie *et al.* (2006) report stream temperature conditions in the coastal area tributaries are suitable for salmonid rearing, and the majority of streams in the middle and interior do not meet suitability criteria for juvenile rearing. Based on limited sampling data, tributaries such as Two Log Creek and Beaver Pond Gulch in the middle subbasin area of Big

River have suitable stream temperatures. In the eastern areas of the watershed, the North Fork Big River subwatershed is suitable for salmonid rearing. Also, streams in the South Fork Big River subbasin are suitable for steelhead rearing, with Gates and Montgomery creeks being notable exceptions with very suitable temperature during the summer period (Downie *et al.*, 2006).

Overall, stream temperature for steelhead is rated as Poor due to moderately and unsuitable stream temperatures that occur across the middle and inland portion of the basin. Although canopy targets are being met in many of the stream reaches surveyed, stream temperature monitoring suggests that the level of regeneration of riparian buffers is not yet adequate to fully protect streams.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The majority of stream reaches sampled in Big River do not meet target conditions for pools and the ratio of pools to riffles. Stream reaches with greater than 40 percent pools and 20 percent riffles are considered suitable for salmonid rearing, migration and feeding. Only 21 percent of the streams sampled met the target for primary pool frequency, and no stream reaches met the target for pool/riffle ratio. Streams have low large woody debris loading, which affects pool frequency and increases the amount of flat water, or glide type habitat.

Other Current Conditions

Although substrate condition is rated as Fair for the egg lifestage, there is conflicting information regarding the current condition of instream habitat with respect to fine sediment. Downie *et al*. (2006) report that less than 50 percent of the spawning areas observed in the basin have good embeddedness ratings (low fine sediment in spawning gravel). GMA (2001) suggests that the presence of fine sediment in spawning gravels is currently not limiting fish production. We rated this condition as Fair to indicate that the basin is likely in a state of recovery, yet given the number of roads and slides in the basin there is much work to be implemented to reduce erosion in the watershed. The basin was rated good for adult fish passage; however, there are some barriers caused by culverts at road crossing that need to be addressed for adult steelhead. The estuary is also reported to be in the early stages of recovery from past logging practices (Downie *et al.* 2006) and was rated to be in Fair condition.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Big River CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats particularly when there is a need

to address frequent flood and mass wasting events, which will be especially significant in this area due to the steep terrain, high road densities and unstable geology.

Roads and Railroads

Road density was rated as a High threat that, unless abated, will continue to limit fish production in the basin. Although sediment quality is not rated as Poor in the basin currently, roads continue to be the largest source of anthropogenic sediment delivery in the basin (GMA 2001). Road-related slides and surface erosion account for 30 percent of the sediment budget delivered to stream channels, 49 percent of the sediment is from natural processes, and timber harvest activities contribute the remaining 20 percent. GMA (2001) found the recent (1989-1999) spike in road construction has increased sediment yields from surface erosion, while road-related mass wasting and harvest-related surface erosion have decreased.

Severe Weather Patterns

Future impacts of severe weather patterns pose a High threat to watershed processes. The impacts of climate change in this region will have the greatest impact on overall watershed processes that may affect all lifestages by reducing habitat conditions such as pool frequency and increasing fine sediment in spawning areas. Overall, the range and degree of temperature and precipitation variability is likely to increase across all watersheds in California.

Other Threats

Timber harvest and the threat of fire are Medium threats to watershed processes within Big River. Improved forest practices and the implementation of the Mendocino Redwood Company's HCP were the basis for rating timber harvest as a Medium future threat in this watershed. The Mendocino Redwood Company is the largest industrial timberland owner in the watershed. With reduced fire frequency over the last few decades, understory fuel loads have likely increased and have increased the threat of large fires that could increase soil destabilization and future erosion. However, because of the current fire suppression capability available, this threat rates as a Medium future threat. Although channelization from past splash damming continues to affect current instream habitat quality, it has not been conducted for decades and is not a future threat.

Limiting Stresses, Lifestages, and Habitats

Based on the type and extent of stresses and threats affecting the population as well as the limiting factors influencing productivity, summer and winter rearing habitat for the juvenile lifestage is most limited. The egg lifestage is likely limited by elevated fine sediment that reduces survival to emergence in many spawning areas across the watersheds.

General Recovery Strategy

Habitat Complexity: Large Wood and Shelter

Restoration actions should focus on improving large woody debris (LWD) frequency across the watershed and the estuary. Riparian areas are in the process of recovery with stands of smaller diameter conifers that currently buffer stream areas. Adding LWD will provide much needed complexity to stream channels until riparian areas reach maturity and begin to recruit LWD naturally to channels. Stream reaches with improved or restored LWD will provide important refuge from high flow events and for increased habitat availability for juvenile steelhead throughout their freshwater residency. Increased LWD loading is also expected to improve sediment routing by sorting gravels and improving spawning habitat quality.

The estuary has been identified as an important refugia area for rearing and smolt lifestages of salmonids (Downie *et al.* 2006), therefore we recommend assessing the potential for improving complexity within this habitat area.

Improve Stream Temperatures

The approach to improving riparian conditions in the basin will need to focus on minimizing further riparian vegetation loss and rehabilitating riparian areas that are currently in poor or fair condition, which primarily occur in the inland subbasins of this watershed. As discussed above, recovering riparian function will improve LWD recruitment, but also is expected to improve summer stream temperatures.

Improve Habitat and Substrate Quality

Reducing sediment delivery from roads and timber harvest is expected to improve a number of key attributes for salmonids in Big River. Slides and surface erosion resulting from road failures and timber harvest currently account for approximately 50 percent of the sediment budget in the watershed. The inland subbasins tend to have steeper slopes and a higher number and volume of slides than coastal and middle areas of the watershed. Reducing management-related sediment delivery from roads and mass wasting to stream channels is expected to improve gravel quality, egg survival, benthic macro-invertebrate production, and pool volume.

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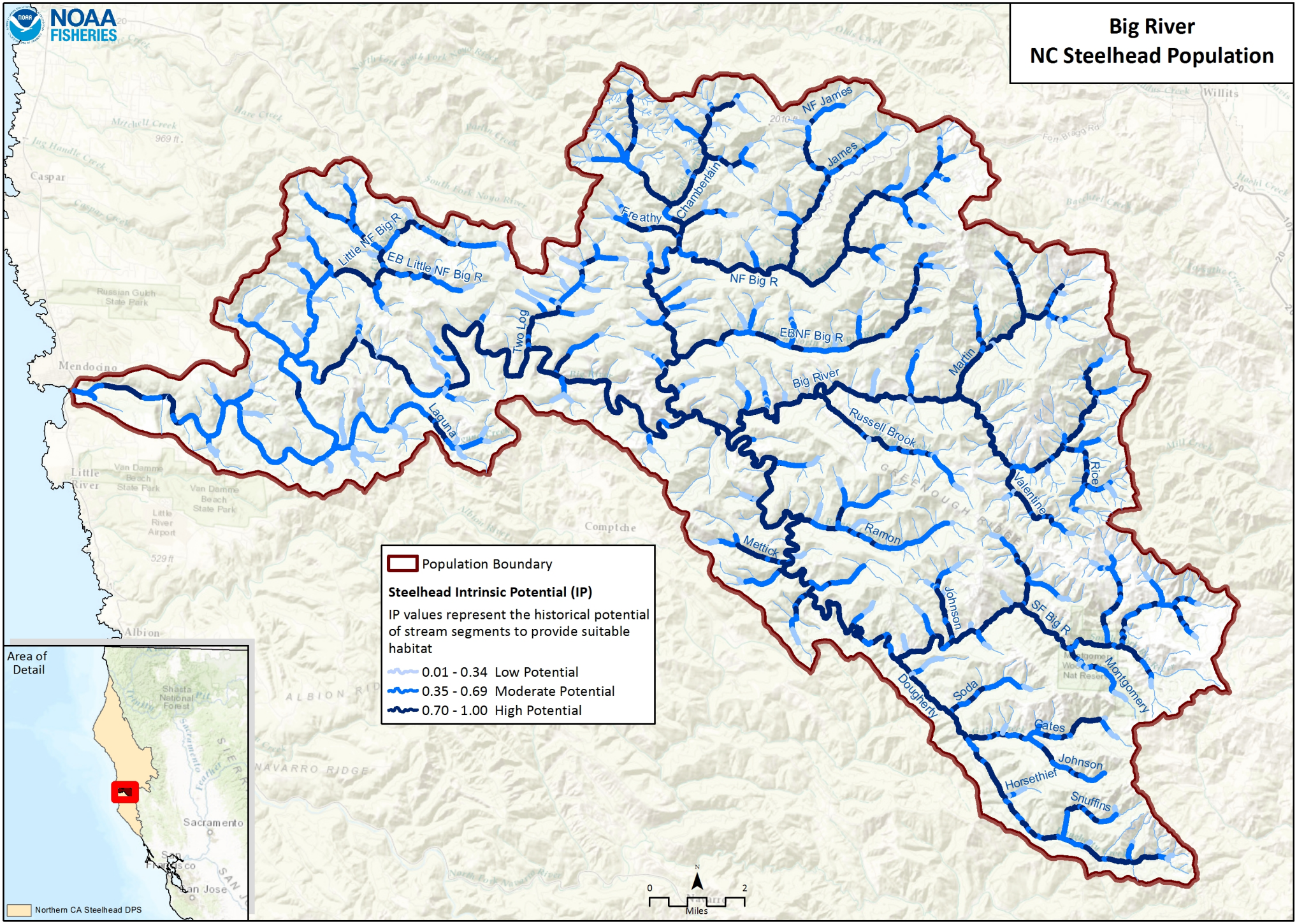
NOAA FISHERIES
Big River
NC Steelhead Population
NF James
James
Chamberlain
Freathy
Little NF Big R
EB Little NF Big R
NF Big R
Two Log
EBNF Big R
Big River
Martin
Russell Brook
Laguna
Rice
Valentine
Ramon
Mettick
Johnson
SF Big R
Montgomery
Dougherty
Soda
Gates
Johnson
Horsethief
Snuffins
Willits
Caspar
Mendocino
Little River
Albion
Comptche
Russian Gulch State Park
Van Damme Beach State Park
Little River Airport
ALBION RIDGE
NAVARRO RIDGE
GREENWOOD RIDGE
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
Shasta National Forest
Sacramento
San Jose
Northern CA Steelhead DPS
0
2
Miles
N

NC Steelhead Big River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams meet target. Current PRF ratio 30:21:43	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	> 75% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor

3	Summer Rearing Juveniles	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 75	Fair
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	46% of streams/ IP-km (>70% average stream canopy)	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	21% of streams/ IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk Factor Score 75	Fair

					Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35		
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.03 Diversions/10 IP-km	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>98% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-km maintains severity score of 3 or lower	Very Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2-0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good

4	Winter Rearing Juveniles	Condition	Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		N/A
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	98.49% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	Fair
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair

			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.03 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		31,300-630,000 = Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<1% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	6.3 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	8.7 Miles/Square Mile	Poor

NC Steelhead Big River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture							
2	Channel Modification	Low	Low	Medium	Medium	Low	Medium	Medium
3	Disease, Predation and Competition							
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Medium	Low
5	Fishing and Collecting	Medium		Low				Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching							
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Low	Medium	Medium
9	Mining							
10	Recreational Areas and Activities	Low	Low					Low
11	Residential and Commercial Development							
12	Roads and Railroads	Low	Medium	Medium	Low	Low	High	Medium
13	Severe Weather Patterns	Low	Medium	Medium		Low	High	Medium
14	Water Diversion and Impoundments	Low		Medium			Low	Low

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
BigR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	CDFW, MMWD, SPAWN	
BigR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	3	10	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, State Parks	
BigR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited	Initial projects should target stream reaches with high IP-km values, however, consideration should be also given to mainstem Big River, particularly mainstem reaches above the estuary.
BigR-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, and use streamway concept where appropriate.	2	25	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited	
BigR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
BigR-NCSW-5.1.1.1	Action Step	Passage	Modify two barriers on James Creek. One barrier is one-half mile from the mouth of James Creek and is a bedrock cascade that needs modification for adult steelhead passage. The second barrier is on the North Fork of James Creek and is located where Highway 20 encroaches on the stream channel and has created a barrier.	1	5	CDFW, Jackson Demonstration State Forest, NMFS	
BigR-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	20	CDFW, Jackson Demonstration State Forest, NMFS	
BigR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
BigR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Identify historic salmonid habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	10	California Coastal Conservancy, CDFW, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks	These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority.
BigR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Fund a watershed coordinator.	2	10	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, RCD, RWQCB, State Parks, Trout Unlimited	Currently, Big River is managed by five or six larger landowners - including State, private, and non-profit. A coordinator is likely necessary to focus actions and resources in key areas and to apply for grants that will span multiple landowners.
BigR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Install properly sized large woody debris to meet targets specified in recovery plan.	2	20	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, UC Extension	Much of Big River has been habitat typed and thus the stream reaches lacking wood can be readily identified. Permitting should be streamlined because of programmatic biological opinions for these types of actions.
BigR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CalFire, CDFW, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Encourage the development and implementation of large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).	2	20	CalFire, CDFW, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks	
BigR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)				
BigR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Increase primary pool frequency to more than 40 percent, and riffle frequency to more than 30 percent in at least 75% of the stream.	2	20	CDFW, NMFS, NOAA RC, Lyme Timber, Private Landowners	
BigR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
BigR-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	20	CDFW, Coastal Ridges, Conservation Fund, Mendocino Redwood Company, Private Landowners, Redwood Forest Foundation, State Parks, The Nature Conservancy	
BigR-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, CalTrans, Conservation Fund, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RWQCB, State Parks	Particular attention should be directed at implementing this action along mainstem Big River. Mainstem temperatures are very warm, particularly in the lower reaches, and it will take a considerable time to grow the riparian canopy to sufficient size to add in overall stream shading.
BigR-NCSW-7.1.1.3	Action Step	Riparian	Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs to the North and South Forks Big River, mainstem Big River, and Daugherty Creek.	2	20	CalFire, Private Landowners	
BigR-NCSW-7.1.1.4	Action Step	Riparian	Develop riparian improvement projects along James Creek to increase canopy levels.	2	20	CDFW, Jackson Demonstration State Forest, NOAA RC, Trout Unlimited	Recommendation from CDFW coastal watershed report.
BigR-NCSW-7.1.1.5	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	20	Jackson Demonstration State Forest, Mendocino Redwood Company, Timber Companies	
BigR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality and distribution for macro-invertebrate productivity (food)				
BigR-NCSW-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	5	CalFire, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USEPA	This sediment reduction plan could be part of a larger road and sediment reduction plan. This plan should tier off recommendations in the Big River TMDL.
BigR-NCSW-8.1.1.2	Action Step	Sediment	Treat high priority slides and landings identified in credible landowner assessments. Focus efforts in the South Daugherty and Chamberlain Creek subbasins.	2	10	CDFW, NOAA RC, Private Landowners, Trout Unlimited	A sediment assessment will identify high priority slides and landings.
BigR-NCSW-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino County Department of Public Works, RWQCB, State Parks	This infrastructure is likely present in much of the Big River subwatersheds.
BigR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
BigR-NCSW-10.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient. Focus on tributaries in the Middle and Inland subbasins that do not meet canopy target of 70 percent. Use CDFW habitat typing data/reports to determine tributaries that do not meet canopy target.	2	10	CDFW, Mendocino Redwood Company, Private Landowners, RCD, Trout Unlimited	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
BigR-NCSW-11.1.1.1	Action Step	Viability	Measure or estimate the condition of key habitat attributes across the watershed. Prioritize tributaries that have been habitat typed in the past.	2	5	CDFW, Lyme Timber, NMFS	
BigR-NCSW-11.1.1.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFW habitat assessment protocols) to ensure ESU-wide consistency.	3	60	CalFire, California Department of Mines and Geology, CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RPFs, RWQCB, SWRCB, UC Extension	Most of the watershed has been habitat typed according to CDFW stream protocols.
BigR-NCSW-11.1.1.3	Action Step	Viability	Monitor population status for response to recovery actions.	2	10	CDFW, NMFS, Jackson State Demonstration Forest	
BigR-NCSW-11.1.1.4	Action Step	Viability	Conduct monitoring activities to determine the abundance of adult and smolt salmonids in Big River.	2	12	CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, State Parks	
BigR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
BigR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
BigR-NCSW-19.1.1.1	Action Step	Logging	Establish greater oversight for pre and post-harvest monitoring by the permitting agency for operations.	3	5	CalFire, CDFW, NMFS	
BigR-NCSW-19.1.1.2	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas.	2	20	NMFS	
BigR-NCSW-19.1.1.3	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	10	CalFire, CDFW, NMFS	
BigR-NCSW-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	10	County, CDFW, NMFS, RCD	
BigR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
BigR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	This plan should leverage the Big River TMDL.
BigR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Continue efforts such as road improvements, and decommissioning to reduce sediment delivery to Big River and its tributaries. CDFW stream surveys indicated Kidwell Gulch, Two Log Creek, and Saurkraut Creek have road sediment inventory and control as a top tier tributary improvement recommendation.	3	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	
BigR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	
BigR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized users to decrease fine sediment loads.	3		CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 2015).	3	100	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	
BigR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	10	NMFS, CDFW, CalFire, Caltrans	
BigR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
BigR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting that could impact steelhead. These agencies should use existing regulations or other mechanisms to minimize water use during the summer months.	2	20	CDFW, CDFW Law Enforcement, Mendocino County, NMFS OLE, NOAA RC, Private Landowners, SWRCB	
BigR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Develop critical flow values to be considered as the basis for minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months. Focus stream gaging efforts on the South Fork Big River.	2	5	CDFW, NMFS, SWRCB	Initial efforts should be focused in upper South Fork Big River where numerous small landowners are believed to divert from Big River for domestic purposes.
BigR-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for steelhead, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	2	60	CDFW, NMFS, Private Landowners, SWRCB	Stream flow modeling will determine critical low flow levels (above action step). Conservation programs are contingent upon water users participation and feasibility of water conservation practices.
BigR-NCSW-24.1.1.4	Action Step	Severe Weather Patterns	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., frequent flooding, extreme low flow conditions (drought), sea level rise, etc.).	2	10	NMFS, County	
BigR-NCSW-24.2	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species' continued existence**				
BigR-NCSW-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-24.2.1.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	20	NMFS, CDFW, CalFire, County	
BigR-NCSW-25.1	**Objective**	**Water Diversion/ Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
BigR-NCSW-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-25.1.1.1	Action Step	Water Diversion/ Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFW, CDFW Law Enforcement, NMFS OLE, Private Landowners, SWRCB	
BigR-NCSW-25.1.1.2	Action Step	Water Diversion/ Impoundment	Improve coordination between agencies and others to address the season of water diversions, off-stream reservoirs, and bypass flows to better protect steelhead and their habitats (CDFG 2004).	2	10	CDFW, NMFS, Private Landowners, SWRCB, USFWS	
BigR-NCSW-25.1.1.3	Action Step	Water Diversion/ Impoundment	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	60	NMFS, NMFS OLE, Private Landowners, SWRCB	
BigR-NCSW-25.1.1.4	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	2	2	CDFW, NMFS, SWRCB	

Big River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
BigR-NCSW-25.1.1.5	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of steelhead and authorized diverters (CDFG 2004).	2	10	SWRCB	
BigR-NCSW-25.1.1.6	Action Step	Water Diversion/ Impoundment	Install streamflow gauging devices to determine the current streamflow condition.	2	10	NMFS, SWRCB, USGS	This information could provide baseline information that would be useful in evaluating changes to baseflow over time.
BigR-NCSW-25.1.1.7	Action Step	Water Diversion/ Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	5	CDFW, NMFS, SWRCB, NOAA RC	
BigR-NCSW-25.1.1.8	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, NMFS, SWRCB, NOAA RC	
BigR-NCSW-25.1.1.9	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	5	CDFW, NMFS, SWRCB, NOAA RC	
BigR-NCSW-25.2	**Objective**	**Water Diversion/ Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
BigR-NCSW-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
BigR-NCSW-25.2.1.1	Action Step	Water Diversion/ Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	1	10	NOAA RC, Private Landowners, RCD, SWRCB	Focus on Landowners in the South Fork Big River subbasin.
BigR-NCSW-25.2.1.2	Action Step	Water Diversion/ Impoundment	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential salmonid streams (CDFG 2004).	2	5	CDFW, NMFS, SWRCB,	

Caspar Creek Population

NC Steelhead Winter-Run

- Role within DPS: Dependent Population
- Diversity Stratum: North Central Coastal
- Spawner Abundance Target: 500 adults
- Current Intrinsic Potential: 12.9 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the SONCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The first known estimate of steelhead abundance in Caspar Creek occurred in 1957 (CDFG 1957) when CDFW staff observed 15-20 juvenile (ranging in size from 1.3 inches to 5 inches) in large pools. The ratio of steelhead to coho salmon was 60-70 percent steelhead to 30-40 percent coho salmon. In the 1960-61 season, Kabel and German (1967 as cited in Gallagher and Wright 2008) counted coho salmon and steelhead entering Caspar Creek at a mill pond fish ladder (located near the mouth of Caspar Creek and which was removed in summer 1961). Although not clearly stated in the Kabel and German (1967 as cited in Gallagher and Wright 2008) report; assuming all fish were counted at this ladder, there were a total of 92 adult steelhead in Caspar Creek in 1960-61. The next estimates consisted of juvenile density by CDFG (1965) staff who documented a density of approximately 20 juvenile steelhead per one hundred feet. Density estimates using seines indicated approximately 2/3rds of the salmonids were coho salmon and 1/3 were steelhead (CDFG 1965).

Burns (1972) evaluated impacts of logging and road building on juvenile salmonid abundance in four northern California streams from 1966 through 1969, including Caspar Creek. Prior to logging and road building on South Fork Caspar Creek in June 1967, the estimated population of *O. mykiss* was 10,183 young-of-year and 673 one year or older fish. Following road building, the population had declined to 1,436 young-of-year and 106 one year or older fish (these declines are not unexpected as the population typically declines over summer due to competition for resources and predation). However, conditions in South Fork Caspar had deteriorated following pre-Forest Practice Rules logging and road construction, and in October 1968 the number of one-year plus fish had declined to 51 fish and increased to 141 in October of 1969.

The Salmon Trollers Marketing Association (STMA) (Maahs 1997) and CDFW estimated adult coho salmon abundance in Caspar Creek in the late 1980s through the 1990s (Maahs 1997). In their abundance surveys, the presence of adult steelhead were also recorded but are considered observational only and not an accurate population estimate due to the sampling methods used by the STMA. Between the winters of 1989/1990 and 1996/1997 combined totals of peak live counts/carcasses ranged from two adult steelhead in 1991/1992 to a high of 13 in 1990/1991. Maahs (1997) noted NC steelhead were less likely to be observed in Caspar Creek due to the short length of the creek, which would allow adults to more quickly enter the watershed, spawn, and return to the ocean than other streams included in their study which suggests the population may have been larger than observed.

In 2004/2005, CDFW initiated sampling in the Caspar Creek watershed, according to criteria in an action plan for monitoring California's coastal salmonid populations (Boydstun and McDonald 2005). Under this monitoring scheme, Caspar Creek and two other local streams serve as life cycle monitoring streams to calibrate regional sampling consisting of extensive spawning surveys to estimate escapement. The sampling is based on redd counts selected under a random stratified survey of ten percent of available habitat each year. In streams that serve as the life cycle stations, abundance of adults and smolts is estimated and a complete census of redd density is conducted (Gallagher and Wright 2009). The 2008/2009 basin-wide estimate of spawning abundance was estimated at seven adults (Gallagher and Wright 2009) and the estimate of average redd abundance was less than 2.5 per kilometer. Estimates of smolt abundance for 2007/2008 was 2,045, and for 2008/2009 estimated abundance was 1,885.

History of Land Use

Caspar Creek drains approximately eight square miles of the California Coast Range in western Mendocino County, entering the Pacific Ocean near the town of Caspar. The first European settlement in the area occurred before the 1860s. In 1860 the Caspar Lumber Company was formed, and logging began in the watershed with a sawmill built at the mouth of Caspar Creek. Clearcut logging was used and logs were dragged down to the watercourses. Three log crib dams were constructed to provide additional discharge for river log drives down to the sawmill, and it is estimated that two log drives per winter took place in each of the North and South Fork drainages. By the late 1890s the entire watershed had been harvested and timber management did not begin again until the early 1960s (primarily excerpted from Ziemer 1998).

Jackson Demonstration State Forest was formed in 1947, when the State of California bought the Caspar Lumber Company which included the majority of the Caspar Creek watershed. In 1962, the Caspar Creek Watershed Study was initiated to obtain more information on the effects of

logging and road construction on sedimentation and aquatic habitat. The study is a cooperative effort between CalFire and the Pacific Southwest Reach Station Redwood Sciences Laboratory. The study has been conducted in two phases. The South Fork phase was designed as a traditional paired-watershed study and involved monitoring the impacts of road construction and selection harvesting by tractor on streamflow, suspended sediment, and bedload. The North Fork phase was started in the early 1980s and harvest units were logged using primarily skyline cable yarding techniques. Road and landing construction and tractor logging were limited to ridgetop and upper slope locations during the North Fork phase.

Current Resources and Land Management

The primary resource and land management practices continue to be timber harvest. Most of the timber management is part of the Caspar Creek Watershed Study which includes ongoing research on the effects of timber harvest to various watershed processes, including flooding and stormflows, erosion and suspended sediment transport, water quality and nutrient cycling, aquatic organisms, and drainage processes. Within the last 12 years, only about two percent of the watershed has been under a timber harvest plan. Only about 10 percent of the watershed is in private ownership, with a small portion of the watershed consisting of rural residential homes (about 40 housing units are present) that are primarily located on the ridge tops. The Caspar estuary is located at Caspar beach, which is visited by numerous swimmers and sunbathers.

Salmonid Viability and Watershed Conditions

The following habitat attributes are rated Poor through the CAP process: habitat complexity, sediment transport, hydrology, and water quality. Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the upper watershed.

Current Conditions

The following discussion focuses on those conditions that are rated Fair or Poor as a result of our CAP viability analysis. The Casper Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Sediment Transport: Road Density

Excessive rates of sediment transport in the Caspar watershed have compromised spawning and rearing habitat. Pool filling appears to be occurring from sediment transport from upslope sources. Sources that contributed to the altered sediment transport are most likely due to existing roads and associated maintenance.

Habitat Complexity: Large Wood and Shelter

According to Stillwater Sciences *et al.* (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. Therefore, LWD is an even more critical habitat element than in more northern streams to form pools or areas of refuge from high flows. Despite LWD ratings for Caspar being rated as Very Good, only 33 of the instream shelter values measured (five percent of the total IP) >80 and shelter values were rated as Poor in the CAP evaluation. This suggests instream shelter is compromised, possibly due to channel incision that may be a function of historical logging practices and historical log drives during the first logging entry. To improve shelter rating, LWD input should be evaluated in specific stream reaches where improvements are anticipated to result in benefits such as reaches with softer banks, and reaches where LWD is rated below Very Good. Focusing on actions to improve instream gravel retention would ultimately work to increase stream bed elevation and floodplain connectivity.

Other Current Conditions

Overall, the Caspar watershed is subject to fewer conditions than many other watersheds in the steelhead DPS due to a singular land use (timber harvest) and a lack of urban or rural residential impacts.

Threats

The following discussion focuses on those threats that are rated as High or Very High (see Caspar Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address threats rated as Low when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Caspar Creek CAP Results.

Disease Predation and Competition

Disease, predation and competition are rated as a High threat to smolts due to the low abundance of this lifestage in the watershed and their risk for predation. Reduced abundance may occur as a result of avian (*e.g.*, gulls and mergansers) and mammal predation (Spence *et al.* 1996). This threat is likely increased due to a lack of sufficient escape cover (undercut banks and entrenched stream reaches).

Logging and Wood Harvesting

Timber harvest remains a threat to steelhead habitat in the Caspar Creek, but at diminished levels compared to historical practices. For steelhead, timber harvest was listed as a threat to watershed

processes due primarily to road use, road location and density, and the resulting increases in sediment input. Nonetheless, the Caspar Creek watershed is unique in that it is a very well-studied watershed and timber harvest plans receive a high degree of scrutiny and oversight, which may ameliorate impacts compared to timber operations in other watersheds.

Roads and Railroads

Road densities are high throughout the watershed, estimated at 4.9 miles of road per square mile of watershed area and at 5.7 miles per square mile of riparian area. Roads parallel many of the waterways within Caspar Creek and impinge on channel migration. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook indicates all lifestages are impaired in the Caspar watershed with summer rearing being the most stressed. Water quantity is likely the most significant limiting habitat attribute and residential development and the associated impacts of development are the most significant threats into the future.

General Recovery Strategy

Habitat Complexity: Large Wood and Shelter and Sediment: Gravel Quality and Distribution of Spawning Gravels

Recovery actions should focus on retaining instream LWD to improve floodplain connectivity through placement of standard log/boulder habitat structures which can effectively increase holding and rearing habitat and retain instream gravels. Since virtually no infrastructure is present in downstream areas, properly sized trees could be felled into stream channels to create these structures. Retention of instream gravels could ultimately increase bed elevation and enhance stream channel interactions with floodplain areas.[1]

Winter habitat LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods. Summer habitat LWD projects should be implemented and designed to provide cover for improved shelter, and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions.

[1] Floodplains have incised and it is likely, based on this incision, that undercut banks and other cover/shelter analogs are significantly less functional than under historical conditions. Based on these criteria, high velocity refugia are considered marginal.

Investigate and Address Sediment Sources

Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall or flooding events.

Investigate and Address Impairment to Caspar Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Lost Coast Diversity Stratum. Restoration actions should address habitat availability and suitability. However, the current function of this small estuary for providing suitable juvenile rearing conditions is unknown. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the habitat potential of the estuary to provide necessary attributes for salmonid survival should occur.

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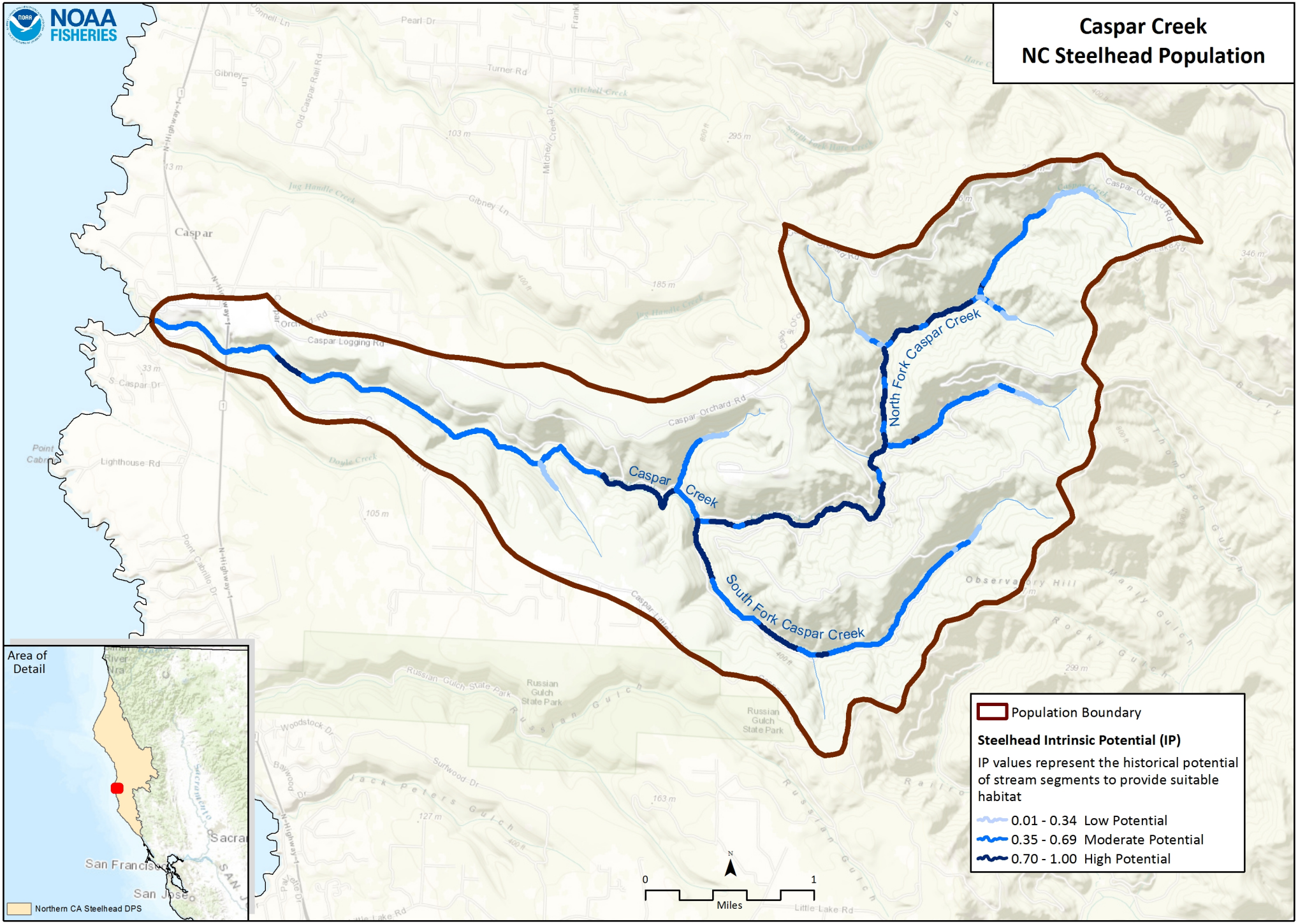
NOAA FISHERIES
Caspar Creek
NC Steelhead Population
North Fork Caspar Creek
Caspar Creek
South Fork Caspar Creek
Caspar
Caspar Orchard Rd
Caspar Logging Rd
Lighthouse Rd
Point Cabrillo Dr
Gibney Ln
Turner Rd
Pearl Dr
Mitchell Creek
Jug Handle Creek
Doyle Creek
Russian Gulch State Park
Jack Peters Gulch
Woodstock Dr
Surfwood Dr
Baywood Dr
Little Lake Rd
Observatory Hill
Area of Detail
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles
N

NC Steelhead Caspar Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Very Good
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	67% streams/ 95% IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	56% Class 5 & 6 across IP-km	Good
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good

3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Very Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	33% streams/ 24% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	67% streams/ 95% IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP km	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	50% to 74% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	75% to 90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	>90% of streams/ IP-Km (>70% average stream canopy; >85% where coho IP overlaps)	100% streams/ 100% IP-km (>70% average stream canopy; >85% where coho IP overlaps)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	56% Class 5 & 6 across IP-km	Good
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.7 - 1.5 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good

4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-km (>6 Key Pieces/100 meters)	Very Good
			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Good
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	67% streams/ 95% IP-km (>40% Pools; >20% Riffles)	Very Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	56% Class 5 & 6 across IP-km	Good
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% Response Reach Connectivity	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good

			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-Km maintains severity score of 3 or lower	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	33% streams/ 5% IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		2045 in 2009 = Smolt abundance which produces high risk spawner density per Spence (2008)	Poor

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.233% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	2% of Watershed in Timber Harvest	Very Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	7% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	4.9 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.7 Miles/Square Mile	Poor

NC Steelhead Caspar Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Medium	Low	Medium
2	Channel Modification	Low	Low	Medium	Low	Low	Medium	Medium
3	Disease, Predation and Competition	Medium	Low	Medium	Low	High	Low	Medium
4	Hatcheries and Aquaculture							
5	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Medium	Medium
6	Fishing and Collecting	Medium		Low		Medium		Medium
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Medium	High	Medium
9	Mining							
10	Recreational Areas and Activities	Low	Low	Medium	Medium	Low	Medium	Medium
11	Residential and Commercial Development	Low	Low	Medium	Medium	Low	Medium	Medium
12	Roads and Railroads	Medium	High	High	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Medium	Medium

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
CaC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate enhancement opportunities for the Caspar estuary.	3	5	California Coastal Conservancy, CDFW, County of Mendocino, Jackson Demonstration State Forest, NMFS, USFS	Evaluation should include analysis of the historical tidal prism vs the current prism of the estuary. Breaching, if it occurs, should also be evaluated and a series of recommendations (in necessary) should be proposed. Careful consideration should be given to preservation of historical foundations of the Caspar Saw Mill which is located in the estuary.
CaC-NCSW-1.1.1.2	Action Step	Estuary	Evaluate juvenile salmonid usage of the Caspar estuary during the summer and late fall period.	3	3	CDFW, Jackson Demonstration State Forest, NMFS, USFS	Steelhead utilization of the Caspar estuary during the summer/late fall is unknown. Lagoons are documented to be important rearing habitats for juvenile steelhead and it is possible the Caspar lagoon may serve a similar role as documented by researchers in other central California lagoons. If steelhead utilization is limited, measures to improve the overall productivity of this habitat feature should be evaluated and enhancement measures proposed.
CaC-NCSW-1.1.1.3	Action Step	Estuary	Evaluate water quality conditions in the estuary.	3	2	CDFW, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
CaC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	5	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	5	CalFire, California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, USFS	Floodplains have incised and it is likely, based on this incision, that undercut banks and other cover/shelter analogs are significantly less functional than under historical conditions. Based on these criteria high velocity refugia are considered marginal. Increased LWD frequencies may provide the winter habitat targeted by this action.
CaC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	2	10	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.	2	10	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-2.1.1.5	Action Step	Floodplain Connectivity	Existing areas with floodplains or off channel habitats should be protected from future urban development to the maximum extent practicable.	3	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, USFS	Avoiding development in existing or historical floodplains on Caspar may result in significant benefits to overwinter survival. No additional development, particularly roads, should occur here so as to avoid precluding future restoration actions.
CaC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				
CaC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	100	CalFire, CDFW, Jackson Demonstration State Forest, USFS	

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelters.	2	5	CalFire, CDFW, Jackson Demonstration State Forest, USFS	These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity and shelter values in potential rearing and migration reaches. Some large woody debris supplementation has already occurred in the watershed.
CaC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility.	2	10	CalFire, CDFW, Jackson Demonstration State Forest, USFS	
CaC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Work with Jackson Demonstration State Forest and USFS staff to implement projects that improve instream shelters.	2	20	CalFire, CDFW, Jackson Demonstration State Forest, USFS	
CaC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**				
CaC-NCSW-8.1.1	Recovery Action	Sediment	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CaC-NCSW-8.1.1.1	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS, Private Landowners, RPFs, RWQCB, USFS	
CaC-NCSW-8.1.1.2	Action Step	Sediment	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	2	100	CalFire, CDFW, Mendocino County, NMFS, RWQCB	
CaC-NCSW-8.1.1.3	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	20	CalFire, Jackson Demonstration State Forest, Lyme Timberland, RWQCB, USFS	
CaC-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream water quality conditions				
CaC-NCSW-10.1.1.1	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	50	CalFire, CDFW, NMFS, NOAA RC, RCD, County	
CaC-NCSW-10.1.1.2	Action Step	Water Quality	Identify and remediate sources of chronic and episodic sediment contribution to the Caspar Creek watershed.	3	100	CalFire, California Department of Mines and Geology, CalTrans, Jackson Demonstration State Forest, Lyme Timberland, USFS	Caspar Creek is heavily monitored through the USFS long term monitoring program. Sources of sediment from roads and landslides resulting from ongoing land management activities should be corrected as soon as feasible to improve over winter survival of juvenile salmonids. This is a broad recommendation and could include major actions such as road reconstruction, decommissioning and landslide stabilization. Conversely, relatively small actions may yield large benefits.
CaC-NCSW-10.1.1.3	Action Step	Water Quality	Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.	3	10	CalFire, Jackson Demonstration State Forest, USFS	Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall or flooding events.
CaC-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
CaC-NCSW-11.1.1.1	Action Step	Viability	Continue ongoing adult and smolt sampling efforts in the watershed. Establish consistent reporting methods to ensure DPS-wide consistency.	1	20	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners, USFS	
CaC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CaC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	25	NMFS, CDFW, CalFire	
CaC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts,USFS, and regulatory agencies with expertise in fisheries issues.	3	30	NMFS, CDFW, CalFire, USFS, County	
CaC-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Disseminate plan to all local fire fighting agencies.	2	3	CalFire, Lyme Timberland, USFS	
CaC-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing fire fighting assistance in the Caspar Creek watershed (and all other watersheds in the County).	2	100	CalFire, Jackson Demonstration State Forest	
CaC-NCSW-15.1.1.5	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by fire fighting actions.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, NMFS, USFS, USFWS	
CaC-NCSW-15.1.1.6	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while fire fighters and fire fighting equipment are on site.	2	100	CalFire, County of Mendocino, Lyme Timberland, USFS	Sediment control is a requirement for all post fire fighting actions. Immediately implementing these measures (when feasible) when equipment and crews are available will minimize mobilization costs and result in a long term cost savings.
CaC-NCSW-15.1.1.7	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	100	CalFire, County of Mendocino	Action is considered In-Kind
CaC-NCSW-15.1.1.8	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	Action is considered In-Kind
CaC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
CaC-NCSW-19.1.1.1	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Jackson Demonstration State Forest, Private Landowners, USFS	Cost based on treating 1 mile (assume 80 acres/mile in 15% High IP with a minimum of 1 mile) at a rate of $1,400/acre.
CaC-NCSW-19.1.1.2	Action Step	Logging	Encourage Jackson Demonstration State Forest and USFS to implement restoration projects as part of their ongoing practices in priority stream reaches and where LWD is found lacking.	2	30	CalFire, CDFW, Jackson Demonstration State Forest, USFS	Recovery actions should focus on retaining instream LWD to improve floodplain connectivity through placement of standard log/boulder habitat structures which can effectively increase holding and rearing habitat and retain instream gravels. Since virtually no infrastructure is present in downstream areas, properly sized trees could be felled into stream channels to create these structures. Retention of instream gravels could ultimately increase bed elevation and enhance stream channel interactions with floodplain areas.
CaC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-19.1.2.1	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	Jackson Demonstration State Forest, Lyme Timberland, Private Landowners, USFS	
CaC-NCSW-19.1.2.2	Action Step	Logging	Implement the Jackson Demonstration State Forest Road Management Plan.	3	100	CalFire, Jackson Demonstration State Forest, USFS	Implementation of the plan for all future harvest should reduce additional sediment input.
CaC-NCSW-19.1.2.3	Action Step	Logging	Establish equipment limitation zones on headwater streams and swales.	2	100	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners, RPFs, RWQCB	
CaC-NCSW-19.1.2.4	Action Step	Logging	Use aerial yarding systems rather than ground-based yarding methods.	2	100	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners	
CaC-NCSW-19.1.2.5	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	3	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, RWQCB, USFS	Timber management is the primary landuse in the watershed and this recommendation is a standard business practice. This recommendation is more likely to be implemented due to the research role that Caspar serves for the USFS and Calfire.
CaC-NCSW-19.1.2.6	Action Step	Logging	Protect headwater channels to minimize anthropogenic fine sediment sources.	2	25	CalFire, Jackson Demonstration State Forest, Lyme Timberland, RWQCB, USFS	
CaC-NCSW-19.1.2.7	Action Step	Logging	See Roads recommendations for additional actions to reduce sediment impacts.				
CaC-NCSW-19.1.2.8	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS, Private Landowners	
CaC-NCSW-19.1.2.9	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	20	CalFire, CDFW, Jackson Demonstration State Forest, NMFS, USFS	
CaC-NCSW-19.1.2.10	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Jackson Demonstration State Forest, USFS	Timber harvest remains a threat to salmonid habitat in the Caspar Creek, but at diminished levels compared to historical practices. For steelhead, timber harvest was listed as a threat to watershed processes due primarily to road use, road location and density, and the resulting increases in sediment input. Nonetheless, the Caspar Creek watershed is unique in that it is a very well-studied watershed and timber harvest plans receive a high degree of scrutiny and oversight, which may ameliorate impacts compared to timber operations in other watersheds.
CaC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
CaC-NCSW-19.1.3.1	Action Step	Logging	Manage timberlands to establish a diverse forest environment exhibiting properly functioning instream habitat, and implement restoration actions where degraded habitat is limiting salmonid production.	3	100	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-19.1.3.2	Action Step	Logging	Reduce the amount and rate of even aged management.	2	50	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners	Changing silviculture practices to uneven age management will likely reduce channel bank erosion and channel incision. Research has found a linkage between increased peak flows associated with clearcut harvesting in small headwater basins and increased sediment yields due to channel expansion.
CaC-NCSW-19.1.3.3	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-19.1.3.4	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-19.1.3.5	Action Step	Logging	Encourage Jackson Demonstration State Forest and USFS to implement restoration projects as part of their ongoing practices in priority stream reaches and where LWD is found lacking.	2	20	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS	We encourage JDSF to initiate an unanchored LWD recruitment program. Engineered structures may be determined to be necessary above the existing weirs used by the USFS for their long term monitoring project.
CaC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
CaC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
CaC-NCSW-19.2.1.1	Action Step	Logging	Reduce the amount and rate of even aged management.	2	100	CalFire, Jackson Demonstration State Forest, USFS	In 1962, the Caspar Creek Watershed Study was initiated to obtain more information on the effects of logging and road construction on sedimentation and aquatic habitat. The study is a cooperative effort between CalFire and the Pacific Southwest Reach Station Redwood Sciences Laboratory. The study has been conducted in two phases. The South Fork phase was designed as a traditional paired-watershed study and involved monitoring the impacts of road construction and selection harvesting by tractor on stream flow, suspended sediment, and bedload. The North Fork phase was started in the early 1980s and harvest units were logged using primarily skyline cable yarding techniques. Road and landing construction and tractor logging were limited to ridgetop and upper slope locations. Based on this study design, other areas in the watershed are likely targeted for even aged management.
CaC-NCSW-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	Jackson Demonstration State Forest, Lyme Timberland, Mendocino County	
CaC-NCSW-19.2.1.3	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	2	100	NMFS	
CaC-NCSW-19.2.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CaC-NCSW-19.2.2.1	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	30	CalFire, CDFW, Jackson Demonstration State Forest, Private Landowners, USFS	
CaC-NCSW-19.2.2.2	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, Jackson Demonstration State Forest, NMFS, Private Landowners	
CaC-NCSW-19.2.2.3	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	40	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CaC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	50	NMFS, CDFW, CalFire	

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from salmonid streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, Mendocino County Department of Public Works, Private Landowners, RWQCB	These areas are likely already established. Efforts should be made to coordinate storage with all landowners in the basin to minimize costs and impacts.
CaC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, California Department of Mines and Geology, County of Mendocino, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners, RWQCB	Not building problematic roads will likely result in a net cost savings. It is anticipated that little future road construction is planned for the Caspar watershed. Existing floodplains without roads should be avoided under all circumstances.
CaC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	5	CalFire, CDFW, Jackson Demonstration State Forest, NMFS	
CaC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Continue education of Jackson Demonstration State Forest staff and private logging contractors regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	30	CalFire, CDFW, Jackson Demonstration State Forest, NMFS	
CaC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Use best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	30	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	
CaC-NCSW-23.1.1.9	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	3	100	CalFire, s Jackson Demonstration State Forest, Private Landowners, RWQCB	Roads that are used for recreational purposes should be patrolled frequently during the winter period to ensure waterbars and other sediment control efforts remain functional throughout the winter period. Unsurfaced roads should also include roads that are lightly rocked and would allow pumping of fine sediment under normal use.
CaC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Reduce road densities by prioritizing high risk areas for decommissioning.	2	20	CalFire, CDFW, County of Mendocino, Jackson Demonstration State Forest, RWQCB, USFS	Priority areas should be those roads adjacent to fish bearing watercourses and smaller tributaries with high sediment delivery potential. The WLPZ road network in the South Fork Caspar should be considered a high priority area for decommissioning.
CaC-NCSW-23.1.1.11	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Coastal Conservancy, CalTrans, CDFW, Jackson Demonstration State Forest, Lyme Timberland, Mendocino County Department of Public Works, NOAA RC, Private Landowners, RCD	
CaC-NCSW-23.1.1.12	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, County of Mendocino, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners	It is assumed many culverts have been upgraded on the JDSF managed portion of the forest.
CaC-NCSW-23.1.1.13	Action Step	Roads/Railroads	Decommission high risk roads.	2	5	CalFire, Jackson Demonstration State Forest, Private Landowners	

Caspar Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CaC-NCSW-23.1.1.14	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	2	10	CalFire, Jackson Demonstration State Forest, Private Landowners	Road densities are high throughout the watershed, estimated at 4.9 miles of road per square mile of watershed area and at 5.7 miles per square mile of riparian area. Roads parallel many of the waterways within Caspar Creek and impinge on channel migration. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality. This is a feasible recommendation for the Caspar watershed due to the fact most of the watershed is in timber management and owned by only a few landowners.
CaC-NCSW-23.1.1.15	Action Step	Roads/Railroads	Implement the Jackson Demonstration State Forest Road Management Plan.	2	20	CalFire, Jackson Demonstration State Forest, Lyme Timberland	
CaC-NCSW-23.1.1.16	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	100	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timberland, NMFS, Private Landowners	
CaC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
CaC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate				
CaC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Jackson Demonstration State Forest, USFS	
CaC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	2	100	CalFire, Jackson Demonstration State Forest, Lyme Timberland, Private Landowners, Public, USFS	
CaC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, California Geological Survey, Jackson Demonstration State Forest, Private Landowners	
CaC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CaC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CaC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids during droughts.	2	100	CalFire, Jackson Demonstration State Forest, RWQCB, SWRCB, USFS	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
CaC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CaC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Work with stakeholders to ensure patterns of water runoff, including surface and subsurface drainage, match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalTrans, Jackson Demonstration State Forest, Lyme Timberland, Mendocino County, USFS, NMFS	
CaC-NCSW-24.1.2.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	20	CalFire, Jackson Demonstration State Forest, USFS	Sediment assessment should identify high-risk shallow-seeded landslide areas
CaC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (impaired instream temperature)				
CaC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Work with stakeholders to protect sources of cool water input from future diversions.	1	100	CalFire, CDFW, Jackson Demonstration State Forest, SWRCB, USFS	

Noyo River Population

NC Steelhead Winter-Run

- Role within DPS: Functionally Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 3,200 adults
- Current Intrinsic Potential: 152.8 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

A population abundance survey was conducted by CDFW (Gallagher 2000) in the Noyo River watershed, which estimated the number of adult steelhead in this basin at 361 fish. Additional surveys conducted by CDFW since 2000 report the abundance of adult steelhead spawning in the Noyo River ranging from 186 to 364 fish annually (Gallagher and Wright 2008). Spence *et al*. (2012) estimates that 3,200 total spawners are needed to meet the historical distribution and abundance for this population.

Steelhead trout are present in most tributaries across the Noyo River watershed (USEPA 1999). Private timber companies and resource agencies have documented juvenile distribution throughout the watershed using various survey methods since the 1980s. These surveys that include both electrofishing and snorkeling have shown that steelhead are well distributed across the basin. Surveys are conducted during the summer months when streamflow is low, and typically do not detect juvenile Chinook salmon presence since most fish migrate to the estuary during the late spring and early summer.

Steelhead smolt abundance for the Noyo River has been estimated using outmigration fyke traps operated by CDFW. Gallagher and Wright (2008) reported an estimated 24,484 smolts (>70mm) from the upper Noyo River watershed above Northspur, which represents production from about one half of the watershed area.

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, Pomo Indians likely utilized the fishery resources of the Noyo River. Native Americans also used fire in coastal areas to clear land for tribal activities. In 1853, timber harvest began in the Noyo River area with the first water-

powered mill in the lower Noyo River. Harvesting of old growth timber continued in the Noyo River watershed until the early part of the 20th century (USEPA 1999). In 1940, tractors were used throughout the basin to yard fallen timber, and roads, skid trails and log landings were constructed to ease transport of the logs to sawmills. By the 1960s, some harvesting of second growth timber had begun, with poor timber harvesting practices continuing into the 1980s, although the Forest Practice Act (1973) has progressively improved road and yarding systems.

Roads and railroads associated with timber harvesting have been in the watershed since the 1800s, and in the 1940s railroads were converted to truck roads. Railroad operations began in 1886 in the watershed, with railroad tracks operating east from Fort Bragg to the Little North Fork. Railway service was completed from Fort Bragg to Willits in 1911, including the construction of an extensive set of trestles that cross the Noyo River. Spur tracks were developed to increase logging opportunities in the North and South Fork Noyo subbasins and were later converted into truck roads (GMA 1999). This railroad line remains in use today as the Skunk Railroad, a popular tourist attraction in Mendocino County.

Current Resources and Land Management

Due to the remote location and large public ownership of the Noyo River watershed, a small number of programs and management plans guide land use activities within the basin. Private timber management companies are the largest landowners in the watershed, with Mendocino Redwood Company (MRC) owning the majority of the upper watershed, and Lyme Redwood Company owning much of the lower Noyo River along the mainstem. Jackson State Forest accounts for 19 percent of the watershed which is located in the South Fork subbasin.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, shelter rating, primary pools, pool/riffle ratio for juvenile rearing, smolts and adult lifestages of salmonids. Stream temperature was also rated as Poor for juvenile summer rearing. Indicators for watershed processes that were rated as Poor through the CAP process included watershed road densities, and riparian road densities. Viability for spawning steelhead adults and smolt abundance, and density of juveniles were all rated as Fair based on recent monitoring conducted by CDFW.

Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that rated as Fair through the CAP process, but are considered important within specific areas of the

watershed include gravel quality for eggs, baseflow conditions for summer rearing, estuary, and physical barriers.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Noyo River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

CDFW habitat typing surveys indicate that no streams within the Noyo River watershed currently meet target values for shelter. Past timber harvest activities and LWD removal programs in the 1970s through the early 1990s have reduced large woody debris loading across stream reaches in this watershed. Forest canopy has begun to recover, with most stream reaches in the watershed approaching or meeting target values; however, riparian trees that make up the riparian corridor are not of sufficient size and age to deliver woody debris that will provide shelter in the near future. Unsuitable habitat complexity and large woody debris volume are expected to limit salmonids during rearing and migration lifestages by reducing pool frequency and volume, cover habitat, and velocity refuge areas required during freshwater residency.

Water Quality: Temperature

Stream temperatures in the mainstem Noyo River are unsuitable for salmonid rearing. Albin (2006) reports suitable stream temperatures in the coastal area tributaries, yet most of the streams, including the mainstem and interior, do not maintain suitable water temperatures for rearing salmonids during the summer months. The South Fork Noyo River and its tributaries currently have suitable stream temperatures. Stream temperatures are reported to be less suitable for salmonids in the upper mainstem Noyo River, North Fork Noyo River, Hayworth Creek, North Fork Hayworth Creek, Olds Creek, Redwood Creek and Burbeck Creek, despite suitable canopy in these tributaries (Albin 2006).

Overall, stream temperature conditions for this population are rated as Poor due to high stream temperatures that occur across the middle and inland portion of the basin. Although canopy targets are being met in many of the stream reaches surveyed, stream temperature monitoring show that the level of regenerated riparian buffers is not yet adequate to fully protect stream temperatures from warmer conditions.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Sediment transport load from roads in the Noyo River watershed was identified as a stress to overall watershed processes. The USEPA TMDL and other studies (GMA 1999) have identified sediment delivery from roads as a limiting factor for salmonids. Although the egg lifestage was not rated as Poor for impaired gravel quality, many reaches of the watershed have poor spawning habitat and therefore the overall watershed was rated as Fair.

Other Current Conditions

The majority of streams sampled in the Noyo River watershed do not meet target conditions for percent of stream reach with pools and the ratio of pools to riffles. Stream reaches with greater than 40 percent pools and 20 percent riffles are considered suitable for salmonid rearing, migration and feeding. Many of the stream reaches, including the mainstem Noyo River, have a high percentage of flat water habitat types. Poor large woody debris loading across the basin affects pool frequency, and results in increased levels of flat water, or glide-type habitat. Current pool/riffle habitat conditions are expected to limit space for juvenile salmonids, and reduce the carrying capacity during the summer period.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Noyo River CAP results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Noyo River CAP results.

Population and Habitat Threats

Roads and Railroads

Road density throughout the Noyo River watershed was identified as the Highest rated threat. Although sediment quality is not rated as Poor in the basin currently, roads continue to be the largest source of anthropogenic sediment delivery in the basin (USEPA 1999). Road densities are high both across the basin and within riparian areas (7.0 miles per square mile, and 7.4 miles per square mile, respectively).

Graham Matthews & Associates (GMA 1999) found an increase over time in road construction, which has increased sediment yield from surface erosion. Of the 838 miles of roads in the basin, approximately 83 percent are seasonal dirt roads (GMA 1999). According to USEPA (1999), aggressive actions are required to reduce sediment delivery from roads to meet the TMDL

allocation for road related sediment. Estimated road-related sediment production for the Noyo River watershed is 183 tons/square mile/year, which is estimated to be an 8 fold increase over 1942 rates.

Logging and Wood Harvesting

Timber has been harvested in the watershed for over 150 years. Improved harvest methods and regulations have reduced the overall impact of this threat in recent decades. Although the rate of harvest in this basin has slowed in the last decade, this threat will continue to exist in the future. For all salmonid lifestages except adults, and overall watershed processes, the threat of timber harvesting activities is rated as a Medium threat. Improved logging methods, such as tree yarding that reduces ground disturbance and reduced harvesting within riparian zones, could keep this threat from returning as a large contributor to habitat stress in the future.

Limiting Stresses, Lifestages, and Habitats

Juvenile summer rearing habitat is impaired by low instream shelter in the form of LWD. The juvenile-rearing and winter-rearing lifestages are limited by the lack of channel complexity instream reaches throughout the basin. Poor channel complexity can alter pool/riffle ratios, reduce instream cover volume, and reduce velocity refuge for salmonids. In addition, the egg lifestage is moderately limited by elevated fine sediment that reduces egg survival to emergence in many spawning areas of the Noyo River and its tributaries. Stream water temperatures occurring in the interior areas of the basin are not suitable and are likely limiting growth and survival of steelhead.

General Recovery Strategy

Improve Habitat Complexity

Restoration actions should improve large woody debris (LWD) frequency across the Noyo River watershed. Riparian areas are in the process of recovery, with stands of smaller diameter conifers that currently buffer stream areas. Strategically adding LWD will provide much needed complexity to stream channels until riparian areas reach maturity, at which time they can begin to recruit LWD naturally to channels. Increasing LWD volumes will improve instream habitat attributes such as pool and riffle frequency and habitat complexity. Increasing the LWD frequency is also expected to improve sediment sorting thereby improving spawning habitat.

Improve Stream Temperatures

The approach to improving riparian conditions in the basin will need to focus on minimizing further riparian vegetation loss and on rehabilitating riparian areas that are currently in poor

condition. In addition, there may be opportunity to conduct riparian improvements on specific reaches that may be contributing to stream warming along interior stream reaches.

Improve Habitat and Substrate Quality

Reducing sediment delivery from roads and timber harvest is likely to improve a number of key habitat attributes for salmonids in the Noyo River. Road-related sediment delivery has increased in the recent past and must be reduced. Upgrading or decommissioning roads throughout the basin will lower erosion rates and improve sediment quality, which will in turn improve spawning and juvenile rearing conditions.

Investigate and Address Impairment to Noyo Estuary

Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Lost Coast Diversity Stratum. Restoration actions should address habitat availability and suitability. However, the current function of this small estuary for providing suitable juvenile rearing conditions is unknown. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the habitat potential of the Noyo River estuary is recommended.

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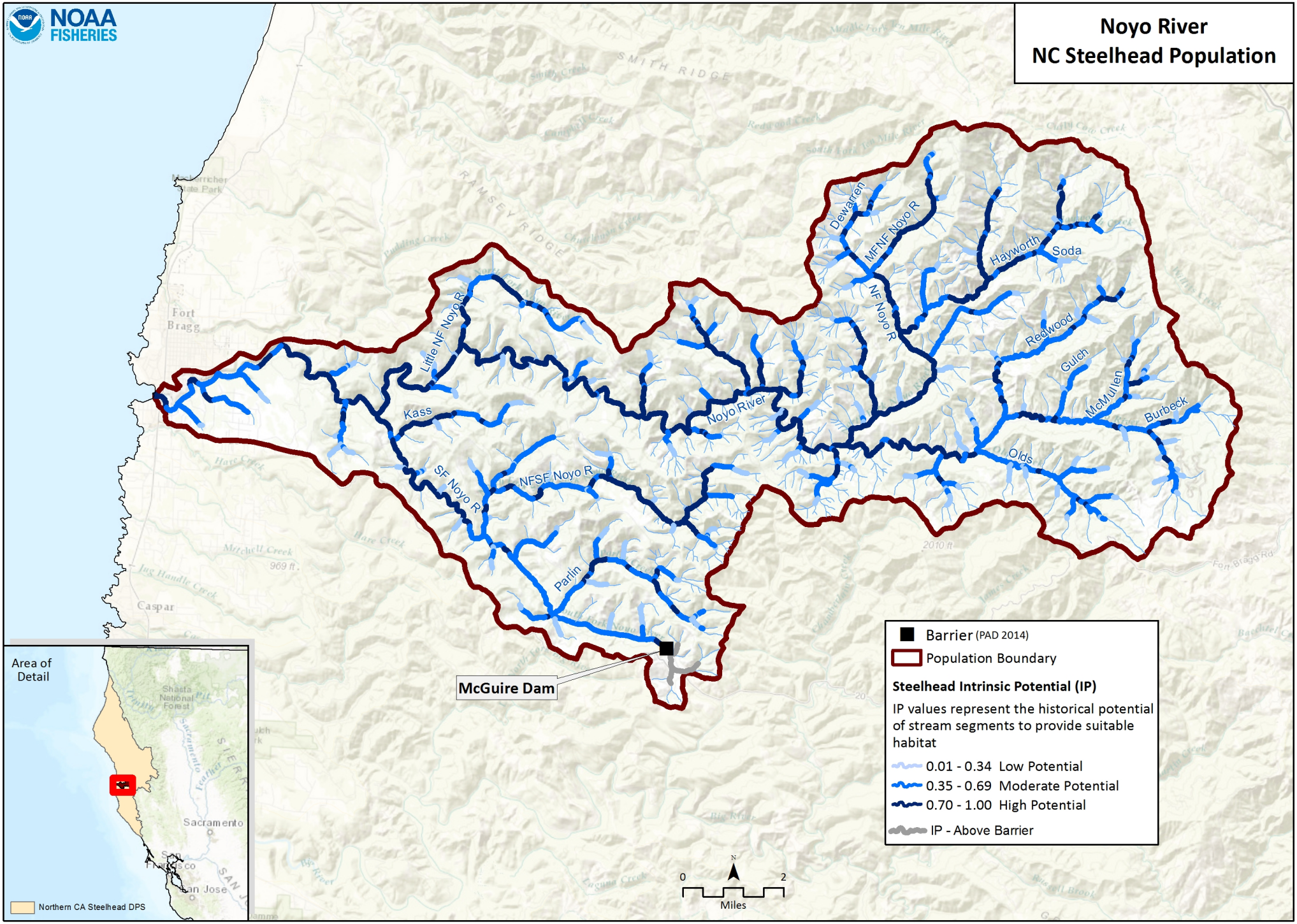
NOAA FISHERIES
Noyo River
NC Steelhead Population
Dewarren
MFNF Noyo R
Haywarth
Soda
NF Noyo R
Redwood
Gulch
McMullen
Burbeck
Olds
Little NF Noyo R
Kass
Noyo River
SF Noyo R
NFSF Noyo R
Parlin
McGuire Dam
Fort Bragg
Caspar
Area of Detail
Shasta National Forest
Sacramento
San Jose
Northern CA Steelhead DPS
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
IP - Above Barrier
N
0
2
Miles

NC Steelhead Noyo River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	0 Diversions/10 IP km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	48% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-km (>40% average primary pool frequency)	Fair
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP km	Very Good
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	48% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	<50% IP-km (<20 C MWMT)	Poor
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	48% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP km	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	75-90% IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	21% in 10yrs and 60% in 20 yrs of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	7.2 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	6.5 Miles/Square Mile	Poor

NC Steelhead Noyo River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture							
2	Channel Modification	Low	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition							
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching							
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Medium	Medium	Medium
9	Mining							
10	Recreational Areas and Activities				Low			Low
11	Residential and Commercial Development	Low			Low			Low
12	Roads and Railroads	Low	Medium	Medium	Medium	Low	High	Medium
13	Severe Weather Patterns	Low	Medium	Medium	Low	Low	Medium	Medium
14	Water Diversion and Impoundments			Medium			Low	Low

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
NoyoR-NCSW-1.1.1.1	Action Step	Estuary	Evaluate enhancement opportunities for Noyo River estuary.	3	5	California Coastal Conservancy, CDFW, County of Mendocino, NMFS	
NoyoR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
NoyoR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate unconfined reaches possessing or having potential for winter rearing habitat restoration.	2	3	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Focus off-channel restoration actions in the lower mainstem Noyo River and areas with high IP-km values (> 0.7).	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
NoyoR-NCSW-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.	2	60	CalFire, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-3.1.1.2	Action Step	Hydrology	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	1	60	CDFW, Jackson Demonstration State Forest, Lyme Timber, Private Landowners, SWRCB	Need to work with private and large industrial timberland owners to develop water storage for summer needs.
NoyoR-NCSW-3.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	20	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-3.1.1.4	Action Step	Hydrology	Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers. Work with the City of Fort Bragg and private landowners in the upper watershed to reduce diversion during the low flow summer period.	3	20	City of Fort Bragg, County of Mendocino, NMFS, SWRCB	
NoyoR-NCSW-3.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**				
NoyoR-NCSW-3.2.1	Recovery Action	Hydrology	Improve flow conditions				
NoyoR-NCSW-3.2.1.1	Action Step	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, NMFS, NMFS OLE, SWRCB	
NoyoR-NCSW-3.2.1.2	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	3	5	CDFW, NMFS, NMFS OLE, SWRCB	
NoyoR-NCSW-3.2.1.3	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of salmonids. Encourage SWRCB deny additional water diversions from the Noyo River watershed.	3	10	CDFW, NMFS, RWQCB, SWRCB	
NoyoR-NCSW-3.2.1.4	Action Step	Hydrology	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of salmonids and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	3	60	CDFW, Lyme Timber, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
NoyoR-NCSW-5.1.1.1	Action Step	Passage	Assess and restore passage at barriers associated with the California Western Railroad.	2	10	Cal Western Railroad, CDFW, Mendocino Redwood Company	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-5.1.1.3	Action Step	Passage	Restore passage in high priority areas of the Noyo River Watershed as identified in existing fish passage databases.	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters				
NoyoR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historic salmonid streams to maintain and enhance current stream complexity, pool frequency, and depth.	3	50		
NoyoR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	60	Cal Western Railroad, CalFire, California Coastal Conservancy, California Department of Mines and Geology, CDFW, City of Fort Bragg, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USACE	
NoyoR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information, where germane, from MRC Noyo Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFW stream habitat data to help determine reaches for LWD placement. South Fork Noyo, Little North Fork Noyo and Redwood Creek are priorities for restoration of LWD.	2	10	Cal Western Railroad, CalFire, California Coastal Conservancy, CDFW, City of Fort Bragg, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Pacific States Marine Fisheries Commission, Private Landowners, RWQCB, Trout Unlimited	Projects such as this are directly aimed at improving long-term survival for all freshwater lifestages of salmonids.
NoyoR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Work with the railroad (California Western Railroad) to stop removal of LWD from the Noyo River.	1	10	Cal Western Railroad, CDFW, NMFS, NOAA RC	
NoyoR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Develop and implement LWD projects in the Noyo River watershed using guidance from Albin (2006), Noyo River Watershed Enhancement Plan, or other credible watershed assessments.	2	10	CDFW, NMFS, NOAA RC	
NoyoR-NCSW-6.1.1.6	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	60	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**				
NoyoR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
NoyoR-NCSW-7.1.1.1	Action Step	Riparian	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	20	CDFW, NMFS, NOAA RC, Private Landowners	
NoyoR-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
NoyoR-NCSW-7.1.2.1	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	60	CalFire, California Coastal Conservancy, CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners	
NoyoR-NCSW-7.1.2.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian no harvest buffers.	2	60	CalFire, California Coastal Conservancy, CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners, Trout Unlimited	
NoyoR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings identified in the MRC Noyo River Watershed Analysis or the Jackson Demonstration State Forest Road Management Plan.	2	5	CalFire, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-8.1.1.2	Action Step	Sediment	NMFS and other landowners will work with RCD or NRCS to encourage sediment reduction assessments beginning with high priority subwatersheds.	2	10	CalFire, CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners, RCD	
NoyoR-NCSW-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CalFire, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-8.1.1.4	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	2	CalFire, CDFW, Mendocino County Department of Public Works, NMFS	
NoyoR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
NoyoR-NCSW-10.1.1.1	Action Step	Water Quality	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	20	CDFW, Hawthorne Timber Co., Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
NoyoR-NCSW-10.1.2	Recovery Action	Water Quality	Improve stream water quality conditions				
NoyoR-NCSW-10.1.2.1	Action Step	Water Quality	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	40	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners	
NoyoR-NCSW-10.1.2.2	Action Step	Water Quality	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.	3	30	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-10.1.2.3	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	20	CDFW, Lyme Timber, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners	
NoyoR-NCSW-10.1.2.4	Action Step	Water Quality	Work with landowners to purchase easements on water rights to encourage the maintenance of surface flows.	3	20	CDFW, Lyme Timber, Mendocino Redwood Company, NOAA RC, Private Landowners, SWRCB	
NoyoR-NCSW-10.1.2.5	Action Step	Water Quality	See hydrology, riparian, and temperature sections				
NoyoR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
NoyoR-NCSW-11.1.1.1	Action Step	Viability	Continue and improve upon monitoring activities to determine the population status of adult and smolt salmonids in the watershed and its tributaries.	3	20	CDFW, Lyme Timber, NMFS	
NoyoR-NCSW-11.1.1.2	Action Step	Viability	Continue funding the life cycle monitoring station	1	5	Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-11.1.1.3	Action Step	Viability	Continue juvenile monitoring efforts initiated by Burns (1972) and continued by Valentine and Jamison (CDF 1992) and Georgia-Pacific Corp. and Campbell Timberland Management (1994-1998) in Little North Fork Noyo River.	2	60	CDFW, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-11.1.1.4	Action Step	Viability	Identify if the population is at short-term or immediate risk of extinction.	2	5	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-11.1.1.5	Action Step	Viability	Identify how a conservation hatchery/supplementation/ augmentation program will complement the overall recovery effort.	2	10	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-11.1.1.6	Action Step	Viability	If determined necessary, identify an out-of-basin source population that could be used to start a population augmentation/supplementation/broodstock program.	2	20	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-19.1.1.1	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, and disconnected from the stream network as appropriate.	2	40	CDFW, Lyme Timber, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners	
NoyoR-NCSW-19.1.1.2	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission or upgrade them, and revegetate the area with appropriate native species.	2	10	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	
NoyoR-NCSW-19.1.1.3	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	Board of Forestry, CalFire, CDFW, Mendocino Redwood Company, NMFS	
NoyoR-NCSW-19.1.1.4	Action Step	Logging	Develop a California Forest Practice monitoring protocol to determine whether specific practices are effectively meeting intended objectives and are providing for the protection of salmonids.	3	20	CalFire, NMFS, CDFW, Jackson State Demonstration Forest	
NoyoR-NCSW-19.1.1.5	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	3	20	CDFW	
NoyoR-NCSW-19.1.1.6	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFW Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	3	5	CalFire, CDFW, Jackson Demonstration State Forest, Lyme Timber, Mendocino Redwood Company, NMFS	
NoyoR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
NoyoR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas within the Noyo River watershed.	2	60	CalFire, CDFW, Mendocino County, NMFS, RWQCB	
NoyoR-NCSW-19.2.1.2	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency of operations within salmonid areas.	2	40	Board of Forestry, CalFire, Mendocino Redwood Company, NMFS, Private Consultants	
NoyoR-NCSW-19.2.1.3	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	10	CalFire, Lyme Timber, NMFS, Private Consultants, Private Landowners	
NoyoR-NCSW-19.2.1.4	Action Step	Logging	Provide information to BOF regarding salmonid requirements and recommend upgrading relevant forest practices.	2	60	CalFire, Lyme Timber,Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-19.2.1.5	Action Step	Logging	Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through ESA Section 10(a)(1)(B).	3	5	NMFS	
NoyoR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
NoyoR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
NoyoR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	5	Lyme Timber, Mendocino Redwood Company, NMFS, Private Landowners, Trout Unlimited	
NoyoR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	20	CalTrans, Lyme Timber, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	20	CalFire, Lyme Timber, CDFW, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	10	Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-23.1.1.5	Action Step	Roads/Railroads	Encourage County of Mendocino to address and adequately maintain the Sherwood Ridge Road. Encourage County of Mendocino to completely close and monitor gates and barriers during the winter period.	2	10	Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.1.6	Action Step	Roads/Railroads	Design and implement a program of BMPs for road maintenance on private roads similar to the program for public roads (Sommarstrom et al., 2002).	2	20	Mendocino County Department of Public Works, NOAA RC, Private Landowners, NMFS	
NoyoR-NCSW-23.1.1.7	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in high priority areas should be considered an extremely high priority for funding (e.g., PCSRF).	2	10	CDFW, NMFS	
NoyoR-NCSW-23.1.1.8	Action Step	Roads/Railroads	Fully implement the Noyo River TMDL.	3	30	CDFW, Lyme Timber, Mendocino Redwood Company, Private Landowners, RWQCB	
NoyoR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	20	NMFS, CDFW	
NoyoR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Continue education of County road engineers, timber company, and railroad maintenance staff regarding watershed processes and the adverse effects of improper road/railroad construction and maintenance to salmonids and their habitats.	2	60	CalFire, Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.2.3	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	10	CalTrans, Lyme Timber, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
NoyoR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	5	CalFire, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.1.3.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	60	Cal Western Railroad, California Department of Mines and Geology, Lyme Timber, Mendocino Redwood Company, Private Landowners	
NoyoR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**				
NoyoR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
NoyoR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, CDFW, Lyme Timber, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners	
NoyoR-NCSW-23.2.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	60	Cal Western Railroad, CalFire, California Department of Mines and Geology, Lyme Timber, Mendocino Redwood Company, NRCS, Private Landowners, RWQCB	
NoyoR-NCSW-23.2.1.3	Action Step	Roads/Railroads	Ensure all existing and new road and railway crossings minimize potential sediment delivery to the stream environment and meet CDFW and NMFS standards for upstream and downstream passage of adult and juvenile salmonids.	2	20	Cal Western Railroad, CDFW, NMFS, NOAA RC	
NoyoR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
NoyoR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
NoyoR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Develop and implement a stream flow model to estimate critical flow levels for the mainstem Noyo River impacted by water diversions for the City of Fort Bragg.	3	10	CDFW, NMFS, Private Landowners, SWRCB	

Noyo River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
NoyoR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows during drought years.	3	10	City of Fort Bragg, Lyme Timber, Mendocino Redwood Company, Private Landowners	

Ten Mile River Population

NC Steelhead Winter-Run

- Role within DPS or ESU: Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 3,400 adults
- Current Intrinsic Potential: 171.1 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The first known estimate of steelhead abundance in the Ten Mile River Watershed was 9,000 spawning adults according to the California Fish and Wildlife Plan (CDFG 1965). In the Fish and Wildlife Plan, CDFW estimated that the Ten Mile River possessed an estimated 103 miles (165 km) of steelhead habitat. This estimate from 1965 is less than the TRT (Spence *et al*. 2008) estimate of 205 km (weighted) of habitat. The 1965 population estimate is believed to have not been based on an actual survey and should be viewed with caution. In the early 1960s, numerous stream surveys by CDFW documented the presence of juvenile steelhead throughout the three major subwatersheds (South Fork, North Fork, Clark Fork) and their tributaries. These stream surveys were generally focused on documenting major blockages to adult salmon and steelhead migration, and information on steelhead presence was generally included as supplemental information rather than quantitative estimates. Information from these surveys may have provided some basis for the 1965 estimate of spawner abundance.

Quantitative information on juvenile steelhead was first estimated by CDFW in 1983 at seven locations. Densities ranged from a high of 2.37 f/m² at Bear Haven Creek to a low of 0.20 f/m² at Bald Hill Creek (Harris, unpublished data, 2011). CDFW conducted another survey of juvenile density in 1991, at ten locations across the watershed. Densities ranged from a high of 0.80 f/m² on Little North Fork Ten Mile to a low of 0.17 f/m² on a mainstem location on North Fork Ten Mile (Harris, unpublished data 2011). In 1992, the Salmon Restoration Association (Maahs 1992) sampled ten locations in Ten Mile and found juvenile steelhead densities ranging between 0.13 f/m² and 0.80 f/m². In 1993, Georgia-Pacific Corp initiated an extensive juvenile monitoring program using fixed 30+ meter reference locations from 24 sample sites. All 24 sampling locations were sampled on a yearly basis between 1993 and 1999. The average of yearly juvenile density

in basin-wide estimates ranged from 0.35 f/m² in 1998 to 0.67 f/m² in 1994 (Ambrose and Hines 1998; Ambrose 2010). Over the seven year sampling duration, one site on the mainstem of South Fork Ten Mile above the Redwood Creek confluence consistently recorded the highest average density estimates, with a basin high of 2.32 f/m² in 1994 (Ambrose and Dreier 1994). Steelhead densities from this location were greater than 1.0 f/m² in five of the seven years sampled (Ambrose 2010).

The Salmon Trollers Marketing Association (Maahs 1996a; Maahs 1997a) estimated smolt abundance in South Fork Ten Mile near the Campbell Creek confluence in 1995, and at two additional locations in 1996, and 1997: Campbell Creek and Smith Creek. In 1995, steelhead smolt abundance in South Fork Ten Mile was estimated at 2,400. In 1996, steelhead smolt abundance was estimated at 2,379 (Campbell Creek), 3,954 (Smith Creek), and 10,500 (South Fork Ten Mile). In 1997 steelhead smolt abundance was estimated at 2,367 (Campbell Creek), 1,700 (Smith Creek), and 3,172 (South Fork Ten Mile).

Starting in the 1989, spawning surveys were sporadically conducted in the Ten Mile River (Salmon Trollers Marketing Association Inc. 1990; Maahs and Gilleard 1994; Maahs 1996b; Maahs 1997b). These surveys focused on documenting Chinook salmon and coho salmon presence and abundance, and were not focused at estimating steelhead abundance. In 2009/2010, Campbell Timberland Management and CDFW initiated sampling in the Ten Mile River watershed according to criteria in an action plan for monitoring California's coastal salmonid populations (Boydstun and McDonald 2005). This monitoring was the first effort at quantifying steelhead adult abundance in the watershed. Under this monitoring scheme, sampling consists of extensive regional spawning surveys to estimate escapement based on redd counts selected under a random stratified survey of ten percent of available habitat each year. The 2009/2010 basin-wide estimate of spawning abundance was estimated at 190 adults (95 percent CI: 59 to 321) (Wright, unpublished data, 2010).

History of Land Use

The history of the Ten Mile River watershed is largely defined by timber harvest, which began in the lower basin about 1870. The first railroad in the area was developed in the 1910s, connecting the South Fork Ten Mile with a sawmill in Fort Bragg. Railroads were extended into the Middle and North Forks by the early 1920s. Until about 1940, the South Fork Ten Mile provided the major log supply to the Union Lumber mill in Fort Bragg. In the 1930s, tractor yarding began to replace railroad yarding, and most of the railroad grades were converted to roads. Major portions of the watershed were harvested between the mid-1940s and the mid-1960s using tractor yarding, with its associated road, skid trails, log layouts, and landing construction. Relative to the 1940-

1960 period, harvest levels were apparently far lower between the late 1960s and the mid-1980s because the old growth forest was depleted and the forest was left to regenerate. Since the mid-1980s most of the watershed is managed using approximately a 60 year average rotation age (GMA 2000 - excerpted from USEPA 2000).

Current Resources and Land Management

The Ten Mile River watershed is entirely privately owned, with Hawthorne Timber Company, LLC (managed by Campbell Timberland Management, LLC), the successor to Georgia-Pacific West, owning about 85 percent of the watershed. Three small non-industrial timber owners and a handful of other residences also own land within the watershed. In general, the forests of the Ten Mile watershed are on their second rotation with a significant proportion of the second growth forests being harvested over the last 25 years.

Numerous restoration projects have occurred in the Ten Mile River, including barrier modifications (generally culvert upgrades), upslope sediment remediation, and instream habitat enhancement. Until recently, most restoration actions were focused on reducing sediment input from upslope roads associated with ongoing timber management. In the past few years, Campbell Timberland Management has conducted, with funding through FRGP, significant effort to improve instream habitat complexity for salmonids through the addition of large woody material. Initial efforts were focused on the South Fork Ten Mile, and today the majority of the South Fork mainstem has been enhanced with LWD. LWD recruitment efforts are now focused on the North Fork Ten Mile and Clark Fork Ten Mile. In 2010 and 2011, approximately 15 miles of mainstem North Fork were enhanced with LWD. Campbell Timberland has indicated that these efforts will continue into the near future (D. Wright, Campbell Timber, personal communication, 2010).

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, riparian vegetation, sediment transport, and rate of harvest. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Ten Mile River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Ten Mile River watershed are poor within all sampled reaches and this is a limiting factor for the summer rearing and smolt lifestages. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat according to shelter rating values. LWD was likely removed during past land management activities and well-intentioned but frequently over ambitious stream clearing practices. However, since these surveys were conducted, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the South Fork, Clark Fork and North Fork. To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future by Campbell Timberland Management (CTM) (D. Wright, Campbell Timber, personal communication, 2011). While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM) are not at the viability targets for these attributes.

Sediment Transport: Road Density

High levels of instream fine sediment and turbidity likely impair the egg, smolt, and winter rearing lifestages within many basins in the Ten Mile River Watershed. The Ten Mile River is considered impaired due to high instream sediment conditions (USEPA 2000). The source analysis in the Ten Mile TMDL included an assessment of sediment sources historically and/or presently impacting water quality. Several management-related factors have contributed to the elevated sediment delivery rates throughout the watershed, primarily the high rate of timber harvest and associated road building. While overall rates have declined in the 67-year study period from 1933-1999, USEPA (2000) determined that sediment generation from road surface erosion had increased. This is not surprising considering the high density of unsurfaced roads in the watershed. Current sediment delivery from all sources is estimated at 629 tons/mi^2/year, with about 50 percent of the total amount attributed to natural processes (*i.e.*, background) and the rest management-related (USEPA 2000).

Other Current Conditions

Altered riparian conditions are common throughout the Ten Mile River watershed, elevating summer water temperatures in some reaches and limiting LWD recruitment. Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for the Ten Mile watershed suggests that riparian stands are relatively well stocked, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (*e.g.*, old growth redwoods can persist instream for hundreds of years as LWD,

and due to their large size create significant habitat forming features). Recruitment of trees of sufficient size and length into the stream channel is likely at a slower rate than under historical conditions, due in part to the much younger age of the extant riparian stands. Conversion of the lower sections of the mainstem Ten Mile River from conifers to grassland for cattle grazing has likely lowered riparian function and diversity adjacent to some of better rearing areas in the lower watershed.

Overall, the Ten Mile watershed is subject to fewer stresses than many other watersheds in the NC Steelhead DPS due to a singular land use (timber harvest) and a lack of urban or rural residential impacts.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Ten Mile River CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Ten Mile River CAP Results.

Roads and Railroads

Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in the Ten Mile watershed. Road densities are high throughout the watershed and are estimated at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. Many of these roads were poorly situated and constructed[1], improperly maintained, and many have been abandoned rather than properly decommissioned.

Fire, Fuel Management, and Fire Suppression

Some areas in the Ten Mile River watershed have High fire hazard rating according to CalFire data. A major fire, particularly if located in areas with High erosion hazard rating could result in major increases in fine sediment and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures would likely result.

Logging and Wood Harvesting

Timber harvest remains a threat to steelhead habitat in the Ten Mile River, but at diminished levels compared to historical practices. For steelhead, timber harvest was listed as a threat for watershed processes due in large part to the high rate of harvest in many of the planning

[1] The majority of these roads were constructed prior to the passing of the California Forest Practices Rules in 1973.

watersheds. Even with application of new California Forest Practice Rules this threat is anticipated to continue into the foreseeable future.

Severe Weather Patterns

Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting high risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat.

Other Threats

No fish hatcheries currently operate within the Ten Mile watershed. In the past the Salmonid Restoration Association operated a small hatchery near Vallejo Gulch. This operation was discontinued in approximately 2000 and the remaining infrastructure was removed about five years ago. The limited duration of hatchery operations and relatively small number of steelhead spawned and released suggest adverse hatchery-related effects were unlikely within the steelhead population. Similarly, invasive species are not known to be problematic within the basin. Illegal marijuana cultivation occurs in some areas, and has the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. General estuary conditions are unknown but should be investigated in the future due to the intact nature of the estuary and the importance of these habitats to provide superior rearing habitat for juvenile steelhead. NMFS is aware of unsubstantiated reports regarding unauthorized fishing in the estuary, which may impact rearing juveniles during the summer period.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Ten Mile watershed. Inadequate habitat complexity in many stream reaches reduces rearing habitat availability, resulting in a decrease in stream carrying capacity. Sediment input into Ten Mile River from upslope land disturbance (principally unsurfaced logging roads) continues to impact instream habitat conditions, likely resulting in pools becoming filled and food availability decreasing in riffle habitats. Restoration actions should continue current efforts at increasing instream habitat complexity to appropriate viability level targets and remediating upslope sources of sediment contribution.

General Recovery Strategy

Improve LWD Volume

Many reaches of the Ten Mile River watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. Fencing and planting in the floodplains could result in major improvement to the lower reaches of the South Fork and mainstem Ten Mile River. As stated above, Campbell Timberland Management has initiated a program of LWD supplementation to enhance habitat complexity. Continuation of this program will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones.

Address Upslope Sediment Sources

Active and abandoned logging roads and skid trails are located throughout the basin and likely contribute large volumes of sediment into the stream environment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Ongoing road work should include a component that closes and decommissions unnecessary and abandoned roads and skid trails to effectuate lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

Investigate and Address Current Estuary Conditions

The Ten Mile River estuary is one of the most intact estuaries within the range of steelhead, in that it has very little anthropogenic infrastructure or other ongoing impacts. However, the current function of the estuary for providing suitable juvenile rearing conditions is unknown. NMFS is not aware of any current or historical water quality sampling or systematic evaluation of physical habitat conditions for rearing. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate current conditions and determine if conditions could be improved.

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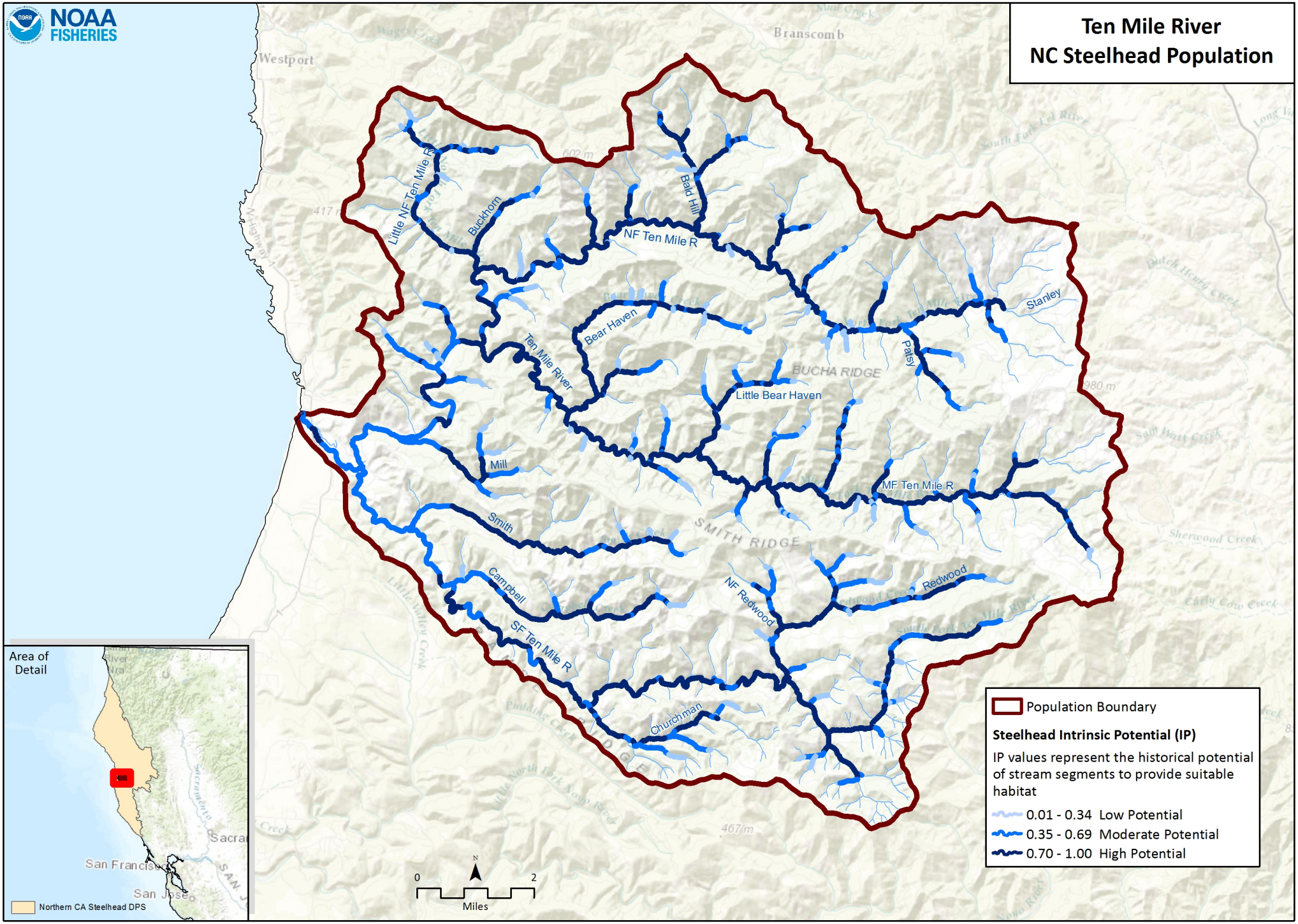
NOAA FISHERIES
Ten Mile River
NC Steelhead Population
Westport
Branscomb
Little NF Ten Mile R
Buckhorn
Bald Hill
NF Ten Mile R
Stanley
Patsy
Bear Haven
Ten Mile River
BUCHA RIDGE
Little Bear Haven
Mill
MF Ten Mile R
Smith
SMITH RIDGE
Campbell
NF Redwood
Redwood
SF Ten Mile R
Churchman
Area of Detail
San Francisco
San Jose
Northern CA Steelhead DPS
0
2
Miles
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential

NC Steelhead Ten Mile River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	87% of streams/ IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower.	Poor
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good

Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	0.40-0.49 LWD Jams over 138403m	Poor
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-Km (>40% average primary pool frequency)	Poor
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	87% of streams/ IP-km (>40% Pools; >20% Riffles)	Good
Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.1 - 5 Diversions/10 IP-km	Fair
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	67% of streams/ IP-km (>70% average stream canopy)	Fair
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.2 - 0.6 Fish/m^2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	87% of streams/ IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	35% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Properly Functioning Condition	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0.01 - 1 Diversions/10 IP-km	Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.16% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	5% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	42% of Watershed in Timber Harvest	Poor
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	51-74% Intact Historical Species Composition	Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	7.2 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	6.2 Miles/Square Mile	Poor

NC Steelhead Ten Mile River CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Low	Medium
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low
3	Disease, Predation and Competition	Low	Low	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	High	Medium	Medium	High
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Medium	High	High
9	Mining	Low	Low	Medium	Medium	Low	Low	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	Medium	High	Medium	High	High
13	Severe Weather Patterns	High	Medium	Medium	Medium	High	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Low	Low	Medium

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat				
TenMR-NCSW-1.1.1.1	Action Step	Estuary	Complete an estuary study to evaluate limiting factors in Ten Mile River estuary.	3	5	CDFW, RWQCB, The Nature Conservancy, Trout Unlimited	Development of a multi-disciplinary Technical Advisory Committee (TAC) to develop the scientific foundation for this study is recommended. The TAC should be familiar with other estuaries and estuary reaches within the Lost Coast Diversity Stratum as well as past and ongoing studies within the CCC DPS.
TenMR-NCSW-1.1.1.2	Action Step	Estuary	Develop Estuary Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.	2	5	CDFW, NMFS, NOAA RC, NOAA SWFSC	
TenMR-NCSW-1.1.1.3	Action Step	Estuary	Where feasible, remove structures and modify practices that degrade or reduce the historical estuarine extent or functions to benefit salmonids.	3	5	Private Landowners, The Nature Conservancy, Trout Unlimited	Ten Mile Estuary is relatively intact and likely has few structures that have significantly modified the historical tidal prism and feeding and transition habitat.
TenMR-NCSW-1.1.1.4	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CDFW, Private Landowners, The Nature Conservancy	Targeting likely limiting factors such as over wintering and smolt transition habitats should be a high priority.
TenMR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge				
TenMR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	5	CalFire, CDFW, Lyme Timberland Private Landowners	These actions should initially target habitat in high priority areas and the lower portions of the three mainstems (North Fork, Clark Fork, and South Fork).
TenMR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Existing beaver habitat should be protected, and issues related to flooding resolved without the removal of beaver habitat (e.g. flow reduction devices, etc.)	3	100	CalFire, CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve large wood frequency				
TenMR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	CDFW, Lyme Timberland, Private Landowners, The Nature Conservancy, Trout Unlimited	Data from CDFW habitat inventories indicate shelters throughout the Ten Mile River watershed are poor within all sampled reaches and this is a limiting factor for the summer rearing and smolt lifestages. LWD was likely removed during past land management activities and well intentioned stream clearing practices. However, since these surveys were completed in the mid-1990's, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the South Fork, Clark Fork and North Fork using the Accelerated Recruitment approach. To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future. While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM (now Lyme) are not at the viability targets for these attributes.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	3	50	CDFW, Lyme Timberland, Private Landowners, The Nature Conservancy, Trout Unlimited	
TenMR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	2	100	CalFire, Lyme Timberland, Private Landowners, RPFs	Promoting growth could include such actions as riparian permanent retention strategies of larger diameter trees and/or conifer release strategies, particularly in areas dominated by hardwoods that historically support conifers. Since the majority of land management practices in the Ten Mile is timber management, this recommendation should be incorporated into ongoing practices and little additional cost is anticipated for successful implementation. Particular attention should be directed at the lower mainstem reaches of Ten Mile which maintain high IP values but where riparian conifer stands are limited due to historical conversion from forest to grazing lands.
TenMR-NCSW-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	30	CalFire, Lyme Timberland Private Landowners, RPFs	
TenMR-NCSW-6.1.1.5	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	100	CalFire, CDFW, Lyme Timberland, Private Landowners, RCD, RWQCB	To implement this recommendation, additional streamlining of the THP process for LWD input by regulatory agencies is necessary. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. In Ten Mile stream reaches where there is little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Installing large woody material into a stream deficient in large wood should be considered a top restoration priority.
TenMR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelters				
TenMR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	Lyme Timberland, Private Landowners	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-6.1.2.2	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	5	CDFW, Lyme Timberland, Private Landowners, The Nature Conservancy	In addition to projects that increase large wood volumes in the three major subwatersheds and their tributaries attention should also be focused in the lower floodplain areas along the lower South Fork Ten Mile and areas below the Clark Fork/North Fork confluence. Projects designed to increase winter refuge habitat in these floodplain areas should be considered a high priority for salmonid habitat recovery. In the past few years, Campbell Timberland Management (now Lyme Timberland) has conducted significant effort to improve instream habitat complexity for salmonids through the addition of large woody material. Initial efforts were focused on the South Fork Ten Mile, and today the majority of the South Fork mainstem has been enhanced with LWD. LWD recruitment efforts are now focused on the North Fork Ten Mile and Clark Fork Ten Mile. In 2010 and 2011, approximately 15 miles of mainstem North Fork were enhanced with LWD. Campbell Timberland (now Lyme Timberland) has indicated that these efforts will continue into the near future.
TenMR-NCSW-6.1.2.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CalFire, CDFW, Private Landowners, RWQCB, USACE	
TenMR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
TenMR-NCSW-7.1.1.1	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other salmonid needs.	2	50	Lyme Timberland, Mendocino Land Trust, Private Landowners	
TenMR-NCSW-7.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	50	Lyme Timberland, Mendocino Land Trust, Private Landowners	
TenMR-NCSW-7.1.1.3	Action Step	Riparian	Place conservation easements on riparian areas.	2	50	Lyme Timberland, Mendocino Land Trust, Private Landowners	Conservations easement can provide an effective conservation strategy for salmonid conservation. Conservation easements facilitate the protection of watershed processes by focusing on areas of particular importance at a relatively reasonable cost (compared to fee title).
TenMR-NCSW-7.1.1.4	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	3	100	Lyme Timberland	This is a contentious issue on most managed forestlands.
TenMR-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
TenMR-NCSW-7.1.2.1	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, CDFW, Lyme Timberland, Private Landowners	Many of the areas historically used for agricultural purposes have been extensively cleared of all riparian vegetation. Targeting restoration in these areas may result in some lands no-longer being farmed for hay production, etc. Landowner outreach will likely be required in these areas.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-7.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Lyme Timberland, Private Landowners	Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for Ten Mile watershed suggests that riparian stands are relatively well stock, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands.
TenMR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-8.1.1	Recovery Action	Sediment	Improve quantity and distribution of spawning gravels				
TenMR-NCSW-8.1.1.1	Action Step	Sediment	Fully implement Ten Mile River TMDL.	2	20	CalFire, Lyme Timberland, Private Landowners, RWQCB	High levels of instream fine sediment and turbidity likely impair the egg, smolt, and winter rearing lifestages within many basins in Ten Mile River Watershed (USEPA 2000). The source analysis in Ten Mile TMDL included an assessment of sediment sources historically and/or presently impacting water quality. Several management-related factors have contributed to the elevated sediment delivery rates throughout the watershed, primarily the high rate of timber harvest and associated road building. While overall rates have declined in the 67-year study period from 1933-1999, the USEPA (2000) determined that sediment generation from road surface erosion had increased. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for salmonid protection.
TenMR-NCSW-8.1.1.2	Action Step	Sediment	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey, Lyme Timberland, Private Landowners, RWQCB	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identifying areas for prioritization.
TenMR-NCSW-8.1.2	Recovery Action	Sediment	Improve instream gravel quality				
TenMR-NCSW-8.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Lyme Timberland, Private Landowners, RWQCB	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain or remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-8.1.2.2	Action Step	Sediment	Stabilize the Miller Pond dam in Little North Fork Ten Mile to prevent catastrophic failure and massive sediment input into critical downstream spawning and rearing areas.	1	5	CDFW, Private Landowners, RWQCB	Little North Fork Ten Mile is one of the most important streams in Ten Mile River watershed.
TenMR-NCSW-10.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions				
TenMR-NCSW-10.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient (i.e., lower reaches of North Fork and South Fork).	2	20	CalFire, Lyme Timberland, Private Landowners, RWQCB	Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Conversion of the lower sections of the mainstem Ten Mile River from conifers to grassland for cattle grazing and agriculture has likely lowered riparian function and diversity adjacent to some of better rearing areas in the lower watershed. Reestablishing a functional riparian forest in these areas (provided landowners are willing) will likely require extensive oversight (watering, cattle exclusion) until the trees become established. Altered riparian conditions are common throughout Ten Mile River watershed, elevating summer water temperatures in some reaches and limiting LWD recruitment.
TenMR-NCSW-10.1.2	Recovery Action	Water Quality	Reduce turbidity and suspended sediment				
TenMR-NCSW-10.1.2.1	Action Step	Water Quality	Work with stakeholders to develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	5	CalFire, Lyme Timberland, Private Landowners, RWQCB	
TenMR-NCSW-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity				
TenMR-NCSW-11.1.1.1	Action Step	Viability	Monitor population status.	1	25	Lyme Timberland, CDFW, Private Landowners	
TenMR-NCSW-11.1.1.2	Action Step	Viability	Perform standardized adult spawning (redd) surveys.	2	5	CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-11.1.1.3	Action Step	Viability	Initiate smolt outmigration study.	3	3	CDFW, Lyme Timberland, NOAA SWFSC	
TenMR-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various salmonid life stages.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, Lyme Timberland, Private Landowners	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
TenMR-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations (e.g., picking up water from areas other than Ten Mile River lagoon). Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
TenMR-NCSW-15.1.2.2	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, USFS, and regulatory agencies with expertise in fisheries issues.	3	50	CalFire, Lyme Timberland, USFS	
TenMR-NCSW-15.1.2.3	Action Step	Fire/Fuel Management	Disseminate plan to all local fire fighting agencies.	2	3	CalFire, Lyme Timberland	
TenMR-NCSW-15.1.2.4	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing fire fighting assistance in the Ten Mile watershed (and all other watersheds in the County).	2	100	CalFire, Lyme Timberland	
TenMR-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TenMR-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire	Do not pull water from the lagoon during fire unless absolutely necessary.
TenMR-NCSW-15.1.4	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
TenMR-NCSW-15.1.4.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
TenMR-NCSW-15.1.4.2	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	100	CalFire, County of Mendocino	
TenMR-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**				
TenMR-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
TenMR-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	2	CalFire	
TenMR-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-19.1.1.1	Action Step	Logging	Work with stakeholders to maintain and expand California's working forestlands and forestlands held by the State, and minimize future conversion of forestlands to agriculture or other land uses.	3	50	CalFire, Lyme Timberland, Private Landowners, County	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-19.1.1.2	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to off-channel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Lyme Timberland, Private Landowners	Timber harvest remains a threat to salmonid habitat in Ten Mile River, but at diminished levels compared to historical practices. Timber harvest was listed as a threat for watershed processes due in large part to the high rate of harvest in many of the planning watersheds. Even with application of new California Forest Practice Rules this threat is anticipated to continue.
TenMR-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TenMR-NCSW-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Lyme Timberland, Private Landowners	Road surface treatment options will vary widely on road use and geology.
TenMR-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				
TenMR-NCSW-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Lyme Timberland, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
TenMR-NCSW-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CalFire, Lyme Timberland CDFW, Private Landowners, RPFs	Conifer release should not be conducted in thermally impaired reaches unless there is significant oversight by a qualified biologist.
TenMR-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.4.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, Lyme Timberland, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
TenMR-NCSW-19.1.4.4	Action Step	Logging	Minimize timber harvest on unstable slopes adjacent to headwater streams in the North Fork Ten Mile.	2	30	CalFire, CDFW, RPFs, RWQCB	
TenMR-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
TenMR-NCSW-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.5.2	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, Lyme Timberland Private Landowners	
TenMR-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
TenMR-NCSW-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Lyme Timberland, Private Landowners	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-19.1.6.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Lyme Timberland, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
TenMR-NCSW-19.1.6.3	Action Step	Logging	Reduce the amount and rate of even aged management.	2	550	CalFire, CDFW, Lyme Timberland, Private Landowners	Changing silviculture practices to uneven age management will likely reduce channel bank erosion and channel incision. Research has found a linkage between increased peak flows associated with clearcut harvesting in small headwater basins and increased sediment yields due to channel expansion.
TenMR-NCSW-19.1.6.4	Action Step	Logging	Use aerial yarding systems rather than ground-based yarding methods.	2	100	CalFire, CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.7	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
TenMR-NCSW-19.1.7.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.1.7.2	Action Step	Logging	Minimize new road construction in riparian zones	2	100	CalFire, Lyme Timberland, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to headwater streams with high IP value habitat.
TenMR-NCSW-19.1.7.3	Action Step	Logging	Establish equipment limitation zones on headwater streams and swales.	2	100	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
TenMR-NCSW-19.1.7.4	Action Step	Logging	See Roads and Railroads for additional recommendations.				
TenMR-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
TenMR-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
TenMR-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-19.2.1.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of salmonids.	3	20	CalFire, Lyme Timberland, Private Landowners	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Other considerations could potentially cover timber harvest activities for multiple watersheds within Mendocino County. A multiple landowner HCP is preferable due to economy of scale and overall, similar land management actions across the watershed.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-19.2.1.3	Action Step	Logging	Assign NMFS staff to conduct THP reviews and provide protective recommendations to avoid take of listed salmonids by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	20	NMFS	The need for this action may change if the California Forest Practice Rules change to be more protective of salmonids or the state receives incidental take authorization through the HCP process.
TenMR-NCSW-19.2.1.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	CalFire, Lyme Timberland, Private Landowners	Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
TenMR-NCSW-19.2.1.5	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners	
TenMR-NCSW-19.2.1.6	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, Mendocino County, Private Landowners	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
TenMR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
TenMR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
TenMR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	5	CalFire, Lyme Timberland, Private Landowners	All new and replacement culverts should be sized to accommodate a 100 year flow event.
TenMR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, Lyme Timberland, Private Landowners	These will likely be replaced as part of future timber harvest plans in Ten Mile watershed.
TenMR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	20		
TenMR-NCSW-23.1.1.4	Action Step	Roads/Railroads	Continue education of County road engineers and maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.	3	10	CalFire, Lyme Timberland, Mendocino County Department of Public Works, Mendocino County RCD, Private Landowners, RWQCB	There are few County roads in the watershed but those that occur should be carefully evaluated.
TenMR-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	30	CalFire, Lyme Timberland, Private Landowners	Legacy roads from past logging activity continue to impact Ten Mile watershed. Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in Ten Mile watershed. Road densities are high throughout the watershed and are estimated at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. Many of these roads were poorly situated and constructed, improperly maintained, and many have been abandoned and not properly decommissioned.
TenMR-NCSW-23.1.2.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Lyme Timberland, Private Landowners	Many roads in the watershed have inside ditches.

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	CalFire, Lyme Timberland, Private Landowners	Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input.
TenMR-NCSW-23.1.2.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Lyme Timberland, Private Landowners	Sediment traps will require a significant maintenance commitment. Conduct inventory of culverts needing sediment traps.
TenMR-NCSW-23.1.2.5	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Lyme Timberland, Private Landowners	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct inventory of culverts needing energy dissipaters.
TenMR-NCSW-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	2	5	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.1.2.7	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	CalFire, Lyme Timberland, Private Landowners	Many logging roads have been upgraded to modern standards, but a lot of work remains before this sediment source is thoroughly minimized. An effective road program should include a component that closes and remediates unnecessary roads and skid trails in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed. The potential for sediment (both through chronic input and large episodic events) is likely to continue. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules.
TenMR-NCSW-23.1.2.8	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, Lyme Timberland, Private Landowners, Trout Unlimited	Focus initial efforts (and/or continue ongoing efforts) in Little North Fork Ten Mile, Bear Haven (CDFG 2004), Mill, Campbell, and Smith Creeks. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. TU has partnered with CTM and Pacific Watershed Associates to upgrade 3.4 miles of inner gorge roads in Little North Fork which should be considered a major priority considering the importance of the salmonid populations in the Little North Fork.
TenMR-NCSW-23.1.2.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	100	CalFire, Lyme Timberland, Private Landowners, RWQCB	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-23.1.2.10	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	2	20	CalFire, California Department of Mines and Geology, Lyme Timberland, Mendocino County Department of Public Works, Private Landowners, RWQCB	This recommendation is likely very feasible within the Ten Mile watershed because a large portion of the watershed in owned by one landowner.
TenMR-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid and minimize impacts on unstable slopes, wetlands, floodplains and other areas of high habitat value.	2	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
TenMR-NCSW-23.1.4.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, Lyme Timberland, Private Landowners	Use NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
TenMR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
TenMR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Develop a road management plan to lower maintenance costs and reduce sediment entering streams.	2	10	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.2.1.2	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	2	10	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
TenMR-NCSW-23.2.2.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, Lyme Timberland, Private Landowners	This action is part of ongoing road maintenance and should be directed at the entire road network.
TenMR-NCSW-23.2.2.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Lyme Timberland, Private Landowners	Cost should be considered part of land owner road management plans.
TenMR-NCSW-23.2.2.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Lyme Timberland, Private Landowners	
TenMR-NCSW-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
TenMR-NCSW-23.2.3.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFW, NRCS, RWQCB, USACE	
TenMR-NCSW-23.2.3.2	Action Step	Roads/Railroads	Encourage CalFire to increase enforcement oversight of THP erosion control measures.	3	100	CalFire, CDFW, NMFS	
TenMR-NCSW-23.2.4	Recovery Action	Roads/Railroads	Increase density, abundance, spatial structure, and diversity				
TenMR-NCSW-23.2.4.1	Action Step	Roads/Railroads	Fully implement the Ten Mile River TMDL.	2	10	RWQCB, EPA	The Ten Mile River does not have time lines specified. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for salmonid protection.
TenMR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
TenMR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
TenMR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with salmonid recovery needs.	2	25	County, CalFire, CDFW, NMFS	

Ten Mile River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
TenMR-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration				
TenMR-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonids recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners, The Nature Conservancy, Trout Unlimited	The main benefit of this action is to improve flow conditions in the lower portion of the watershed where a few homes and limited agricultural use occurs.
TenMR-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
TenMR-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development to the greatest extent practicable.	2	100	CDFW, Lyme Timberland, Private Landowners	
TenMR-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, Lyme Timberland, Private Landowners, RWQCB, The Nature Conservancy	Little infrastructure exists on the floodplains aside from numerous roads. Creation and restoration of offchannel habitat features could be used as a demonstration project and reference point for future actions in regards to costs, feasibility, biological effectiveness, and appropriate construction techniques. Areas in the lower reaches of the Ten Mile River should be designed with consideration of providing high flow refugia.
TenMR-NCSW-24.1.4	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
TenMR-NCSW-24.1.4.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, RWQCB, State Parks	Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting high risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat. Assess extent of high-risk shallow-seeded landslide areas and develop rehabilitation plan.
TenMR-NCSW-24.1.5	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
TenMR-NCSW-24.1.5.1	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows.	3	100	CDFW, NMFS OLE, SWRCB	Some diversions are present in the lower portion of the watershed. All diversions should be closely evaluated during drought period to ensure minimal impact to rearing salmonids.
TenMR-NCSW-24.1.5.2	Action Step	Severe Weather Patterns	Work with stakeholders to implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	20	CDFW, NMFS, Private Landowners, SWRCB	
TenMR-NCSW-24.1.5.3	Action Step	Severe Weather Patterns	Develop critical flow values to be considered as the basis for minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	2	5	CDFW, NMFS, Private Landowners, SWRCB	
TenMR-NCSW-24.1.5.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for steelhead, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	3	100	CDFW, NMFS, Private Landowners, SWRCB	

Usal Creek Population

NC Steelhead Winter-Run

- Role within DPS or ESU: Potentially Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 1,100 adults
- Current Intrinsic Potential: 27.5 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

The earliest known quantitative information on steelhead in Usal Creek was obtained from a report on fish rescue efforts initiated by CDFW in 1940 (Brown *et al.* 1994). Fish rescue efforts in 1945 (Shapovalov 1949) were directed at saving juveniles in response to stream dewatering during the late-summer/early-fall low flow period. In 1945 a total of 25,821 juvenile steelhead and 61,133 juvenile coho salmon were rescued from mainstem Usal Creek and possibly the estuary (a maximum distance of only 1.7 miles). The first quantitative sampling effort on record was conducted by CDFW in 1983 and consisted of a 30-meter sampling reach in North Fork Usal Creek. Sampling was conducted for the purpose of assessing juvenile salmonid presence and abundance (Harris 2010). No juvenile coho salmon were detected and juvenile steelhead abundance was low with a density of only 0.39 fish per square meter (f/m^2). CDFW conducted a more comprehensive effort in 1987 and sampled numerous tributaries[1] and found steelhead presence throughout all sampled reaches[2] (Harris 2010) although they did not estimate density. From 1993 to 2000, Georgia-Pacific Corporation continued the juvenile sampling effort[3] at three index reaches[4] and recorded juvenile steelhead densities ranging from a low of 0.19 f/m^2 (North Fork Usal in 2000) to a high of 2.6 f/m^2 (North Fork Usal in 1994) (Ambrose 2010). In 2008, CDFW initiated a three-year pilot study to evaluate monitoring methods for California's Coastal Salmonid Monitoring Plan, which included Usal Creek in the study design. This CDFW pilot study used a far more robust sampling method than previous juvenile sampling efforts. The pilot study was directed at obtaining estimates of adult abundance using a statistically rigorous

[1] Sampled tributaries included reaches on North Fork Usal, South Fork Usal, Bear, Little Bear, and Julias creeks. Densities were not documented for the 1987 effort.

[2] No coho salmon were detected in 1987.

[3] Juvenile coho salmon were detected in South Fork Usal in 1993 and 1996 at very low densities.

[4] North Fork Usal, South Fork Usal, and Soldier creeks.

sampling design. Results from the 2008/2009 sampling year, based on a random sample of reaches, estimated only five steelhead (95 percent CI 1-12) adults spawned in the watershed (Gallagher and Wright 2009). Results from the 2009/2010 season, where six reaches were sampled, yielded an estimate of 31 (95 percent CI 11-51) spawning adults (D. Wright, Campbell Timber, personal communication, 2010).

Steelhead are likely distributed throughout all anadromous reaches of Usal Creek. On the North Fork a long cascade fall is present that precludes anadromous access to the majority of the upper North Fork watershed (D. Wright, Campbell Timber, personal communication, 2009). Areas of higher quality habitat exist in South Fork Usal and some of the tributaries where some higher quality instream habitat structure persists in discrete isolated patches.

History of Land Use

The predominant land use in the Usal Creek watershed is timber management, with a small recreation component with a State Parks campground located along the Usal Creek estuary. Timber management began in the Usal watershed in 1889, proceeding from the estuary up into the lower reaches of North Fork and South Fork Usal creeks. A sawmill and the town of Usal were located along the estuary, but were eventually abandoned by the early 1950s (Gertz 2005). The first phase of timber harvest ended in 1898, but later resumed in the late 1940s/early 1950s. The second wave of timber harvest is believed to be more destructive than the initial entry due to the advent of mechanized ground-based logging methods and increased road building. During the 1960s and 1970s, the old-growth redwood forests were completely removed, aside from a small number of isolated trees. Most timber was removed with ground-based yarding equipment that typically dragged logs down into riparian areas for staging on riparian landings. These logs were hauled out of the watershed over a large network of riparian roads. By the mid-1980s, with the removal of the old-growth forest, logging activities decreased down to the occasional timber harvest plan. In 1985 California State Parks established Sinkyone State Park at the former site of the Usal logging company and town site located adjacent to the Usal Estuary. Today the forest is in a period of recovery and the overstory has changed from a heavily dominated redwood overstory to a forest with young redwood and which now has a significant hardwood and Douglas-fir overstory component (R. Ballard, Campbell Timber, personal communication, 2009).

Current Resources and Land Management

The majority (98 percent) of the Usal watershed is privately owned, with Sinkyone State Park located in the lower portion of the watershed. Redwood Forest Foundation, Inc. (RFFI), a private nonprofit organization, is the major landowner in the watershed. RFFI purchased the Usal watershed from Hawthorne Timberland Management in 2007 and operates it as a multi-objective

community-based forest with the goal of ensuring a sustained timber yield while restoring non-timber attributes on the forest. Only two private residences are located in the watershed and these are situated far from any fish bearing streams. To date, relatively few instream restoration projects have occurred on the forest (J. Ambrose, NMFS, personal observation, 1989-1999, 2009). Most restoration has focused on reducing sediment input from upslope roads, although some instream wood placement occurred in the South Fork in the early 1990s and a conifer release pilot project was initiated in the lower floodplain reaches of the North and South Fork in the mid-1990s. Many of the sediment reduction restoration efforts have occurred as part of timber harvest plans conducted in the watershed over the last 20 years. Little management of aquatic habitat and species occurs within the basin, except for irregular field habitat surveys conducted by CDFW and RFFI personnel as part of CDFW's coast wide monitoring effort.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: shelter rating, LWD frequency, estuary/lagoon quality and extent, and streamside road density. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Usal Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Usal Creek watershed are Poor within all sampled reaches. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat. Large portions of this functional instream structure were likely removed due to past land management and well-intentioned stream clearing practices.

Estuary: Quality and Extent

Available information obtained from historical photographs does not provide a clear image of the estuary's historical size and extent. Inferences, based on removal of old growth conifers from the floodplain and current rates of sediment input from the upper watershed, suggest the estuary may have provided more suitable rearing habitat for salmonids than occur under current conditions. Due to the importance estuaries play in the survival of steelhead, further assessment of the potential to enhance and restore estuarine quality and extent should be conducted.

Other Current Conditions

The original forest of Usal Creek was almost completely removed. The removal occurred relatively recently compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to Usal Creek watercourses. The alteration of sediment transport will likely continue to affect multiple steelhead lifestages in the watershed. The December 2006, Soldier Creek landslide will likely continue to contribute sediment into the watershed, and the transport of this sediment into the ocean will likely take many years under current conditions.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Usal Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Usal Creek CAP Results.

Roads and Railroad

Legacy roads from past logging and mining activity continue to impact the Usal watershed. Road densities are high throughout the watershed and are estimated at 3.5 miles of road per square mile overall and at 4.5 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed[5], not properly maintained, and many have been abandoned.

Severe Weather Patterns

The Usal Creek watershed exhibits a Mediterranean-type climate, with an average rainfall between 45 and 75 inches that falls predominantly between the months of October and April. Although winter and spring seasons can be relatively wet (especially within higher elevations), the summer and fall can be warm; however, the maritime influence results in many days of prolonged fog which moderates seasonal temperatures within the lower basin. Severe weather patterns, coupled with the existing road network, may exacerbate and accelerate future sediment delivery and land sliding.

Other Threats

No fish hatcheries operate within the Usal watershed, so hatchery-related effects are unlikely within the steelhead population. Similarly, invasive species are not known to be problematic

[5] The majority of these roads were constructed prior to the passing of the California Forest Practice Rules in 1973.

within the basin. Illegal marijuana cultivation is likely to occur in some of the drainages and has the potential to severely degrade juvenile rearing conditions by diverting water from streams and introducing toxic quantities of fertilizers and pesticides.

Fire, Fuel Management and Fire Suppression

Past logging resulted in a conversion of the conifer-dominated overstory to an overstory dominated by hardwoods in many areas. The combination of younger conifer and hardwoods likely leaves portions of the Usal Creek watershed more vulnerable to wildfire than under historical conditions. The remote location of the watershed may increase its vulnerability to large fire events due to potential delays in quickly responding to wildfire in Usal Creek.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Usal Creek watershed. Inadequate habitat complexity reduces rearing habitat availability, resulting in a decrease instream carrying capacity. Sediment input from upslope sources (*e.g.*, logging roads) can fill pools and decrease food availability in riffle habitats. Poor estuarine rearing conditions likely compound stresses to the juvenile lifestage, removing a critical environment for steelhead rearing from the watershed. Restoration actions should target addressing these issues within high potential stream reaches.

General Recovery Strategy

Improve Riparian Canopy Composition and LWD Volume

Much of the Usal Creek watershed would benefit from improved riparian composition and structure, which would improve LWD recruitment and increase instream shelter for juvenile fish. General practices to improve riparian condition include initiating a program of conifer release to promote existing conifer growth, particularly in the lower portions of North and South Fork Usal and the Usal mainstem. The lower reaches have a heavy alder overstory component that slows the growth of understory conifers and ultimately impedes the rate of future conifer recruitment to the wetted channel (J. Ambrose, NMFS, personal observation, 2009). An immediate program of LWD supplementation to enhance habitat complexity will likely be necessary due to the long period of time it will likely take for LWD to naturally recruit from existing riparian zones.

Address Upslope Sediment Sources

Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but a lot of work remains before this significant sediment source is thoroughly

addressed. Of particular note, until recently the Usal County Road was poorly maintained by Mendocino County and contributed significant volumes of sediment into the North Fork. To the maximum extent practicable, problem roads and active erosion sites, such as the campground near Hotel Gulch on State Parks Property (see photo below), should be prioritized and addressed as part of a comprehensive sediment reduction plan for the entire Usal basin. The program should include a component that closes and remediates unnecessary roads and skid trails and moves campsites away from watercourses (see Figure 1) in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans is a top mitigation priority.

Picture 1: Campsite and roadway - upslope sediment sources within the Usal Creek watershed.

Improve Passage Conditions for Juvenile and Smolt Lifestages

Mainstem Usal Creek is highly aggraded and likely precludes juvenile movement out of the estuary into the upper tributaries in the fall. During drought conditions, smolt outmigration into the ocean is likely blocked due to dewatering in the late spring. Installing instream structures to more efficiently route sediment out of Usal, and therefore reduce the duration and extent of dewatering, should be examined.

Investigate and Address Current Estuary Conditions

The historical potential of the Usal Estuary is unknown; however, it is believed by many to be highly compromised due to aggradation from past land-management practices in the upper portion of the watershed. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the intrinsic potential of the estuary, within constraints of the existing geological context of the basin, to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved.

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NOAA FISHERIES
Usal Creek
NC Steelhead Population
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Waterfall Gulch
Chimney Rock
Bear
Little Bear
Usal Creek
Soldier
Hotel Gulch
Julias
South Fork Usal
Shady Dell
Sinkyone Wilderness State Park
Anderson Gulch
Dark Gulch
Area of Detail
Northern CA Steelhead DPS
0
1
Miles

NC Steelhead Usal Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 25	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	Fair
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 25%	Very Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17% (0.85mm) and >30% (6.4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	57.4% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor

Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	35.7% of streams/ IP-km (>40% average primary pool frequency)	Poor
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 41.6	Good
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 41.6	Good
Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% accessible	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	91.9% across IP-km (>70% average stream canopy)	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	66% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	75 to 89% IP-km (<20 C MWMT)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.85 Fish/m^2	Good
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	>90% of Historical Range	Very Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	of streams/ IP-km (>40% average primary pool frequency)	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	57.4% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	47.1% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 25	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	<50% of IP-km or <16 IP-km accessible*	Poor
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Evidence of Toxins or Contaminants	Very Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces moderate risk spawner density per Spence (2008)	Fair

6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.117% of Watershed in Impervious Surfaces	Very Good
			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	18% of Watershed in Timber Harvest	Good
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	0% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	>75% Intact Historical Species Composition	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	>3.5 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	4.3 Miles/Square Mile	Poor

NC Steelhead Usal Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture							
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low
3	Disease, Predation and Competition	Low				Low		Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Low		Low		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching							
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development		Low	Low	Low	Low	Low	Low
12	Roads and Railroads	Low	Low	High	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	High	Medium	High
14	Water Diversion and Impoundments	Low	Low	Medium		Low	Low	Low

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat				
UC-NCSW-1.1.1.1	Action Step	Estuary	Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.	2	10	CDFW, State Parks	Efforts should be directed at facilitating channel scour as well as providing summer refugia for rearing juvenile salmonids in the estuary and the lower mainstem. Available information obtained from historical photographs does not provide a clear image of the estuary's historical size and extent. Inferences, based on removal of old growth conifers from the floodplain and current rates of sediment input from the upper watershed, suggest historically the estuary may have provided more suitable rearing habitat for salmonids than under current conditions. Due to the importance estuaries play in the survival of salmonids, further assessment of the potential to enhance and restore estuarine quality and extent should be conducted. An immediate program of LWD supplementation to enhance habitat complexity will likely be necessary due to the long period of time it will likely take for LWD to naturally recruit from existing riparian zones.
UC-NCSW-1.1.1.2	Action Step	Estuary	Evaluate and implement as appropriate, sediment removal from Usal lower mainstem and estuary. Sediment could be used as a rock source of the numerous unpaved roads in the watershed as well as for the Usal County Road.	2	5	CA Coastal Commission, CDFW, Mendocino County Department of Public Works, RFFI, State Parks	The historical potential of Usal estuary is unknown; however, it is believed to be highly compromised due to aggradation from past land-management practices in the upper portion of the watershed. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Excess sediment could be used as a rock source for the numerous unpaved roads in the watershed and for Usal County Road. The rock would likely need to be crushed, once removed from the estuary in order to provide an adequate road base.
UC-NCSW-1.1.1.3	Action Step	Estuary	Enhance and restore estuary function by improving complex habitat features.	2	10	CA Coastal Commission, CDFW, Mendocino County, State Parks, NOAA RC	
UC-NCSW-1.1.1.4	Action Step	Estuary	Encourage State Parks to fund and implement restoration actions that benefit CCC coho and NC steelhead and other special status species in the lagoon. Requirements and goals will vary by species.	2	30	State Parks	Actions may include installing habitat forming features such as large wood to increase scour and provide refugia for down migrants.
UC-NCSW-1.1.2	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone				
UC-NCSW-1.1.2.1	Action Step	Estuary	Conduct conifer release by thinning hardwoods in lower reaches of South and North Fork Usal Creek. Conifers could serve as a source for future large woody debris recruitment into the estuary and aid in cooler water temperatures flowing into estuary.	2	5	RFFI	

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-1.1.2.2	Action Step	Estuary	Initiate riparian planting of conifers within the riparian zones that are currently dominated by hardwoods and floodplain areas that are absent of conifers.	2	5	CDFW, Lyme Timberland, State Parks	Initial efforts should focus on the alder dominated riparian areas along the mainstem and lower North and South Forks of Usal Creek. Historical photographs of the Usal floodplain indicate the presence of old growth conifers. Replanting the floodplain would likely facilitate LWD recruitment in the distant future.
UC-NCSW-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**				
UC-NCSW-1.2.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events				
UC-NCSW-1.2.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	10	State Parks	Additional educational signage along the estuary should be included with this recommendation. Signage should explain estuarine function and its benefits to endangered species and water quality of a properly functioning estuary.
UC-NCSW-1.2.1.2	Action Step	Estuary	Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to Usal lagoon.	3	10	CDFW Law Enforcement, NMFS OLE, State Parks	Unauthorized breeching reported during smolt season.
UC-NCSW-1.2.1.3	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.	3	100	State Parks	
UC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
UC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Create flood refuge habitat (e.g., create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats), and hydrologically connected floodplains with riparian forest.	1	10	CDFW, NOAA RC, RFFI, State Parks	Areas with perennial flow and high IP-km scores should be targeted first for this measure. Little infrastructure exists on the floodplain. Creation and restoration of off-channel habitat features could be used as a demonstration project and reference point for future actions in regards to costs, feasibility, biological effectiveness, and appropriate construction techniques. Areas in the lower reaches of Usal should be designed with consideration of providing high flow refugia.
UC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFW, RFFI, State Parks	Assessments have already been conducted but additional site specific field checks and mapping are likely needed.
UC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter baseflow and flood stage.	3	20	CDFW, NOAA RC, RFFI, State Parks	
UC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Replant floodplain with native overstory vegetation.	2	20	CDFW, RFFI, State Parks	
UC-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-5.1.1	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)				
UC-NCSW-5.1.1.1	Action Step	Passage	Evaluate smolt (and juvenile rearing) outmigration constraints, particularly during drought year low flow conditions, through the aggraded estuary, mainstem Usal, and lower reaches of N Fk. Usal.	2	10	RFFI, State Parks	Evaluation should consider flow conditions and impacts to smolt outmigration under extreme drought conditions through the month of June.
UC-NCSW-5.1.1.2	Action Step	Passage	Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season..	1	5	CDFW, NMFS, RFFI, State Parks	Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season.
UC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
UC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	10	CDFW, NMFS, RFFI, State Parks	
UC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Install Large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	5	CDFW, NMFS, RFFI, State Parks	Usal Creek has approx. 5 km of High IP habitat. Data from CDFW habitat inventories indicate shelters throughout the Usal Creek watershed are poor within all sampled reaches. Initial efforts should be directed at the lower reaches where significant aggradation limits summer rearing habitat. Unsecured LWD input is practical in Usal Creek because almost no downstream infrastructure is present other than the County bridge which is recommended in this plan for upgrades. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document.
UC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Mechanically recruit alder from floodplain surfaces into the stream channel.	2	5	, CDFW, RFFI, State Parks	Recruit alders at least 20 feet away from the stream banks to maintain bank integrity. Rather than felling trees by chainsaw, pull over with winches and place root balls in the channel. Recruit at a rate of one tree per channel width in the lower portions of North Fork and South Fork Usal and appropriate locations on the mainstem. This action should occur within the context of a larger overall large wood (conifer) enhancement effort throughout the watershed.
UC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Identify historical steelhead habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	15	CDFW, NMFS, RFFI, State Parks	Increasing channel confinement should be a priority in the lower portion of Usal Creek. A confined channel would more efficiently sort and process bed material and thus, facilitate development of resilient pool riffle structure.
UC-NCSW-6.1.1.5	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CDFW, NMFS, RFFI, State Parks	Little bank hardening is anticipated to be needed in Usal watershed.
UC-NCSW-6.1.1.6	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	CDFW, Private Landowners	This recommendation should be adopted as a reoccurring recommendation for all timber harvest plans.
UC-NCSW-6.1.1.7	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody material for all historical anadromous salmonid rearing habitats in Usal Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CDFW, NMFS, State Parks	Manipulation of Large Woody Material should not occur until evaluated by a hydrologist and/or qualified biologist familiar with Lost Coast streams.
UC-NCSW-6.1.1.8	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	3	100	CDFW, RFFI, RWQCB, State Parks	Significant oversight and evaluation should occur prior to removal of any large wood structure.
UC-NCSW-6.1.1.9	Action Step	Habitat Complexity	Conserve and manage forestlands for older forest stages.	3	25	CDFW, RFFI, RWQCB, State Parks	

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-6.1.1.10	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	100	RFFI, State Parks	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. The forest is in a period of recovery from past intensive harvest practices and the overstory has changed from a heavily dominated redwood overstory to a forest with young redwood and a significant hardwood and Douglas-fir overstory component. Conifer release will ultimately restore riparian processes by providing a source for future large wood recruitment into watercourses.
UC-NCSW-6.1.1.11	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	3	50	RFFI, State Parks	
UC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools				
UC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Excavate sediment and build up channel bars.	2	10	CDFW, RFFI, State Parks, USACE	Using an excavator/backhoe, remove sediment from incipient pools or adjacent to incipient bars, and place the sediment on incipient bars. Grade the placed sediment to contoured form and attach to banks, mimicking alternate bars in general shapes. Bars should confine the active channel approximately 50% in width. This rough design estimate should be refined by results from field survey and hydraulic model analysis. Place LWD and available coarse sediment on bar surfaces to increase resistance to erosion.
UC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-8.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment				
UC-NCSW-8.1.1.1	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	The original forest of Usal Creek was almost completely removed. The removal occurred relatively recently compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to Usal Creek watercourses. The alteration of sediment transport will likely continue to affect multiple salmonid life stages in the watershed. The December 2006, Soldier Creek landslide will likely continue to contribute sediment into the lower watershed, and the transport of this sediment into the ocean will likely take many years under current conditions.
UC-NCSW-8.1.2	Recovery Action	Sediment	Improve instream gravel quality				
UC-NCSW-8.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	30		

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-8.1.2.2	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	10	, CDFW, IWRP, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	
UC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
UC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, RFFI	
UC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, RFFI	
UC-NCSW-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, RFFI	
UC-NCSW-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, RFFI	
UC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
UC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by fire fighting actions.	2	100	CalFire	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
UC-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)				
UC-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, storage tanks, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire	Do not draft water from the lagoon during fire unless absolutely necessary.
UC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**				
UC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
UC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	2	CalFire, NMFS	
UC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
UC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, RFFI	These will likely be replaced as part of future timber harvest plans in Usal watershed. Action is considered In-Kind
UC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	30	Lyme Timberland, Mendocino County Department of Public Works, RFFI, State Parks	Some upgrades on RFFI lands have already occurred. The long-term benefits that would result from this recommendation should be carefully evaluated against the possibility of short term increases in sedimentation and turbidity.

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
UC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	Mendocino County Department of Public Works, RFFI, State Parks	Legacy roads from past logging activity continue to impact the Usal watershed. Road densities are high throughout the watershed and are estimated at 3.5 miles of road per square mile overall and at 4.5 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed, not properly maintained, and many have been abandoned.
UC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Encourage County of Mendocino to winterize the Usal County road using modern techniques to ensure sediment from roads does not enter North Fork Usal Creek.	2	100	CDFW, Mendocino County Department of Public Works, RFFI	The Usal County Road should be properly winterized every year to ensure sediment from this dirt road does not enter Usal Creek or other anadromous streams in the area. Road closure during the winter period should be implemented if necessary to ensure integrity of road winterization efforts.
UC-NCSW-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	This should be an ongoing program (approximately every three years), particularly for County road maintenance staff regarding sediment remediation on the Usal County Road. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input.
UC-NCSW-23.1.2.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	20	Lyme Timberland, Mendocino County Department of Public Works, RFFI, State Parks	However, a longer duration is associated with the action due to the large road and skid trail network and low rate of timber harvest. North Fork Usal's mainline riparian road should be considered one of the top decommission priorities.
UC-NCSW-23.1.2.5	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	Of particular note, the Usal County Road is poorly maintained by Mendocino County and is believed to contribute significant volumes of sediment into the North Fork. To the maximum extent practicable, problem roads and active erosion sites, such as the campground near Hotel Gulch on State Parks Property, should be prioritized and addressed as part of a comprehensive sediment reduction plan for the entire Usal basin. The program should include a component that closes and remediates unnecessary roads and skid trails and moves campsites away from watercourses in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules.

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from steelhead streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	2	5	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.1.2.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	Mendocino County Department of Public Works, RFFI, State Parks	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Number of energy dissipaters will be identified from road assessment.
UC-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
UC-NCSW-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid and minimize impacts on unstable slopes, wetlands, floodplains and other areas of high habitat value.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
UC-NCSW-23.1.4.1	Action Step	Roads/Railroads	Replace the existing bridge on Usal County Road located in the Sinkyone State Parks Campground.	2	5	Mendocino County, State Parks	Due to stream bed aggradation the current bridge likely cannot pass a 100 year flow event in Usal Creek. Protection of this inadequate crossing in a major concern that may preclude necessary instream LWD enhancement above the bridge.
UC-NCSW-23.1.4.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	Use NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
UC-NCSW-23.1.5	Recovery Action	Roads/Railroads	Prevent or minimize adverse alterations to riparian species composition and structure				
UC-NCSW-23.1.5.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	Many abandoned roads and active roadside areas have extensive infestations of pampas grass.
UC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
UC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road construction/density, dams, etc.)				
UC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFW, NRCS, RWQCB, USACE	This should be considered a standard practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
UC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Work with stakeholders to develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	10	RFFI	A lower priority due to the projected low rate of timber harvest actions in the watershed in the immediate upcoming years resulting in a subsequent lack of road construction/reconstruction. A suitable plan for this watershed may incorporate a road sediment reduction plan as part of the future harvest planning scenario.
UC-NCSW-23.2.1.3	Action Step	Roads/Railroads	For all dirt roads, apply (at a minimum), the road standards outlined in the California Forest Practice Rules.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	This recommendation is specifically directed at the County of Mendocino for the Usal County Road and State Parks for the Sinkyone Campground at Usal Beach. Action is considered In-Kind
UC-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
UC-NCSW-23.2.2.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
UC-NCSW-23.2.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-23.2.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	2	20	Mendocino County Department of Public Works, RFFI, State Parks	This is a feasible recommendation for the Usal watershed due to the large number of abandoned and poorly maintained roads. Many of these roads are historical logging roads and skid trails that are no longer used. Decommissioning should evaluate potential impacts and benefits in terms of sediment mobilization between leaving road in current conditions and reopening for decommissioning purposes.
UC-NCSW-23.2.3.2	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.2.3.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	Mendocino County Department of Public Works, RFFI, State Parks	
UC-NCSW-23.2.3.5	Action Step	Roads/Railroads	Encourage County of Mendocino to address sediment input from the Usal County road into Waterfall Gulch (tributary to North Fork Usal).	2	20	CDFW, Mendocino County Department of Public Works, NMFS, RFFI, State Parks	The Usal County Road should be properly winterized every year to ensure sediment from this dirt road does not enter Usal Creek or other anadromous streams in the area.
UC-NCSW-23.2.3.6	Action Step	Roads/Railroads	Use excess gravel in the Usal Estuary as a source of road rock material in the watershed including the Usal County Road.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	Rock from the estuary will need to be crushed to increase adhesion and some limited infrastructure will be needed for crushing.
UC-NCSW-23.2.4	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
UC-NCSW-23.2.4.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific road management plan is created and implemented.	2	20	County of Mendocino, RFFI, State Parks	
UC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
UC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to the estuary (impaired quality and extent)				
UC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	10	FEMA, Mendocino County, State Parks, USACE	
UC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration				
UC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead.	3	10	CalFire, CalTrans, CDFW, NMFS, RFFI, RWQCB, SWRCB	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
UC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
UC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development to the greatest extent practicable.	1	100	CDFW, County, RFFI, State Parks	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc.
UC-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Evaluate and implement restoration or creation of offchannel habitats and backwater alcoves on the lower Usal floodplain.	2	15	CDFW, NMFS, RFFI, State Parks	Little infrastructure exists on the floodplain.
UC-NCSW-24.1.4	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment				

Usal Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
UC-NCSW-24.1.4.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalFire, RFFI, RWQCB, State Parks	Usal Creek watershed exhibits a Mediterranean-type climate, with an average rainfall between 45 and 75 inches that falls predominantly between the months of October and April. Although winter and spring seasons can be relatively wet (especially within higher elevations), the summer and fall can be warm; however, the maritime influence results in many days of prolonged fog which can moderate seasonal temperatures within the lower basin. Severe weather patterns, coupled with the existing road network, may exacerbate and accelerate future sediment delivery and land sliding.
UC-NCSW-24.1.4.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, RFFI, RWQCB, State Parks	Assess and prioritize high-risk shallow-seeded landslide and develop plan to rehabilitate.
UC-NCSW-24.2	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**				
UC-NCSW-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize increased landscape disturbances				
UC-NCSW-24.2.1.1	Action Step	Severe Weather Patterns	Minimize additional development on the lower Usal floodplain.	2	100	Mendocino County Department of Public Works, RFFI, State Parks	

Wages Creek Population

NC Steelhead Winter-Run

- Role within DPS: Potentially Independent Population
- Diversity Stratum: Northern Central Coastal
- Spawner Abundance Target: 700 adults
- Current Intrinsic Potential: 17.4 IP-km

For information regarding CC Chinook salmon and CCC coho salmon for this watershed, please see the CC Chinook Salmon volume of this recovery plan and the CCC coho salmon recovery plan (http://www.westcoast.fisheries.noaa.gov/).

Abundance and Distribution

Quantitative information on steelhead abundance in Wages Creek was obtained from juvenile fish sampling efforts initiated by CDFW in 1988[1]. The sampling effort consisted of a 30-meter sampling reach in Wages Creek on October 24, 1988. More juvenile coho salmon were detected than juvenile steelhead, likely due to an outplanting effort by CDFW earlier in the year. Subsequent sampling was conducted most years from 1989 through 2002 by CDFW and Georgia-Pacific Corp., and yielded estimates of steelhead juvenile density ranging from 0.50 fish per meter square (f/m^2) to 0.07 f/m^2. In 1995, CDFW began a three-year program of heavily planting the lower portion of Wages Creek with thousands of juvenile coho salmon in an effort to reestablish coho salmon into the watershed. As part of this effort an outmigrant trap was operated in lower Wages Creek in 1999 (www.krisweb.com/kristenmile) to evaluate the smolt densities the following spring. Trapping results documented 877 (one-year-old or older) smolts outmigrating from the watershed and 1107 young-of-the-year steelhead juveniles. In 2008, CDFW initiated a three-year pilot study to evaluate monitoring methods for California's Coastal Salmonid Monitoring Plan, which included Wages Creek in the study design. This CDFW pilot study used a far more robust sampling method than previous juvenile sampling efforts and was directed at obtaining estimates of adult abundance using a statistically rigorous sampling design. Results from the 2009/2010 sampling year, based on a random sample of reaches in Wages Creek, estimated 35 steelhead adults spawned in the watershed (D. Wright, Campbell Timber, personal communication, 2010). Under current conditions, steelhead are likely distributed throughout all anadromous reaches of Wages Creek, the sole exceptions being high-gradient headwater streams and areas upstream of migration barriers.

[1] http://www.krisweb.com/

History of Land Use

The predominant land use within the Wages Creek watershed is timber management, with limited residential housing located along the lower reaches of Ryder Gulch and lower mainstem Wages. These lower reaches are floodplain areas and were cleared of the overstory canopy for grazing and farming purposes. At least one sawmill was located in Wages Creek at Ryder Gulch, where the creek was dammed to form a log pond (Figure 1). The first logging entry into the watershed began in approximately the later 1800s. At the mouth of Wages Creek is a privately owned campground which encompasses the Wages Creek estuary.

Picture 1: Ryder Gulch mill and mill pond circa 1889-1893. Ryder Gulch is a tributary to Wages Creek. Image courtesy of Mendocino County Historical Society.

Current Resources and Land Management

The entire Wages Creek watershed is privately owned, with Hawthorne Timberland Management owning the largest proportion. Private residences are located in the lower watershed. To date, relatively few instream restoration projects have occurred in Wages Creek, with most restoration actions being focused on reducing sediment input from upslope roads associated with timber management. Little management or evaluation of aquatic habitat and species occurs within the basin, except for irregular field habitat surveys conducted by CDFW personnel as part of CDFW's coast wide monitoring effort.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: habitat complexity, riparian vegetation, and sediment transport. Recovery strategies will focus on improving these poor conditions as well as those needed to ensure population viability and functioning watershed processes.

Current Conditions

The following discussion focuses on those conditions that were rated Fair or Poor as a result of our CAP viability analysis. The Wages Creek CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Habitat Complexity: Large Wood and Shelter

Data from CDFW habitat inventories indicate shelter ratings throughout the Wages Creek watershed are poor within all sampled reaches. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat. Large portions of this functional instream structure were likely removed due to past land management and well-intentioned but often misguided stream clearing practices. Inadequate instream habitat complexity is believed a major stressor for the adult, summer rearing, winter rearing, and smolt lifestages.

Other Current Conditions

The original old growth forest of Wages Creek has been completely removed, aside from some scattered residual trees. The final removal occurred relatively recently, compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to the watercourses. The alteration of sediment transport will likely continue to affect multiple lifestages of steelhead in the watershed.

Threats

The following discussion focuses on those threats that were rated as High or Very High (see Wages Creek CAP Results). Recovery strategies will likely focus on ameliorating threats rated as High; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Wages Creek CAP Results.

Roads

Legacy roads from past logging and mining activity continue to impact the Wages watershed. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per

square mile overall and at 5.3 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed[2], not properly maintained, and many have been abandoned.

Other Threats

No fish hatcheries operate within the Wages watershed, so hatchery-related effects are unlikely within the steelhead population. Similarly, invasive species are not known to be problematic within the basin. Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. General estuary conditions are unknown but should be investigated in the future. NMFS is aware of unsubstantiated reports regarding unauthorized fishing in the estuary, which may impact rearing juveniles during the summer period.

Limiting Stresses, Lifestages, and Habitats

Threat and stress analysis within the CAP workbook suggests summer juvenile survival is likely a limiting factor affecting steelhead abundance within the Wages Creek watershed. Inadequate habitat complexity reduces rearing habitat availability, resulting in a decrease in stream carrying capacity. Sediment input into Wages Creek has accelerated over the past several decades due to upslope land disturbance, likely resulting in pools becoming filled and food availability decreasing in riffle habitats. Restoration actions should target addressing these issues within high potential stream reaches.

General Recovery Strategy

Improve LWD volume

Most of the Wages Creek watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. An immediate LWD supplementation program to enhance habitat complexity will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones.

Address Upslope Sediment Sources

Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly

[2] The majority of these roads were constructed prior to the passing of the California Forest Practice Rules in 1973.

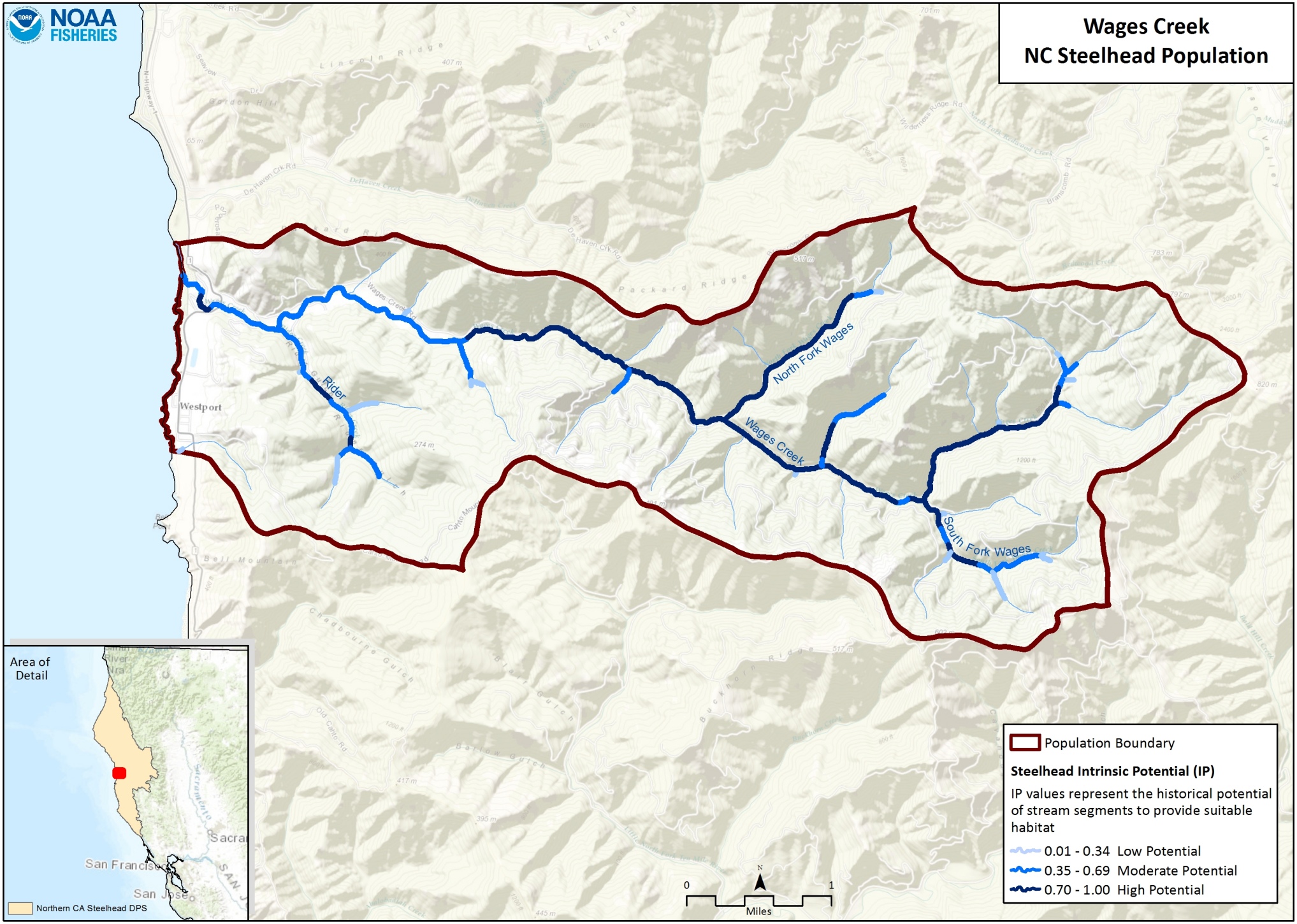
addressed. The program should include a component that closes and remediates unnecessary roads and skid trails, lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

Investigate and Address Current Estuary Conditions

The historical potential of the Wages Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond *et al.* 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved.

Literature Cited

Bond, M. H., S. A. Hayes, C. V. Hanson, and B. R. MacFarlane. 2008. Marine Survival of Steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. Canadian Journal of Fisheries and Aquatic Sciences 65:2242-2252.


NOAA FISHERIES
Wages Creek
NC Steelhead Population
Westport
Rider
North Fork Wages
Wages Creek
South Fork Wages
Area of Detail
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles

NC Steelhead Wages Creek CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	36% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<1 Spawner per IP-km (Spence et al 2012)	>1 spawner per IP-km to < low risk spawner density per Spence et al (2012)	low risk spawner density per Spence et al (2012)		<1 Spawner per IP-km (Spence et al 2012)	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	>17.1% (0.85mm) and >33.7% (4mm)	Poor
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good
3	Summer Rearing Juveniles	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair

Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	50% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	<50% of streams/ IP-km (>40% average primary pool frequency)	Poor
Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.5 diversions per 10 IP-km	Fair
Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good

			Riparian Vegetation	Canopy Cover	<50% of streams/ IP-Km (>70% average stream canopy)	50% to 74% of streams/ IP-Km (>70% average stream canopy)	75% to 90% of streams/ IP-Km (>70% average stream canopy)	>90% of streams/ IP-Km (>70% average stream canopy)	100% streams with canopy >80% canopy as of survey from 1996	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	36% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-km (>50% stream average scores of 1 & 2)	Good
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT)	50 to 74% IP km (<20 C MWMT)	75 to 89% IP km (<20 C MWMT)	>90% IP km (<20 C MWMT)	>90% IP-km (<20 C MWMT)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Density	<0.2 Fish/m^2	0.2 - 0.6 Fish/m^2	0.7 - 1.5 Fish/m^2	>1.5 Fish/m^2	0.30 Fish/m2	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
4	Winter Rearing Juveniles	Condition	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor

			Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>40% Pools; >20% Riffles)	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	36% Class 5 & 6 across IP-km	Poor
			Riparian Vegetation	Tree Diameter (South of SF Bay)	≤69% Density rating "D" across IP-km	70-79% Density rating "D" across IP-km	≥80% Density rating "D" across IP-km	Not Defined		
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	<50% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good

5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-km (>80 stream average)	Fair
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	1.5 diversions per 10 IP-km	Fair
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	>90% IP-km (>6 and <14 C)	Very Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No Acute or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	Good
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)		Smolt abundance which produces high risk spawner density per Spence (2008)	Poor
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.197% of Watershed in Impervious Surfaces	Very Good

			Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0% of Watershed in Agriculture	Very Good
			Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	29% of Watershed in Timber Harvest	Fair
			Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	1% of watershed >1 unit/20 acres	Very Good
			Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	>75% Intact Historical Species Composition	Very Good
			Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	4.1 Miles/Square Mile	Poor
			Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	5.3 Miles/Square Mile	Poor

NC Steelhead Wages Creek CAP Threat Results

	Threats Across Targets	Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
	Project-specific-threats	1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Low	Low	Medium	Low	Low	Low	Low
3	Disease, Predation and Competition	Low	Low	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium		Medium		Medium		Medium
6	Hatcheries and Aquaculture							
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Low	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Low	Medium	Low	High	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Medium	Medium	Low	Medium

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
WgC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical complex habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CA Coastal Commission, CDFW, Private Landowners	The historical potential of the Wages Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Due to various constraints, the overall habitat potential is likely relatively small.
WgC-NCSW-1.1.1.2	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	5	CDFW	
WgC-NCSW-1.1.1.3	Action Step	Estuary	Restore estuary function by reducing fine sediment input from the upper watershed.	2	50	CA Coastal Commission, CDFW, Private Landowners	Refer to road strategy recommendations.
WgC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
WgC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	3	10	CDFW, Private Landowners, Trout Unlimited	
WgC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Private Landowners, Trout Unlimited	
WgC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelter ratings				
WgC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity.	2	20	Lyme Timberland	Wages Creek has been habitat typed and areas lacking in pool habitats are known.
WgC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	CalFire, CalTrans, Lyme Timberland, CDFW, Mendocino County, Private Landowners, RWQCB, USACE	Some landowners in the lower portions of Wages Creek may be concerned about potential property impacts associated with large wood materials adjacent to their infrastructure.
WgC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	25	Mendocino County RCD	
WgC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency				
WgC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	100	Lyme Timberland	Promoting growth could include such actions as riparian permanent retention strategies of larger diameter trees and/or conifer release strategies, particularly in areas dominated by hardwoods.
WgC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, PG&E, Private Landowners, RPFs	
WgC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	CalFire, CDFW, Lyme Timberland, Private Landowners	Costs may be higher in Wages Creek than in some of the other watersheds in the Lost Coast Diversity Stratum due to the presence of rural residences in the lower portion of the watershed. Due to the presence of these structures, additional engineering may be required. Low gradient floodplain areas should be initially target for restoration.

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-6.1.2.4	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	Lyme Timberland	Initial focus should be directed at lower floodplain areas. This strategy would provide benefits to steelhead as well as coho salmon. Due to presence of some infrastructure in the area, the plan should carefully evaluate potential impacts of wood mobilization during high flow events.
WgC-NCSW-6.1.2.5	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	20	Lyme Timberland, RPFs	NMFS programmatic biological opinion with the Corps and NOAA RC should be used to minimize permitting delays.
WgC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-7.1.1	Recovery Action	Riparian	Improve canopy cover				
WgC-NCSW-7.1.1.1	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	2	10	CalFire, Lyme Timberland, Private Landowners	Most of the Wages Creek watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with small landowners in the floodplain to increase riparian buffer widths and initiating planting of native vegetation. An immediate LWD supplementation program to enhance habitat complexity will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones.
WgC-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	100	Lyme Timberland, Private Landowners	This practice would have major benefits if implemented in the lower floodplain where numerous small landowners live.
WgC-NCSW-7.1.1.3	Action Step	Riparian	Plant native vegetation in lower Wages and Rider Gulch to promote streamside shade.	3	10	CDFW, NRCS, RWQCB	
WgC-NCSW-7.1.2	Recovery Action	Riparian	Improve tree diameter				
WgC-NCSW-7.1.2.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
WgC-NCSW-8.1.1.1	Action Step	Sediment	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching salmonid streams (CDFG 2004).	3	10	CalFire, Lyme Timberland, Private Landowners, RWQCB	
WgC-NCSW-8.1.1.2	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	10	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, Lyme Timberland	
WgC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	CalFire, Lyme Timberland	
WgC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance				
WgC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFW, NMFS, USFWS	

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)				
WgC-NCSW-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, Lyme Timberland	Require all water truck/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
WgC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
WgC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
WgC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and their impacts to salmonids, to local fire fighting agencies and CalFire to further educate staff regarding safe use of retardants.	2	1	CalFire, NMFS	
WgC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
WgC-NCSW-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
WgC-NCSW-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	3	10	CalFire, CDFW, Lyme Timberland, RWQCB	
WgC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (gravel quality and quantity)				
WgC-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, California Geological Survey, Lyme Timberland, Private Landowners	
WgC-NCSW-19.1.3.2	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	100	CalFire, CDFW, RPFs, RWQCB	
WgC-NCSW-19.1.3.3	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
WgC-NCSW-19.1.4.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
WgC-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	25	CalFire, Lyme Timberland, CDFW, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize impairment to instream habitat complexity (reduced large wood and/or shelter)				
WgC-NCSW-19.1.6.1	Action Step	Logging	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
WgC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-19.2.1.1	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, Lyme Timberland, Mendocino County, Private Landowners	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
WgC-NCSW-19.2.1.2	Action Step	Logging	Discourage rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners	
WgC-NCSW-19.2.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	2	40	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.2.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-19.2.2.1	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey, Lyme Timberland, RPFs	
WgC-NCSW-19.2.2.2	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	CalFire, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-19.2.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse.	2	100	CalFire, California Geological Survey, CDFW, Lyme Timberland, Private Landowners, RPFs, RWQCB	
WgC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	Lyme Timberland, Mendocino County, Private Landowners	Legacy roads from past logging activity continue to impact the Wages watershed. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile overall and at 5.3 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed , not properly maintained, and many have been abandoned.
WgC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	3	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	10	CalFire, Lyme Timberland, RWQCB	Abandoned riparian roads in the upper portion of mainstem Wages should be closely evaluated for decommissioning. The original old growth forest of Wages Creek has been completely removed, aside from some scattered residual trees. The final removal occurred relatively recently, compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to the watercourses. The alteration of sediment transport will likely continue to affect multiple life stages of NC steelhead in the watershed.
WgC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so materials from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Lyme Timberland, Private Landowners, RWQCB	

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology				
WgC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	25	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance				
WgC-NCSW-23.1.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas.	3	20	CalFire, CDFW, Lyme Timberland, Private Landowners	Initial focus should be directed in steeper portions of the upper watershed. Active and abandoned logging roads and skid trails exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality. This is a feasible recommendation for the Wages Creek watershed due to the fact most of the watershed is in timber management and owned by only a few landowners. The program should include a component that closes and remediates unnecessary roads and skid trails, lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery.
WgC-NCSW-23.1.3.2	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	2	5	Lyme Timberland	
WgC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**				
WgC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Lyme Timberland, Private Landowners	This is part of ongoing maintenance requirements. Correct conditions that are likely to deliver sediment to streams, otherwise roads will be hydrologically closed/disconnected (fills and culverts removed, natural hydrology of hillslope largely restored).
WgC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Apply forest practice rules road winterization standards to all roads in the watershed.	2	20	CalFire, Lyme Timberland, Private Landowners	This action step will require outreach to smaller landowners in the lower portion of the watershed for effective implementation.
WgC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Lyme Timberland, Private Landowners	
WgC-NCSW-23.2.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	CalFire, California Geological Survey, Lyme Timberland, Private Landowners	
WgC-NCSW-23.2.1.5	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CalFire, California Geological Survey, CDFW, Lyme Timberland, Mendocino County, RWQCB	
WgC-NCSW-23.2.1.6	Action Step	Roads/Railroads	Develop and implement a specific road management plan. A plan should be developed within the next 10 years. The plan should identify areas of high threat and develop recommendations to mitigate or remediate the impacts.	2	20	CalFire, California Geological Survey, CDFW, Lyme Timberland, Mendocino County, RWQCB	

Wages Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
WgC-NCSW-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
WgC-NCSW-23.2.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Lyme Timberland	
WgC-NCSW-23.2.2.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	20	Lyme Timberland	
WgC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
WgC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to watershed hydrology				
WgC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	1	20	CDFW, Private Landowners, SWRCB	
WgC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids.	3	10	CalFire, Lyme Timberland, CDFW, Private Landowners, RWQCB, SWRCB	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
WgC-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonid recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of steelhead (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners	
WgC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
WgC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, California Geological Survey, Lyme Timberland, RWQCB	These areas should be identified and efforts should be made to minimize disturbance leading to increased risk of mobilization.
WgC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
WgC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	30	CalFire, FEMA, Lyme Timberland Mendocino County	
WgC-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalFire, Lyme Timberland, Mendocino County, Private Landowners	

NC Steelhead DPS Rapid Assessment Profile: North-Central Coastal Diversity Stratum Populations

Cottaneva Creek

- Role within DPS: Potential Independent Population
- Spawner Abundance Target: 129-261 adults
- Current Intrinsic Potential: 21.9 IP-km

Pudding Creek

- Role within DPS: Potentially Independent Population
- Spawner Abundance Target: 141– 285 adults
- Current Intrinsic Potential: 23.9 IP-km

Albion River

- Role within DPS: Independent Population
- Spawner Abundance Target: 290-581 adults
- Current Intrinsic Potential: 48.6 IP-km

Abundance and Distribution

In these watersheds steelhead are present in variable numbers and widely distributed. The type of data and quality of data vary by watershed and by year. Of the three, Pudding Creek is the most intensively monitored due to a salmonid lifecycle monitoring program which has been in operation for over ten years and is run by Campbell Timberland Management. Mean estimates of adult abundance in Pudding Creek, based primarily on redd counts, have ranged between 10 in 2008/9 to >525 in 2003/4 (AUC Estimate) (Gallagher 2005; Gallagher and Wright 2008). In 2011, smolt abundance was estimated to total 14,284 (SE = 1,457) individual fish (Gallagher and Wright 2012). The first juvenile sampling was initiated in 1988 by CDFW, and then began on a more-or-less yearly basis in 1993 to present. Density estimates have varied considerably, depending on site sampled and year, but in all years steelhead juveniles were successfully detected (D. Wright, Campbell Timber, personal communication, 2013).

Mean estimates of adult abundance in the Albion River have generally been conducted through redd counts as part of CDFW's coastal Mendocino County salmonid life cycle and regional status and trends monitoring effort. The Albion sampling effort is part of a larger regional sampling program and estimates are therefore not specifically derived to estimate the greater Albion River steelhead population. In 2008/9, eight steelhead adults (0-22) were estimated, in 2009/10 no adults

were estimated, and in 2010/11 at total of 19 adults (0-126) were estimated (Gallagher and Wright 2012). Juvenile sampling has occurred sporadically since the late 1980s.

Aside from sporadic estimates of summer juvenile abundance, relatively little sampling has occurred in Cottaneva Creek. Cottaneva Creek is included in the overall suite of streams sampled in CDFW's coastal Mendocino County salmonid life cycle and regional status and trends monitoring effort but like the Albion River population, the sampling effort is part of a larger regional sampling program and estimates are, therefore, not specifically derived to estimate the greater Albion River steelhead population. In 2008/9, 2009/10, and 2010/11 one reach was sampled and no redds were detected (Gallagher and Wright 2012).

History of Land Use, Land Management and Current Resources

The historic land use in the three watershed is largely defined by timber harvest, which generally began in the latter 1800s/early 1900s. Railroads were constructed in the three watersheds and timber was harvested and transported to sawmills at Rockport (Cottaneva Creek), Glenblair and Fort Bragg (Pudding Creek), or Albion Harbor (Albion River). Rate of timber harvest varied between the watershed but by the 1970s all of the original forest in all three watersheds had been harvested and the forests were in their second harvest rotation. In general, the Albion River watershed was less intensely harvested than either Pudding or Cottaneva creeks and maintains some of the better stocked forest stands in private ownership in Mendocino County. Both Pudding and Cottaneva creeks were subjected to extensive even-aged management of their second growth forest (J. Ambrose, NMFS, personal communication, 2013).

The lower Albion River estuary was modified with the construction of sawmills, planning mills, *et cetera* which operated until 1928 and now has a small boat harbor and 22 acre campground. The Albion River estuary, unlike many other estuaries in the Diversity Stratum remains open year-round and tidal influence extends as much as five miles upstream (Downie *et al.* 2004). The majority of the Pudding Creek estuary was inundated after the construction of the Pudding Creek dam where waters of Pudding Creek and the Noyo River were impounded for diversion to the Union Lumber Mill in Fort Bragg. A sawmill was located adjacent to the Cottaneva estuary and operated sporadically until the mid-1950s.

The human population in Pudding Creek is approximately 2,307 people but habitat in the watershed is generally located at the top of southern ridge line or on the marine terrace in the City of Fort Bragg. Cottaneva Creek is sparsely populated with a total of 23 people. The total Albion River basin population is about 912 people, with many of the population located around the small hamlets of Albion and Comptche.

Diversity Stratum Population and Habitat Conditions

Impaired conditions result directly or indirectly from human activities, and are expected to continue until restored and/or the threat acting on these conditions is abated. The majority of conditions evaluated for the three watersheds were rated as Good for most lifestages. Overall, the Cottaneva, Pudding, and Albion watersheds are subject to fewer conditions than many other watersheds in the Diversity Stratum due to a singular land use (timber harvest) and a general lack of urban or rural residential impacts.

The following discussion focuses on those conditions that were rated as Poor or Fair for steelhead life history stages (see "North-Central Coastal Diversity Stratum" Rapid Assessment). These were: Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and functioning watershed processes.

Estuary: Quality and Extent

Estuary conditions are rated as Fair and have moderate effects on the target lifestages, due in large part to the altered conditions of the Pudding Creek estuary and generally unsuitable summer rearing conditions due to poor water quality. The other two estuaries, while somewhat impaired due to existing infrastructure, are less impacted than many other similar habitats in the DPS.

Hydrology: Baseflow and Passage Flows

Hydrology: Baseflow and Passage Flows was rated as Fair and has moderate effects to the summer rearing lifestages, primarily due to ongoing water diversions in the Albion River watershed near the town of Comptche.

Habitat Complexity: Large Wood and Shelter

Lack of habitat complexity in the form of wood and high levels of instream sediment resulted in a Fair rating and is having a moderate adverse effect on the adult, summer, and winter rearing lifestages. Lack of instream complexity is likely the result of long term land uses related to timber harvest in the three watersheds, particularly impacts associated with mechanized logging practices prior to the California Forest Practice Rules and removal of wood during the 1970s-1980s. Of reaches sampled in the three watersheds, data from CDFW habitat inventories indicate large wood is lacking. However, since these surveys were conducted, extensive efforts to improve instream habitat conditions have been conducted in portions of all three streams. While significant efforts have occurred, it is likely that instream habitat conditions overall are not at the

viability targets for these attributes. Threats that have caused, are causing, or may cause this condition to continue to impair steelhead life history targets include Logging, Fire and Fuel Management, and Roads/Railroads.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Impaired gravel quality and quantity had a major adverse effect (Poor rating) on the egg lifestage, and is potentially limited for that lifestage. This factor is rated as Fair and has had a moderate effect on the adult and summer and winter rearing lifestages. These ratings reflect the generally high sediment loads throughout the three watersheds in particular and the Diversity Stratum in general. Threats that may cause this condition to continue to impair steelhead life history targets include Logging, Fire and Fuel Management, and Roads/Railroads.

Viability: Density, Abundance and Spatial Structure

Viability: Density, Abundance and Spatial Structure is rated as Fair and has had a moderate effect on the target lifestages. Steelhead populations are depressed in the three watersheds but all three populations maintain juvenile steelhead presence and distribution throughout the mainstems and tributaries.

Water Quality: Turbidity or Toxicity

Turbidity is rated as Fair and has had a moderate effect on adults, wintering juveniles, and smolts. Sources of increased turbidity are the result of high rates of fine sediment input from upslope areas throughout the three watersheds.

Threats

The following discussion focuses on those threats that were rated as Poor or Fair (see "North-Central Coastal Diversity Stratum" Rapid Assessment). Recovery strategies focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in "North-Central Coastal Diversity Stratum" Rapid Assessment.

Fire, Fuel Management and Fire Suppression

This threat is rated as Poor and is considered a major contributor to the conditions Habitat Complexity: LWD and Sediment: Gravel Quality and Distribution of Spawning Gravels due to a fire reducing potential sources of future LWD recruitment and potentially increasing the rate of fine sediment input into spawning gravels following runoff in response to winter rainfall events. Increased rates of sedimentation are typical, and in combination with past and ongoing sources of sediment input, could significantly impact gravel quality and quantity necessary for successful

spawning and food production. According to CalFire data, some areas in the Cottaneva and Albion watersheds have High fire hazard rating. A major fire, particularly if located in areas with High erosion hazard rating could result in major increases in fine sediment and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures would likely result.

Logging and Wood Harvesting

Timber harvest is rated as Poor and remains a major contributor to two conditions for steelhead in all three watersheds, but at diminished levels compared to historical practices. It is considered a major contributor to the conditions of Habitat Complexity: Large Wood and Shelter; and Sediment: Gravel Quality and Distribution of Spawning Gravels. Even with application of new California Forest Practice Rules, this threat is anticipated to continue into the foreseeable future. Rates of timber harvest are particularly high in the three watersheds: 17,698 acres in the Albion River (64 percent of the total watershed) in the last 20 years; 4,562 acres in Cottaneva Creek (43 percent of the total watershed) in the last 15 years; and 6,899 acres in Pudding Creek (61 percent of the total watershed) in the last 20 years (NMFS 2013).

Recreational Areas and Activities

As a result of extensive private land ownership which is primarily zoned by the County for timber production, there is little if any recreation ongoing in the Diversity Stratum, and this threat is rated as Very Good and is considered a negligible or minor contribution to the conditions. However, the impact of activities associated with unauthorized OHV use, particularly during the winter months, is rated as Fair and considered to have a moderate contribution to the condition of Sediment: Gravel Quality and Distribution of Spawning Gravels**.** Unauthorized OHV use is typically most prevalent in areas adjacent to urban areas, and of the three watersheds, Pudding Creek is the most impacted (J. Ambrose, NMFS, personal communication, 2013).

Roads and Railroads

Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in the three watersheds. Road densities are high throughout the watersheds (3.3 miles/mile^2 in Cottaneva; 3.1 miles/mile^2 in Pudding; and 7.7 miles/mile^2 in Albion) and many of these roads were poorly situated and constructed[1], improperly maintained, and many have been abandoned rather than properly decommissioned. It is hoped, with the implementation of the MRC HCP, sediment input originating from the road networks in Cottaneva Creek and the

[1] The majority of these roads were constructed prior to the passing of the California Forest Practice Rules in 1973. Some roads are located in very erosive areas, particularly in Cottaneva Creek which has an erodibility rating of 8 (on a scale of 0-10) (NMFS 2013).

Albion River will decrease over time. The MRC HCP includes extensive road reconstruction, maintenance, and decommissioning actions which, over the 80-year lifespan of the HCP, should result in notable improvements to instream conditions.

Severe Weather Patterns

This threat is rated as Good or Fair for ten conditions. Because of the potential for severe weather to affect flows, it is rated as Poor and considered a major threat to Hydrology: Baseflow and Passage Flows. The impacts of a severe drought (in conjunction with ongoing diversions in the Albion River of surface flows) could adversely affect the summer rearing lifestage of steelhead in the watershed, particularly during the summer months.

Water Diversion and Impoundments

There are relatively few diversions or impoundments in the three watersheds, and this threat is rated as Very Good for nine conditions, Fair for two conditions, and Poor for Viability: Density, Abundance and Spatial Structure. This is due primarily to concerns over the impact of summer water diversions in portions of the upper Albion. Water diversions are a major concern in Marsh Creek (near Comptche) which was listed as a fully appropriated stream by the State Water Resources Control Board in 1998 (NMFS 2013).

Fishing and Collecting

Fishing is rated as Fair and considered a moderate contributor to the condition of Viability: Density, Abundance, and Spatial Structure primarily due to the ambiguity of the California Freshwater Sport Fishing Regulations. The regulations imply hatchery trout and hatchery steelhead are present in Cottaneva Creek and Albion River when in reality, they are not. Concerns were raised over potential fishing impacts from uninformed fishers who presume hatchery fish may be present in areas where they do not occur. Furthermore, the regulations authorize summer fishing with a bag limit of zero. Fish that are caught during a summer fishery are almost certainly exclusively listed steelhead and/or coho salmon juveniles which could be injured by being caught and landed and then released.

Limiting Conditions, Lifestages, and Habitats

The egg, summer rearing and winter rearing lifestages are most limited by current conditions and future threats facing steelhead in Cottaneva Creek, Pudding Creek, and the Albion River. The conditions most limiting include: Large Wood and Shelter; and Gravel Quality and Distribution of Spawning Gravels. The greatest threats to recovery in these watersheds result from Logging, Severe Weather, Fire and Roads.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating conditions and threats rated as Poor or Fair, as discussed above, although strategies that address other factors may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in these watersheds are discussed below with more detailed and site-specific recovery actions provided in "North-Central Coastal Diversity Stratum" Rapid Assessment.

Habitat Complexity: Large Wood and Shelter

Many reaches in the watersheds would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. Fencing and planting in the floodplains could result in major improvement to the lower reaches of the lower Albion River. Continuation of LWD enhancement efforts by the major landowners in these watersheds will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones. In addition to directly contributing to habitat complexity, LWD and other habitat features such as boulders support development of complex pools, and improve pool/riffle ratios.

Address Upslope Sediment Sources to Improve Gravel Quality and Quantity

Active and abandoned logging roads and skid trails are located throughout the three watersheds and likely contribute large volumes of sediment into the stream environment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Ongoing road work should include a component that closes and decommissions unnecessary and abandoned roads and skid trails to effectuate lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

High priority sites identified as major sources of sediment contribution should be the initial focus of future restoration actions. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall events, flooding, or earthquakes.

Literature Cited

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Gallagher, S. P. 2005. Evaluation of coho salmon (*Oncorhynchus kisutch*) and steelhead (*O. mykiss*) spawning ground escapement estimates for monitoring status and trends of California coastal salmonids: 2000-2005 escapement estimates for several Mendocino County, coastal streams. California Department of Fish and Game, Arcata, CA.

Gallagher, S. P., and D. W. Wright. 2008. A regional approach to monitoring salmonid abundance trends: a pilot project for the application of the California coastal salmonid monitoring plan in coastal Mendocino County: Year III. 2007-08 final report to CDFG Fisheries Restoration Grant Program, Grant P0610540, Coastal Mendocino County salmonid monitoring project.

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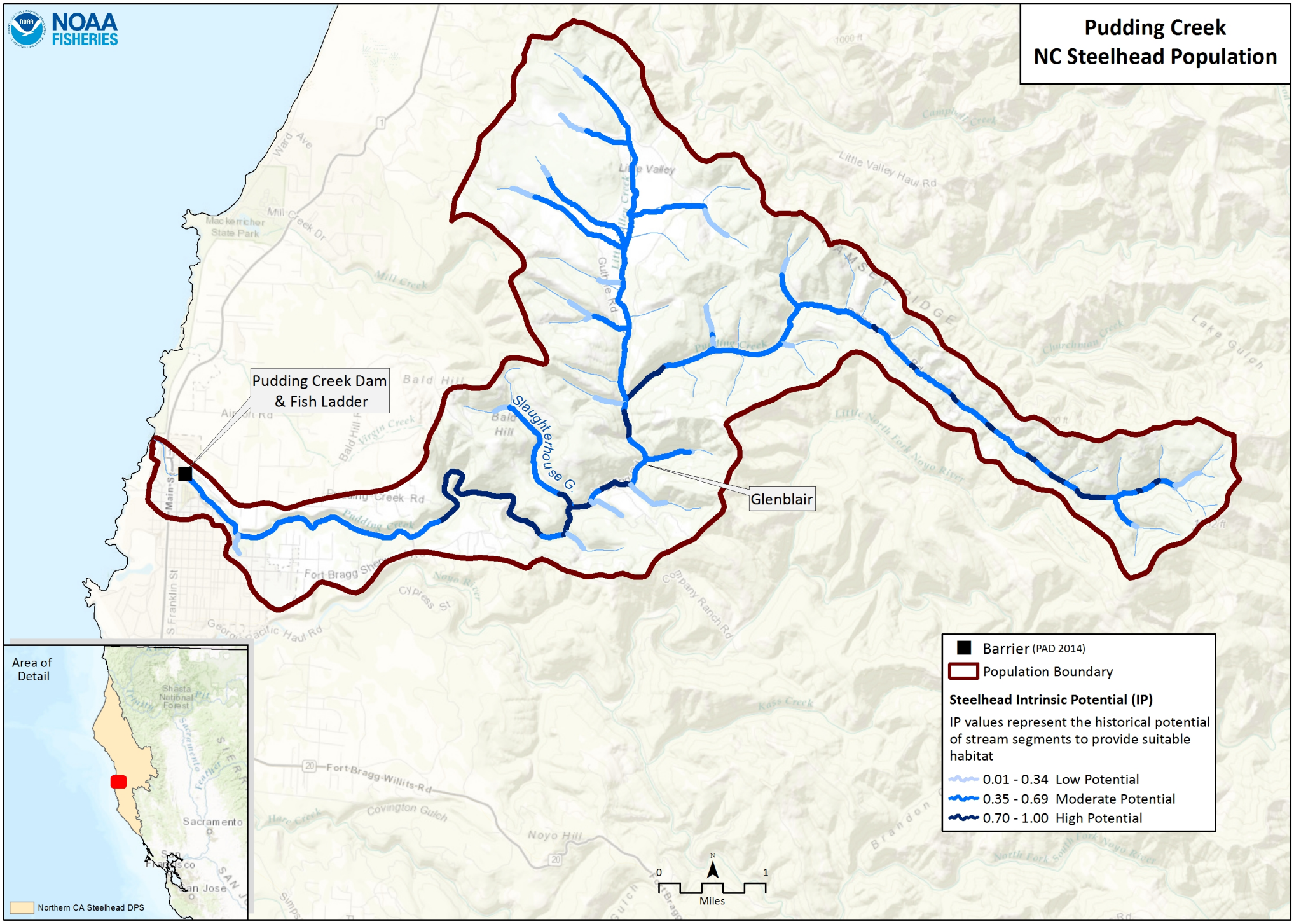
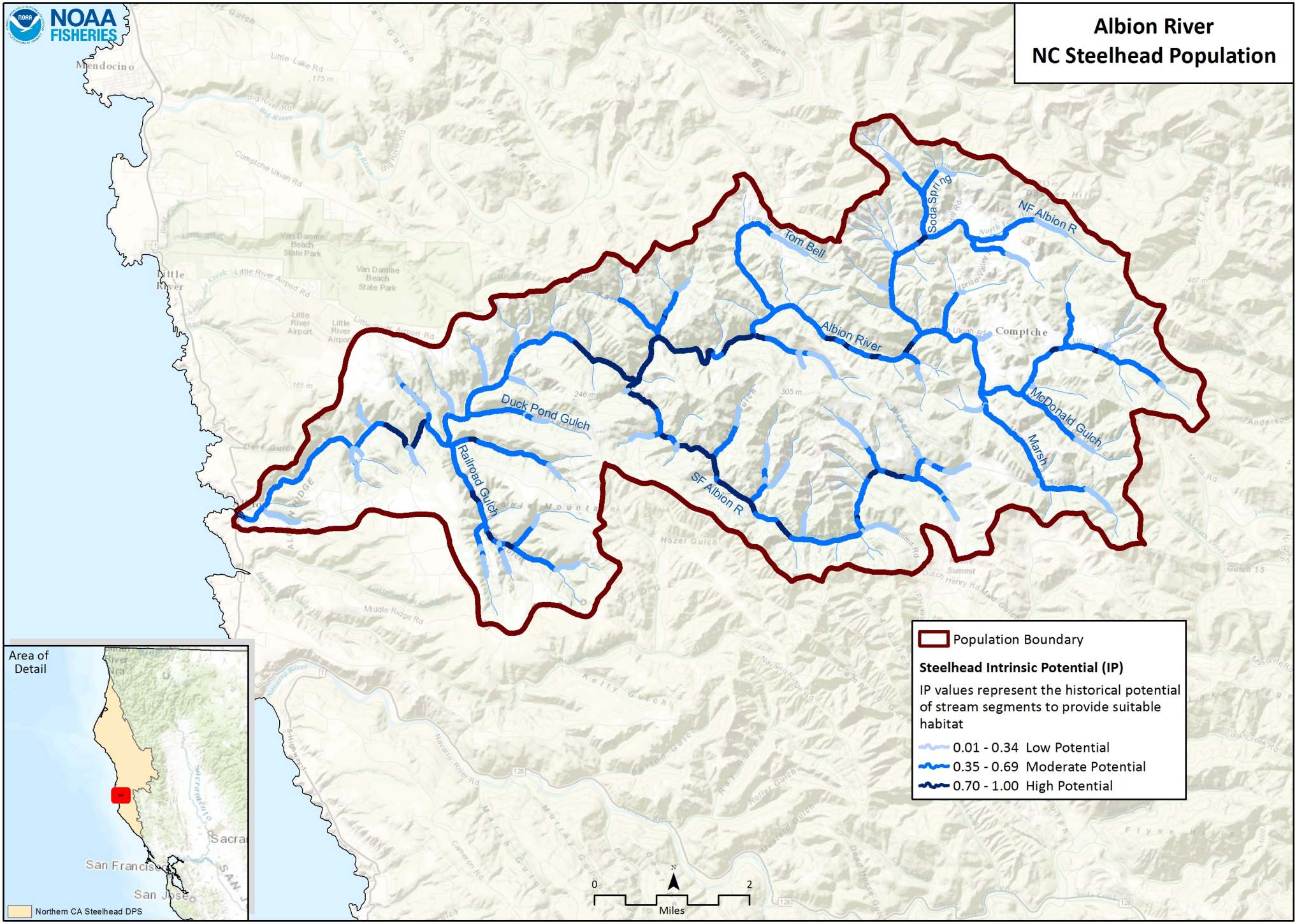
NMFS (National Marine Fisheries Service). 2013. GIS database for recovery planning. Santa Rosa, California. May.


NOAA FISHERIES
Cottaneva Creek
NC Steelhead Population
Dunn
NF Cottaneva
MF Cottaneva
Cottaneva
Rockport
Area of Detail
Northern CA Steelhead DPS
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles


NOAA FISHERIES
Pudding Creek
NC Steelhead Population
Pudding Creek Dam & Fish Ladder
Glenblair
Slaughterhouse G.
Area of Detail
Northern CA Steelhead DPS
Barrier (PAD 2014)
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
1
Miles
Fort Bragg-Willits Rd
Little Valley Haul Rd
Mackerricher State Park
Mill Creek Dr
Ward Ave
Bald Hill
Pudding Creek Rd
Fort Bragg
Georgia Pacific Haul Rd
Cypress St
Noyo River
Company Ranch Rd
Covington Gulch
Noyo Hill
Kass Creek
Brandon
Lake Gulch
Churchman Creek
Little North Fork Noyo River
Shasta National Forest
Sacramento
San Jose


NOAA FISHERIES
Albion River
NC Steelhead Population
Tom Bell
Soda Spring
NF Albion R
Albion River
Duck Pond Gulch
Railroad Gulch
SF Albion R
Marsh
McDonald Gulch
Comptche
Mendocino
Little River
Van Damme Beach State Park
Little River Airport
Middle Ridge Rd
Comptche Ukiah Rd
Area of Detail
Northern CA Steelhead DPS
San Francisco
San Jose
Population Boundary
Steelhead Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
0
2
Miles
N

NC Steelhead DPS: North-Central Coastal Diversity Stratum (Pudding/Albion/Cottaneva)						
Habitat & Population Condition Scores By Life Stage: **VG = Very Good** **G = Good** **F = Fair** **P = Poor**		**Steelhead Life History Stages**				
		Adults	**Eggs**	**Summer-Rearing Juveniles**	**Winter-Rearing Juveniles**	**Smolts**
Stresses: Key Attribute: Indicators	**Riparian Vegetation: Composition, Cover & Tree Diameter**			G	G	
	Estuary: Quality & Extent	G		F	G	G
	Velocity Refuge: Floodplain Connectivity	G			G	G
	Hydrology: Redd Scour		G			
	Hydrology: Baseflow & Passage Flows	G	G	F		G
	Passage/Migration: Mouth or Confluence & Physical Barriers	G		G	G	G
	Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios	G		F	F	
	Habitat Complexity: Large Wood & Shelter	F		P	P	F
	Sediment: Gravel Quality & Distribution of Spawning Gravels	F	P	F	F	
	Viability: Density, Abundance & Spatial Structure	F		F		F
	Water Quality: Temperature			F		G
	Water Quality: Turbidity & Toxicity	F		G	F	F

NC Steelhead DPS: North-Central Coastal Diversity Stratum (Pudding/Albion/Cottaneva)													
Threat Scores **L: Low** **M: Medium** **H: High**		**Stresses**											
		Altered Riparian Species: Composition & Structure	Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Complexity and/or Pool/Riffle Ratio	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Impaired Instream Temperatures	Water Quality: Increased Turbidity or Toxicity
Threats - Sources of Stress	**Agriculture**	L	L	L	L		L	L	L	L		L	L
	Channel Modification	L	L	L	L	L	L	L	L	L		L	L
	Disease, Predation, and Competition	L	L	L			L	L	M		M	L	L
	Fire, Fuel Management, and Fire Suppression	L	L	L	L		L	M	H	H		M	M
	Livestock Farming and Ranching	L	L	L	L		L	L	L	L		L	L
	Logging and Wood Harvesting	L	L	L	L		L	M	H	H		M	M
	Mining	L	L	L	L		L	L	L	L		L	L
	Recreational Areas and Activities	L	L	L	L		L	L	L	M		L	L
	Residential and Commercial Development	L	L	L	L		L	L	M	M		L	L
	Roads and Railroads	L	M	L	L		L	M	M	H		L	H
	Severe Weather Patterns	L	M	L	L	H	L	L	M	M		M	M
	Water Diversions and Impoundments	L	L	L	L	M	L	L	L	M	H	L	L
	Fishing and Collecting										M		
	Hatcheries and Aquaculture										L	L	L

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
CotC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical complex habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	20	CA Coastal Commission, CDFW, Mendocino Redwood Company, RWQCB	The historical potential of the Cottaneva Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Due to various constraints, the overall habitat potential is likely relatively small.
CotC-NCSW-1.1.1.2	Action Step	Estuary	Restore estuary function by reducing fine sediment input from the upper watershed.	3	100	CalFire, CalTrans, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
CotC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.	2	20	CalFire, CalTrans, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	10	CalFire, California Coastal Conservancy, CDFW, Mendocino Redwood Company	
CotC-NCSW-2.1.1.4	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	3	5	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelter				
CotC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches.	2	25	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	2	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	25	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.4	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	20	CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.5	Action Step	Habitat Complexity	Manage native trees in riparian areas for older age classes, and increased basal area.	3	100	CDFW, County of Mendocino, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-6.1.1.6	Action Step	Habitat Complexity	Work with stakeholders to develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	10	Mendocino Redwood Company, CalFire, NMFS, CDFW	Initial focus should be directed at lower floodplain areas. This strategy would provide benefits to steelhead as well as coho salmon. Due to presence of some infrastructure in the area, the plan should carefully evaluate potential impacts of wood mobilization during high flow events.
CotC-NCSW-6.1.1.7	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	20	Mendocino Redwood Company	NMFS programmatic biological opinion with the Corps and NOAA RC should be used to minimize permitting delays.
CotC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-7.1.1	Recovery Action	Riparian	Improve riparian conditions				
CotC-NCSW-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	25	Mendocino Redwood, Private Landowners, CDFW, NMFS, CalFire	
CotC-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	100	Mendocino Redwood, Private Landowners	Most of the watershed is in timber management so a large portion of this cost will be absorbed into ongoing operations. However, this practice would have major benefits if implemented in the lower floodplain where numerous small landowners live. Riparian vegetation in these areas have been heavily impacted and it is likely costs will be proportionately greater than in the upper portions of the watershed.
CotC-NCSW-7.1.1.3	Action Step	Riparian	Plant native vegetation in Cottoneva Creek to promote streamside shade.	2	20	Mendocino Redwood, Private Landowners, CDFW, NMFS, CalFire	
CotC-NCSW-7.1.1.4	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	3	100	Mendocino Redwood Company	
CotC-NCSW-7.1.1.5	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	Mendocino Redwood Company	
CotC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
CotC-NCSW-8.1.1.1	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFW, NMFS, NRCS, RWQCB, USACE, USFWS	
CotC-NCSW-8.1.1.2	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	30	CalFire, CDFW, County of Mendocino, Mendocino Redwood Company, NRCS, RWQCB	
CotC-NCSW-11.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**				
CotC-NCSW-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity				
CotC-NCSW-11.1.1.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	2	25	CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-11.1.1.2	Action Step	Viability	Use standardized watershed assessments (Coastal Monitoring Plan) within sub-watersheds not previously evaluated in MRC's 2005 effort.	2	10	CalFire, CalTrans, CDFW, Mendocino Redwood Company, NMFS, Private Landowners	
CotC-NCSW-11.1.1.3	Action Step	Viability	Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.	3	20	CDFW, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-15.1	**Objective**	**Fire/Fuel Management**	**Address other natural or manmade factors affecting the species continued existence**				
CotC-NCSW-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction and prescribed fire techniques to minimize sediment impacts to various steelhead life stages.	2	100	CalFire, Mendocino Redwood Company	This recommendation should be considered a standard practice. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities.
CotC-NCSW-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Mendocino Redwood Company	
CotC-NCSW-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CotC-NCSW-15.1.2.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams.	2	100	CalFire, Mendocino Redwood Company	
CotC-NCSW-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-15.2.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)				
CotC-NCSW-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of NC steelhead.	2	100	CalFire	
CotC-NCSW-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should coordinate with resource agencies to minimize impacts to listed salmonids.	3	100	CalFire, CDFW, NMFS, NRCS	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions.
CotC-NCSW-15.2.1.3	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	3	20	CalFire, CDFW, County of Mendocino	
CotC-NCSW-15.2.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to watershed hydrology				
CotC-NCSW-15.2.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire	
CotC-NCSW-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on the biological recovery criteria				
CotC-NCSW-16.1.1.1	Action Step	Fishing/Collecting	Improve CDFW fishing regulations to minimize impacts to adult and juvenile steelhead.	2	2	CDFW	Fishing regulation include a summer fishery without a bag limit which could likely harm listed steelhead juveniles. References to hatchery trout (which are not planted in the watershed) should be removed from regulations so as to not inadvertently encourage fishing for a resource which is not present in the watershed.
CotC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)				
CotC-NCSW-19.1.1.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Road surface treatment options will vary widely on road use, availability of local rock sources and geology.
CotC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to habitat complexity (reduced large wood and/or shelter)				

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

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CotC-NCSW-19.1.2.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
CotC-NCSW-19.1.2.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RPFs	
CotC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire, Mendocino Redwood Company	
CotC-NCSW-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
CotC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
CotC-NCSW-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
CotC-NCSW-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.5.2	Action Step	Logging	Minimize use of winter operations for timber harvest activities.	3	100	CalFire, California Department of Mines and Geology, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Particular emphasis should be placed on avoiding ground based winter operations during the rainy period. Aerial or skyline logging should be considered as preferred alternative to ground based logging, particularly in locations with high erosion hazard ratings or in watersheds of high IP value.
CotC-NCSW-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)				
CotC-NCSW-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-19.1.6.2	Action Step	Logging	Minimize new road construction in riparian zones	3	100	CalFire, Mendocino Redwood Company, Private Landowners	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to CFPRs Class 1 streams with high IP value habitat.
CotC-NCSW-19.1.6.3	Action Step	Logging	See Roads and Railroads for additional recommendations.				
CotC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
CotC-NCSW-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within salmonid areas.	3	20	CalFire, CDFW, Private Landowners, RWQCB	

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
CotC-NCSW-19.2.1.3	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CalFire, Mendocino County, Private Landowners, RWQCB	
CotC-NCSW-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
CotC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	Mendocino Redwood Company	
CotC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	3	10	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
CotC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	50	CalFire, CDFW, Mendocino Redwood Company, RWQCB	
CotC-NCSW-23.1.1.5	Action Step	Roads/Railroads	Use best available management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 2015).	2	10	Mendocino Redwood Company	
CotC-NCSW-23.1.1.6	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.7	Action Step	Roads/Railroads	Limit winter use of unsurfaced (unrocked) roads and recreational trails to decrease fine sediment loads.	2	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.8	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.9	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Mendocino Redwood Company	
CotC-NCSW-23.1.1.10	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	5	Mendocino Redwood Company	
CotC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
CotC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, County of Mendocino, Mendocino Redwood Company, Private Landowners, RWQCB	

Cottaneva Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
CotC-NCSW-23.1.2.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	30	CalFire, CalTrans, Mendocino County, Mendocino Redwood Company, RWQCB, USACE	
CotC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
CotC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in current and historical habitats.	3	10	CalFire, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, Mendocino Redwood Company, Private Landowners, RWQCB	
CotC-NCSW-23.2.1.3	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Geological Survey, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	
CotC-NCSW-23.2.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	CalFire, Mendocino Redwood Company, Private Landowners	
CotC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
CotC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to hydrology (impaired water flow)				
CotC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact steelhead.	2	10	CalFire, CalTrans, CDFW, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RPFs, RWQCB, SWRCB	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
CotC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	1	20	CDFW, Private Landowners, SWRCB	
CotC-NCSW-24.1.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonid recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of steelhead (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners	
CotC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
CotC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, California Geological Survey, CalTrans, CDFW, Mendocino County, Mendocino Redwood Company, Private Landowners, RPFs, RWQCB	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat				
PudC-NCSW-1.1.1.1	Action Step	Estuary	Evaluate Pudding Creek impoundment and its contribution/effect to salmonid survival (CDFG 2004).	1	5	CDFW, Lyme Timber, NMFS	The impoundment at Pudding Creek may function as winter habitat for steelhead and possibly as summer rearing habitat at the upper end of the impoundment. Water quality near the dam is often very poor during the summer/fall low flow period. Evaluation should include a component to assess native and exotic predators and determine if levels of predation are detrimental to viability targets. Evaluation should include potential benefits/detriments to tidewater goby, salmonids, and sculpin movement. Evaluation should include potential impacts to emigrating juvenile attempting to move upstream in the estuarine reach, description of the significance of various impacts, and whether the estuary promotes conditions suitable to delayed migration (and possible missing year class benefits).
PudC-NCSW-1.1.1.2	Action Step	Estuary	Provide passage under Highway 1 to the impoundment at Ocean Lake Mobile Home Park.	3	5	CalTrans, CDFW, Mendocino County	
PudC-NCSW-1.1.2	Recovery Action	Estuary	Increase and enhance habitat complexity features				
PudC-NCSW-1.1.2.1	Action Step	Estuary	Evaluate feasibility and benefits of repairing the dam at Highway 1 as appropriate to maintain over wintering habitat in the estuary (CDFG 2004).	3	10	CA Coastal Commission, Georgia-Pacific, USACE	
PudC-NCSW-1.1.2.2	Action Step	Estuary	Repair of the dam should based on the results of the evaluation study and only if benefits are found to outweigh the detriments to the Pudding Creek coho salmon and steelhead population. If evaluation study concludes the dam does not facilitate improved rearing conditions compared to an unimpaired estuary for coho salmon and steelhead, the dam should be removed, and the estuary restored to historical conditions.	3	10	CA Coastal Commission, USACE, CDFW, NMFS	
PudC-NCSW-1.1.3	Recovery Action	Estuary	Reduce toxicity and pollutants				
PudC-NCSW-1.1.3.1	Action Step	Estuary	Minimize potential impacts of water drafting from the Pudding Creek impoundment.	3	100	CDFW, City of Fort Bragg, Georgia-Pacific, SWRCB	The water right holder should evaluate the potential impacts of their water diversion to rearing juvenile salmonids. This will only likely need to occur if future diversions are markedly increased over current diversions.
PudC-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
PudC-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Lyme Timber, NOAA RC, Private Landowners	
PudC-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	20	CalFire, Lyme Timber	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-2.1.1.3	Action Step	Floodplain Connectivity	Evaluate channel restoration opportunities in the Little Valley subwatershed and evaluate potential benefits to juvenile rearing habitats.	2	7	CDFW, Lyme Timber, NOAA RC, RWQCB, Trout Unlimited	The evaluation should consider all available historical documentation and include input from geomorphologists and restoration experts. The evaluation should include a series of recommendation to restore channel complexity in Little Valley if restoration is determined to have a net benefit to juvenile rearing condition and quantity. Water extraction from Little Valley should also be evaluated and compliance with State Water Law determined. Campbell Timberland Management (now Lyme Timber) has initiated some beneficial "passive" restoration efforts in Little Valley a number of years ago. These efforts have consisted of removing all cattle and ceasing agricultural activities in the floodplain and terrace. The grassland meadows are no longer mowed in an effort to allow riparian vegetation to recolonize the riparian terrace and valley. According to Campbell's analysis of historical aerial photography, the entire Little Valley Creek stream channel was ditched and straightened in the 1950s/1960s. Most sinuous reaches were bypassed but can still be observed in present aerial photos.
PudC-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency				
PudC-NCSW-6.1.1.1	Action Step	Habitat Complexity	Implement a large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).	2	5	CDFW, Lyme Timber, Trout Unlimited	It is anticipated that significant cost savings (and ecological benefits) would be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used over engineered structures. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the watershed was allowed to stay in place. These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity and shelter values in potential rearing and migration reaches. Some large woody debris supplementation has already occurred in the watershed.
PudC-NCSW-6.1.1.2	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CDFW, Lyme Timber, RWQCB, USACE	Evaluate road relocation as an option prior to initiating stream bank stabilization in Pudding Creek watershed. This recommendation should be standard practice for current or future stream bank protection projects.
PudC-NCSW-6.1.1.3	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter for juveniles and smolts.	3	100	CDFW, Lyme Timber, NMFS	
PudC-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve shelter and percent primary pools				
PudC-NCSW-6.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	20	CDFW, Lyme Timber, Private Landowners	
PudC-NCSW-6.1.2.2	Action Step	Habitat Complexity	Protect existing riparian areas to maintain LWD supply and canopy.	3	20	CDFW, Lyme Timber, NMFS, Private Landowners	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

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PudC-NCSW-6.1.2.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	100	CDFW, Lyme Timber, NMFS, Private Landowners	
PudC-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-7.1.1	Recovery Action	Riparian	Improve tree diameter				
PudC-NCSW-7.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Lyme Timber,	Historical logging practices effectively removed all of the original conifer overstory (principally redwood) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas.
PudC-NCSW-7.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CDFW, Lyme Timber	Most of the riparian areas along mainstem Pudding Creek are under forest management and do not require replanting. However, if restoration of the Little Valley is anticipated, efforts should be directed at replanting the areas along riparian corridors in Little Valley. Little Valley was cleared for agricultural purposes and cattle grazing. Currently, cattle grazing is a minor land use in the area.
PudC-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
PudC-NCSW-8.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Lyme Timber, Private Landowners, RWQCB	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels.
PudC-NCSW-8.1.1.2	Action Step	Sediment	Decommission Slaughterhouse Gulch riparian road.	3	10	CalFire, California Geological Survey, Lyme Timber, RWQCB	Slaughterhouse Gulch was identified as IP-km (lower value) and it is currently a subwatershed where spawning occurs. However, juvenile rearing is unlikely in all but the wettest water years.
PudC-NCSW-8.1.1.3	Action Step	Sediment	Evaluate all roads and skid trails throughout the winter period on private and public lands.	2	100	CDFW, NMFS, Private Landowners, RWQCB	
PudC-NCSW-8.1.1.4	Action Step	Sediment	Permitting agencies should evaluate all authorized erosion control measures during the winter period.	2	60	CalFire, CDFW, RWQCB	

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

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PudC-NCSW-11.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**				
PudC-NCSW-11.1.1	Recovery Action	Viability	Increase spawner density				
PudC-NCSW-11.1.1.1	Action Step	Viability	Continue ongoing life cycle monitoring station at Pudding Creek dam (CDFG 2004). Establish consistent reporting methods to ensure ESU-wide consistency.	1	10	CDFW, Lyme Timber, NMFS, Trout Unlimited	
PudC-NCSW-11.1.1.2	Action Step	Viability	Re-evaluate spawner density targets pending completion of Little Valley habitat suitability report.	3	10	NMFS	
PudC-NCSW-11.1.1.3	Action Step	Viability	Continue juvenile monitoring originally initiated by CDFW in 1980's near the Slaughterhouse Gulch confluence.	2	10	CDFW, Lyme Timber	
PudC-NCSW-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)				
PudC-NCSW-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Lyme Timber	Timber harvest remains a threat to salmonid habitat in Pudding Creek watershed, but at diminished levels compared to historical practices. Even with application of new California Forest Practice Rules this threat is anticipated to continue.
PudC-NCSW-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
PudC-NCSW-19.1.2.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Lyme Timber	
PudC-NCSW-19.1.2.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Lyme Timber	
PudC-NCSW-19.1.2.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, Lyme Timber	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identify areas for prioritization.
PudC-NCSW-19.1.3	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure				
PudC-NCSW-19.1.3.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Lyme Timber	
PudC-NCSW-19.1.4	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
PudC-NCSW-19.1.4.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Lyme Timber	
PudC-NCSW-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**				
PudC-NCSW-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
PudC-NCSW-19.2.1.1	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	CalFire, Lyme Timber	Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
PudC-NCSW-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CDFW, Mendocino County, RWQCB, SWRCB	
PudC-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 2015).	2	100	CalFire, Lyme Timber, Private Landowners	Legacy roads from past logging activity continue to impact Pudding Creek watershed.
PudC-NCSW-23.1.1.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Lyme Timber	Many roads in the watershed have inside ditches.
PudC-NCSW-23.1.1.3	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Lyme Timber, Private Landowners	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct an assessment of number and extent of dissipaters to determine cost for upgrade.
PudC-NCSW-23.1.1.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Lyme Timber, Private Landowners	Sediment traps will require a significant maintenance commitment.
PudC-NCSW-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration				
PudC-NCSW-23.1.2.1	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	3	100	CalFire, Lyme Timber, Private Landowners	
PudC-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
PudC-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
PudC-NCSW-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Lyme Timber, Private Landowners	This action is part of ongoing road maintenance and should be directed at the entire road network.
PudC-NCSW-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Lyme Timber, County, Mendocino Redwood Company, Private Landowners	Due to proximity of Fort Bragg to Pudding Creek, unauthorized trail use by off road vehicles is a common occurrence. Implement measures to ensure Sherwood Ridge Road remains closed during the winter period. The Noyo Watershed Alliance has worked to maintain winter closures. Ongoing management practices in the watershed include maintenance of existing gate and other forms of road closure.
PudC-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
PudC-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
PudC-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies.	3	10	CDFW, Mendocino County, RWQCB, SWRCB	
PudC-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact salmonids. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CalFire, CDFW, Lyme Timber, RWQCB, SWRCB	Few if any water diversions are present along mainstem Pudding Creek aside from the diversion lower in the watershed at the Pudding Creek dam.
PudC-NCSW-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration				
PudC-NCSW-24.1.2.1	Action Step	Severe Weather Patterns	Ensure Pudding Creek fish ladder is performing sufficiently to pass migrating fish during drought conditions.	2	20	CDFW, Lyme Timber, Georgia-Pacific	
PudC-NCSW-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment and/or toxicity)				

Pudding Creek, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
PudC-NCSW-24.1.3.1	Action Step	Severe Weather Patterns	Work with stakeholders to ensure patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalFire, Lyme Timber	
PudC-NCSW-24.1.3.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, Lyme Timber	Conduct an assessment of high-risk shallow-seeded landslide areas to determine extent and protective measures.

Albion River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
AlbnR-NCSW-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat				
AlbnR-NCSW-1.1.1.1	Action Step	Estuary	Remove riprap and gabion rock within the estuary and restore with a bioengineering solution.	2	5	California Coastal Conservancy, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-1.1.1.2	Action Step	Estuary	Identify key locations to install LWD structures and improve shelter within the estuary.	2	10	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	
AlbnR-NCSW-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity				
AlbnR-NCSW-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	
AlbnR-NCSW-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	
AlbnR-NCSW-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)				
AlbnR-NCSW-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the Comptche area to minimize effects to the North Fork Albion and mainstem Albion.	2	5	NOAA RC, NRCS, Private Landowners, SWRCB	
AlbnR-NCSW-3.1.1.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	30	CDFW, NOAA RC, Private Landowners, SWRCB	
AlbnR-NCSW-3.1.1.3	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	100	CDFW Law Enforcement, NMFS OLE, SWRCB	
AlbnR-NCSW-3.1.1.4	Action Step	Hydrology	Install streamflow gaging devices to determine the level of impairment to natural flow. Determine sites appropriate for gaging below Comptche on the mainstem and the North Fork.	3	10	CDFW, Mendocino Redwood Company, NMFS, Private Landowners, USGS	
AlbnR-NCSW-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers				
AlbnR-NCSW-5.1.1.1	Action Step	Passage	Investigate the feasibility of removing the earthen dam on Marsh Creek to increase habitat availability for salmonids.	3	2	CDFW, NOAA RC, Private Landowners	
AlbnR-NCSW-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.				
AlbnR-NCSW-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	2	2	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-6.1.1.2	Action Step	Habitat Complexity	Utilize information developed on LWD demand and recruitment potential in the MRC Albion Watershed Analysis to target areas lacking LWD for remediation.	2	2	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking. Consider falling existing riparian trees as a method to increase complexity and LWD frequencies.	3	50	CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	
AlbnR-NCSW-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratio (hydraulic diversity)				

Albion River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
AlbnR-NCSW-6.1.2.1	Action Step	Habitat Complexity	Increase the frequency of LWD to rate as Good (over 75% of IP-km within the watershed).	2	20	CDFW, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners	
AlbnR-NCSW-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-7.1.1	Recovery Action	Riparian	Improve tree diameter				
AlbnR-NCSW-7.1.1.1	Action Step	Riparian	Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for salmonids (CDFG 2004). Focus efforts on the Albion River and tributaries in the eastern part of the watershed.	2	20	CDFW, Private Landowners	
AlbnR-NCSW-8.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-8.1.1	Recovery Action	Sediment	Improve instream gravel quality				
AlbnR-NCSW-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings that are identified in the MRC Albion River Watershed Analysis or other credible assessments.	2	10	CDFW, Mendocino County, NOAA RC, Private Landowners	
AlbnR-NCSW-8.1.1.2	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFW, or CalFire.	2	20	CDFW, NOAA RC, NRCS, RWQCB	
AlbnR-NCSW-11.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**				
AlbnR-NCSW-11.1.1	Recovery Action	Viability	Increase spatial structure and diversity				
AlbnR-NCSW-11.1.1.1	Action Step	Viability	Monitor the response of population abundance and key habitat attributes to recovery efforts across the watershed.	3	24	CDFW, Mendocino Redwood Company, NMFS, Private Landowners	
AlbnR-NCSW-11.1.1.2	Action Step	Viability	Conduct surveys in areas of the mainstem Albion, South Fork Albion, and the North Fork Albion, and selected tributaries.	2	20	CDFW, Mendocino Redwood Company, NMFS	
AlbnR-NCSW-11.1.1.3	Action Step	Viability	Support a community based salmonid monitoring program in the Albion watershed.	3	10	CDFW, NOAA RC, Private Landowners, Public	
AlbnR-NCSW-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**				
AlbnR-NCSW-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance				
AlbnR-NCSW-19.1.1.1	Action Step	Logging	Work with logging companies and private landowners to reduce the percent acres of the watershed harvested to less than 25 percent in a ten year period.	3	20	CalFire, CDFW, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB	
AlbnR-NCSW-19.1.1.2	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	60	CalFire, CDFW, Mendocino County, NMFS, Private Landowners	
AlbnR-NCSW-19.1.1.3	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	60	CalFire, Mendocino County, Mendocino Redwood Company, NMFS	
AlbnR-NCSW-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				
AlbnR-NCSW-23.1.1.1	Action Step	Roads/Railroads	Assess and implement road upgrades on Docker Hill Road along the North Fork Albion River.	2	10	Lyme Redwood Company, CDFW, Mendocino County, Mendocino Redwood Company, NOAA RC, Private Landowners	
AlbnR-NCSW-23.1.1.2	Action Step	Roads/Railroads	Conduct road and sediment assessment on the Comptche Ukiah Road segment that drains to the Albion Watershed.	2	5	Mendocino County Department of Public Works, NOAA RC	
AlbnR-NCSW-23.1.1.3	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB	
AlbnR-NCSW-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**				
AlbnR-NCSW-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)				

Albion River, Northern California Steelhead (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Comment
AlbnR-NCSW-23.2.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
AlbnR-NCSW-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	5	CDFW, NRCS, Private Landowners, RCD	
AlbnR-NCSW-23.2.1.3	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 2015).	2	20	Mendocino County, NOAA RC, NRCS, Private Landowners, RCD	
AlbnR-NCSW-23.2.1.4	Action Step	Roads/Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources at high priority areas.	2	15	CDFW, Mendocino Redwood Company, Private Landowners, RWQCB	
AlbnR-NCSW-24.1	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species continued existence**				
AlbnR-NCSW-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)				
AlbnR-NCSW-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users in the Comptche area to minimize depletion of summer base flows during droughts. Provide restoration funding for alternatives such as storage tanks and rainwater harvest to rural residential residents.	2	10	Mendocino County, NOAA RC, Private Landowners, Trout Unlimited	
AlbnR-NCSW-24.1.1.2	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	2	20	CDFW, Private Landowners, SWRCB	
AlbnR-NCSW-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**				
AlbnR-NCSW-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to watershed hydrology				
AlbnR-NCSW-25.1.1.1	Action Step	Water Diversion/Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for steelhead.	3	10	CDFW	
AlbnR-NCSW-25.1.1.2	Action Step	Water Diversion/Impoundment	Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow	3	20	CDFW	
AlbnR-NCSW-25.1.1.3	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	2	10	CDFW, SWRCB	
AlbnR-NCSW-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**				
AlbnR-NCSW-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)				
AlbnR-NCSW-25.2.1.1	Action Step	Water Diversion/Impoundment	Evaluate and monitor the Lake and Streambed Alteration Agreement program compliance related to all water diversions (CDFG 2004).	2	5	CDFW, NMFS	
AlbnR-NCSW-25.2.1.2	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	10	CDFW, County of Mendocino, NMFS, NMFS OLE, SWRCB	
AlbnR-NCSW-25.2.1.3	Action Step	Water Diversion/Impoundment	Support the SWRCB in regulating groundwater.	3	100	CDFW, Mendocino County, NMFS, SWRCB	
AlbnR-NCSW-25.2.1.4	Action Step	Water Diversion/Impoundment	Promote conjunctive use of water with water projects whenever possible.	2	10	CDFW, County of Mendocino, NMFS, RCD, SWRCB	