

# Lagunitas Creek



Location	• Marin County
Watershed Area	• 109.0 Square Miles
Potential Habitat	• 64.5 Stream Miles
Vegetation	• 22% Conifer, 28% Riparian or Montane Forest, 35% Grassland
Erodability	• Moderate
Ownership Patterns	• 52% Private, 48% Public
Dominant Land Uses	• Water Supply, Agriculture, Rural Residential
Housing Density	• Moderate
TMDL Pollutants	• Sediment, Nutrients, Pathogens



Giacomini Wetlands Project  
Photo provided by Robert Campbell



**Lagunitas Creek Coho Salmon:** Persistent – Moderate Abundance

### Recovery Goals

- ✓ Establish life cycle monitoring, including operation of outmigrant traps
- ✓ Expand fish and habitat monitoring programs, including the estuary

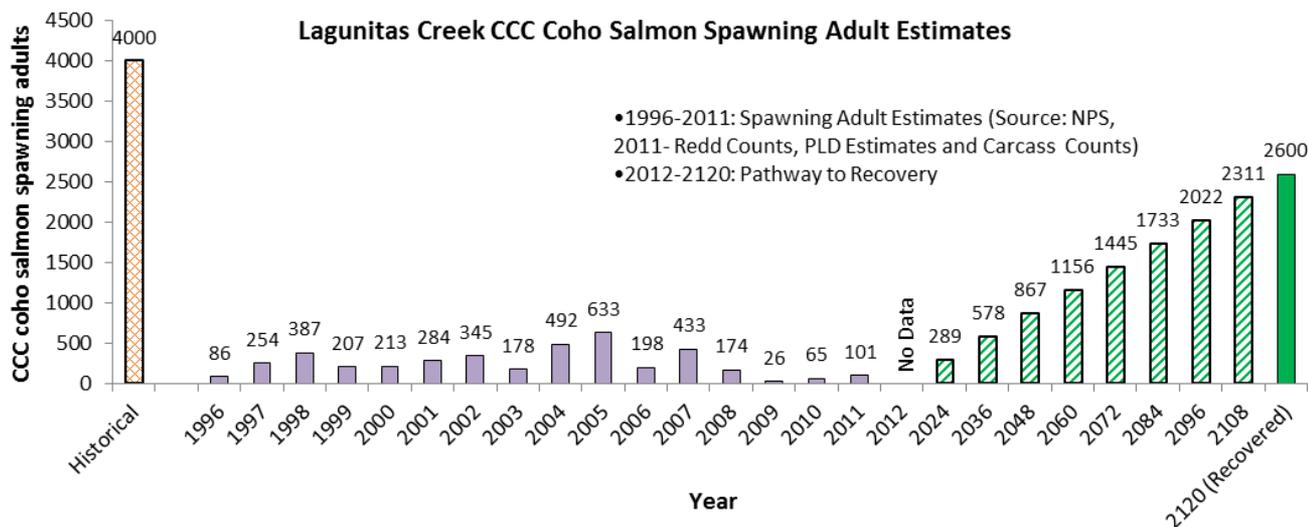
## Lagunitas Creek Adult Spawner Targets

**Downlisting to Threatened**  
**1,300**

**Recovery**  
**2,600**

**STEELHEAD: YES**  
**CHINOOK SALMON: NO**

### Lagunitas Creek CCC Coho Salmon Spawning Adult Estimates



# Lagunitas Creek

Potential Habitat: 64.5 miles  
Recovery Target: 2,600 Spawning Adult Coho Salmon

## Current Instream, Watershed and Population Conditions



## Preventing Extinction & Improving Conditions

### Priority 1: Immediate Restoration Actions

- Conduct a salmonid limiting factors assessment in Keys Estero and Tomales Bay
- Continue riparian protection and enhancement and sediment control projects
- Restore channel complexity and increase pool frequency; retain, recruit and actively input large wood into stream
- Develop cooperative projects with private landowners to conserve summer flows
- Develop floodplain enhancement in modified and incised channels
- Restore fish passage throughout the watershed for all life stages

### Priority 2 & 3: Long-Term Restoration Actions

- Evaluate alterations to diking and leveeing to increase shoreline complexity and natural function
- Evaluate undeveloped and developed floodplain property for potential function and acquisition potential
- Evaluate potential of modification to the Olema Ranch Campground to improve floodplain function
- Implement Marin County Flood Zone activities for the improvement of coho salmon habitat
- Fully implement practices consistent with the SFRWQCB pathogen and sediment TMDLs.

## Recovery Partners



## Future Threats



## Reducing Future Threats

### Priority 1: Immediate Threat Abatement Actions

- Provide funding assistance to landowners willing to fence livestock out of riparian and other sensitive areas
- Implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate sediment sources
- Avoid reductions of flow <8 cfs below major dams in the summer
- Provide consistent fishery flows below Peter's Dam by improving gauging at SP Taylor Park
- Discourage the transfer of water from Nicasio Reservoir to Kent Lake which could degrade water quality releases into Lagunitas Creek
- Discourage the proposed water diversion through Groundwater Well by North Marin Water District

### Priority 2 & 3: Long-Term Threat Abatement Actions

- Promote bio-engineering solutions as appropriate
- Implement rotational grazing strategies
- Conserve and manage forestlands for older forest stages
- Address failing or inadequate septic systems in rural areas
- Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input
- Develop riffles and/or spawning channels below Kent Dam to increase spawner distribution and success



Streambank restoration on Walker Creek  
Photo by Bob Coey, NMFS

## Conservation Highlights

- Extensive monitoring activities are conducted in Lagunitas by Marin Municipal Water District, SPAWN, and the National Park Service. Lagunitas has one of the most robust data sets for CCC coho salmon.
- The County of Marin and the NPS have remediated several passage barriers in the Lagunitas Creek watershed.
- SPAWN is also involved in sediment remediation activities.

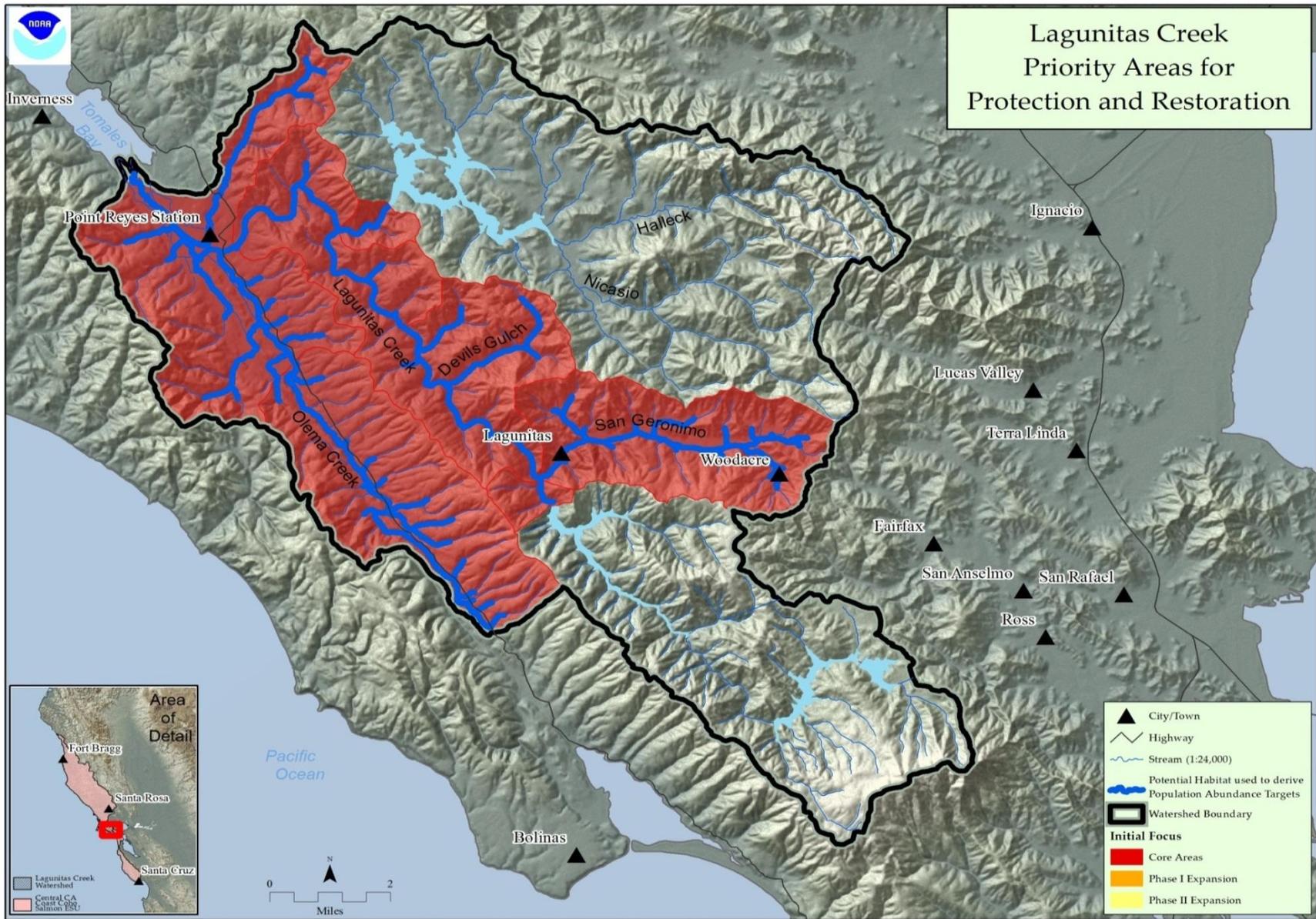


Figure 1: Map of Lagunitas Creek

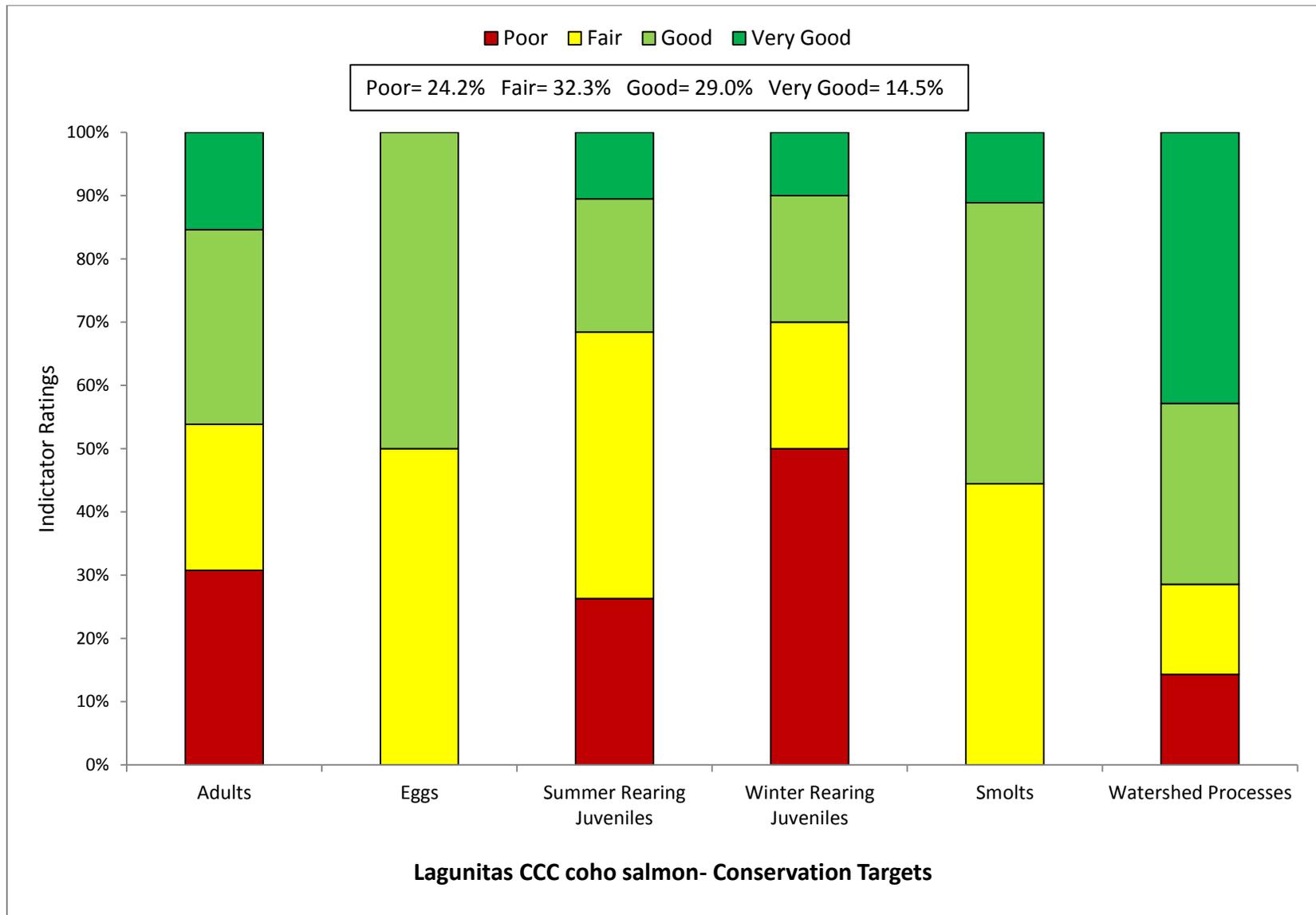


Figure 2: Viability Results by Lifestage

**Table 1: CAP Viability Results ~ Lagunitas Creek**

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<b>2.99 Key Pieces/100m</b>	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<b>&lt;1 to 1.3 Key Pieces/100m</b>	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	<b>&lt;50% of streams/ IP-km (&gt;30% Pools; &gt;20% Riffles)</b>	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	<b>50% to 74% of streams/ IP-km (&gt;80 stream average)</b>	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	<b>Risk Factor Score =33</b>	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	<b>75% of IP-km to 90% of IP-km accessible</b>	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	<b>91.88 of IP-km accessible</b>	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	<b>0% Class 5 &amp; 6 across IP-km</b>	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	<b>na</b>	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	<b>75% of IP-km to 90% of IP-km accessible</b>	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	<b>&lt;50% Response Reach Connectivity</b>	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	<b>No Acute or Chronic</b>	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	<b>75 to 90% of streams/ IP-km maintains severity score of 3 or lower</b>	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	<b>&gt;1 spawner per IP-km to &lt; low risk spawner density per Spence (2008)</b>	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	<b>Risk Factor Score =42</b>	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	<b>Risk Factor Score =58</b>	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	12-14% (0.85mm) and <30% (6.4mm)	Good	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	50% streams 46% IP-km (>50% stream average scores of 1 & 2)	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	Impaired but functioning	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	2.99 Key Pieces/100m	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 to 1.3 Key Pieces/100m	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	50% streams 73% IP	Fair	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	0% streams 0% IP-km (>80 stream average)	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	Risk Factor Score =67	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score =50	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	2.7 Diversions/10 IP-km	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	75% of IP-km to 90% of IP-km accessible	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	91.88 of IP-km accessible	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	50% to 74% of streams/ IP-km (>85% average stream canopy)	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	0% Class 5 & 6 across IP-km	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	na	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	50% streams 46% IP-km (>50% stream average scores of 1 & 2)	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	50 to 74% IP-km (<16 C MWMT)	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	No Acute or Chronic	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	>90% of streams/ IP-km maintains severity score of 3 or lower	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	<0.2 fish/meter^2	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	75-90% of Historical Range	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	2.99 Key Pieces/100m	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	<1 to 1.3 Key Pieces/100m	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-km (>30% Pools; >20% Riffles)	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	0% streams 0% IP-km (>80 stream average)	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	91.88 of IP-km accessible	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	0% Class 5 & 6 across IP-km	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	na	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	50% streams 46% IP-km (>50% stream average scores of 1 & 2)	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	No Acute or Chronic	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	75 to 90% of streams/ IP-km maintains severity score of 3 or lower	Good	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	<b>Impaired but functioning</b>	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	<b>50% to 74% of streams/ IP-km (&gt;80 stream average)</b>	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	<b>2.7 Diversions/10 IP-km</b>	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	<b>Risk Factor Score =33</b>	Very Good	TRT Spence (2008)	NMFS Flow Protocol Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	<b>75% of IP-km to 90% of IP-km accessible</b>	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	<b>75-90% IP-km (&gt;6 and &lt;16 C)</b>	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	<b>No Acute or Chronic</b>	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	<b>75 to 90% of streams/ IP-km maintains severity score of 3 or lower</b>	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	<b>Smolt abundance which produces moderate risk spawner density per Spence (2008)</b>	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	<b>0.432% of Watershed in Impervious Surfaces</b>	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	<b>0.33% of Watershed in Agriculture</b>	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	<b>&lt;15% of Watershed in Timber Harvest</b>	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	<b>9% of watershed &gt;1 unit/20 acres</b>	Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	<b>25-50% Historical Species Composition</b>	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	<b>2.2 Miles/Square Mile</b>	Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	<b>2.9 Miles/Square Mile</b>	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

**Table 2: CAP Threats Results ~ Lagunitas Creek**

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	Medium	Medium	Medium	Low	High	Medium
2	Channel Modification	High	Medium	Medium	High	Medium	High	High
3	Disease, Predation and Competition	Low	-	Medium	Medium	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Medium	Low	Medium	Medium
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	Low	-	-	-	-	-	Low
7	Livestock Farming and Ranching	Medium	Medium	High	Medium	Medium	Medium	High
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Low	Medium	Medium
9	Mining	Low	Low	Medium	Medium	Low	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Medium	Low	Low	Medium
11	Residential and Commercial Development	Medium	Medium	High	Very High	Medium	Very High	Very High
12	Roads and Railroads	Medium	High	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	High	Very High	Medium	High	High
14	Water Diversion and Impoundments	Medium	Low	Very High	Medium	Medium	Medium	High
Threat Status for Targets and Project		High	High	Very High	Very High	Medium	Very High	Very High

# Central CA Coast Coho Salmon ~ Lagunitas Creek

## ACTIONS FOR RESTORING HABITATS

### 1. Restoration- Estuary

1.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.1.1. **Recovery Action:** Improve estuarine freshwater inflow

1.1.1.1. **Action Step:** Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary

1.1.1.2. **Action Step:** Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen)

1.1.2. **Recovery Action:** Reduce extent of estuarine shoreline development

1.1.2.1. **Action Step:** Evaluate alterations to diking and leveeing which has reduced shoreline complexity and natural function

1.1.2.2. **Action Step:** Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements

1.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.2.1. **Recovery Action:** Increase the extent of estuarine habitat

1.2.1.1. **Action Step:** Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary

1.2.1.2. **Action Step:** Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay (CDFG 2004).

1.2.1.3. **Action Step:** Per a completed limiting factors assessment, and utilizing adaptive management guidelines, develop restoration projects in areas which have high value physical and chemical properties for rearing salmonids

1.2.2. **Recovery Action:** Increase and enhance habitat complexity features

1.2.2.1. **Action Step:** Restore estuarine wetlands and sloughs, develop floodplain and backwater habitat projects, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.

### 2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Evaluate potential acquisition of easements to protect floodplain function on lower Lagunitas Creek.

- 2.1.1.2. **Action Step:** Where existing infrastructure exists within historical floodplains or offchannel habitats, and where restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.
  - 2.1.1.3. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and acquisition potential.
  - 2.1.1.4. **Action Step:** Evaluate potential of modification to the Olema Ranch Campground to accommodate improved floodplain function on Olema Creek.
  - 2.1.1.5. **Action Step:** Evaluate existing road and transportation networks and identify measures to reduce interaction of transportation infrastructure on tributary, mainstem and estuarine floodplain process.
  - 2.1.1.6. **Action Step:** Implement Marin County Flood Zone activities for the improvement of coho salmon habitat
- 2.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
- 2.2.1. **Recovery Action:** Increase and enhance velocity refuge
    - 2.2.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.
    - 2.2.1.2. **Action Step:** Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).
    - 2.2.1.3. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.
    - 2.2.1.4. **Action Step:** Evaluate the acquisition of easements for the improvement of refuge habitat
  - 2.2.2. **Recovery Action:** Rehabilitate and enhance floodplain connectivity
    - 2.2.2.1. **Action Step:** Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.
    - 2.2.2.2. **Action Step:** Target habitat restoration and enhancement projects that will function between winter base flow and flood stage.
    - 2.2.2.3. **Action Step:** Identify areas where floodplain connectivity can be re-established in low gradient response reaches (e.g. Olema Ranch Campground). Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity, develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats.

### 3. [Restoration- Habitat Complexity](#)

- 3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
- 3.1.1. **Recovery Action:** Improve pool shelter rating
- 3.1.1.1. **Action Step:** Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles
- 3.1.1.2. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) by installing multiple log structures in select reaches of Larsen, San Geronimo, Woodacre, and Olema Creeks
- 3.1.1.3. **Action Step:** Focus efforts to restore channel complexity in the Tocaloma reach of the Lagunitas mainstem to improve smolt survival.
- 3.1.2. **Recovery Action:** Increase frequency of primary pools
- 3.1.2.1. **Action Step:** Increase pool frequency in 25% of streams within the watershed to improve conditions for adults, and summer/winter juveniles
- 3.1.2.2. **Action Step:** Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Olema, Woodacre and San Geronimo Creeks
- 3.1.2.3. **Action Step:** Hold restoration workshops to specifically focus on restoration techniques that promote winter rearing juvenile habitat complexity in the Tocaloma reach of the lower Lagunitas mainstem. In addition, focus on restoration techniques that specifically address declining pool frequency and shelter ratings for summer rearing juveniles.
- 3.1.2.4. **Action Step:** Analyze whether summertime low-flow pools (perceived to be a limiting factor) are filling up with fine sediment from San Geronimo Creek between flow events that have enough power to scour the pools. This could be examined by surveying selected pools in detail several times a year (long enough to cover several potential scour and fill events), as was conducted in 1981.
- 3.1.3. **Recovery Action:** Improve pool:riffle:flatwater ratio
- 3.1.3.1. **Action Step:** Increase riffle frequency in 25% of streams within the watershed to improve conditions for spawning adults
- 3.1.3.2. **Action Step:** Increase riffle frequency to achieve optimal conditions (20% riffles) by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of San Geronimo Creek
- 3.1.3.3. **Action Step:** In the San Geronimo Creek sub-watershed, continue public outreach and education for private landowners, residents, commercial, public utility and county workers regarding best management practices to control erosion, protect riparian vegetation, retain LWD, and minimize disturbance to coho salmon from domestic animals.
- 3.1.4. **Recovery Action:** Increase large wood frequency

- 3.1.4.1. **Action Step:** Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles
- 3.1.4.2. **Action Step:** Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in select reaches of Olema Creek
- 3.1.4.3. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Larsen, Woodacre, San Geronimo, and Devils Gulch Creeks
- 3.1.4.4. **Action Step:** Expand on the efforts of the Regional Water Quality Control Board and Marin Municipal Water District efforts retain LWD.
- 3.1.4.5. **Action Step:** Install structures with multiple logs and root balls because they are more effective than structures with only one log.

3.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

3.2.1. **Recovery Action:** Improve habitat complexity

- 3.2.1.1. **Action Step:** Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations

#### 4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

- 4.1.1.1. **Action Step:** 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.
- 4.1.1.2. **Action Step:** 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 §1707 (CDFG 2004).

4.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.2.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

- 4.2.1.1. **Action Step:** Develop rearing habitat curves to identify optimal base flow conditions
- 4.2.1.2. **Action Step:** Continue to support efforts to model flows and water usage
- 4.2.1.3. **Action Step:** Develop cooperative projects with private landowners to conserve summer flows

4.2.2. **Recovery Action:** Minimize redd scour

- 4.2.2.1. **Action Step:** Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries including San Geronimo Creek
- 4.2.2.2. **Action Step:** Manage riparian areas for their site potential composition and structure.

- 4.2.2.3. **Action Step:** Improve spawning success and egg survival through improving channel configuration, sediment dynamics, and channel roughness and stability

## 5. Restoration- Landscape Patterns

- 5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

- 5.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

- 5.1.1.1. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.

- 5.1.1.2. **Action Step:** Conserve water resources by implementing Water Diversion Recommendations

- 5.1.2. **Recovery Action:** Prevent increased landscape disturbance

- 5.1.2.1. **Action Step:** Decommission and or re-locate riparian roads upslope to achieve desirable riparian road density criteria (<0.1 to 0.4 Miles/Square Mile)

- 5.1.2.2. **Action Step:** Improve sediment transport by implementing Road Recommendations

- 5.1.2.3. **Action Step:** Implement DS level recommendations

## 6. Restoration- Passage

- 6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

- 6.1.1. **Recovery Action:** Improve access of spawning adults and juveniles

- 6.1.1.1. **Action Step:** Restore fish passage at Roy's Pools to facilitate unimpeded passage for all life stages into the San Geronimo Creek

- 6.1.1.2. **Action Step:** Remove all barriers in the Woodacre, Arroyo, Larsen and Montezuma and San Geronimo subwatersheds

- 6.1.1.3. **Action Step:** Removal all remaining barriers in the Cheda, Devil's Gulch and Olema subwatersheds.

- 6.1.1.4. **Action Step:** Work with MMWD to evaluate alternatives/feasibility to provide passage over Seeger Dam (Nicasio Reservoir).

## 7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

## 8. Restoration- Riparian

- 8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

- 8.1.1. **Recovery Action:** Improve canopy cover

- 8.1.1.1. **Action Step:** Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects on State and Federal park and private lands (e.g., Devil's Gulch).
- 8.1.1.2. **Action Step:** Plant native riparian species and native conifers/hardwoods in the riparian zone within the central portion of the watershed (Olema and lower Lagunitas Creek mainstem) to increase overall tree diameter
- 8.1.1.3. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).

8.1.2. **Recovery Action:** Improve tree diameter

- 8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)
- 8.1.2.2. **Action Step:** Implement the SGVSEP to protect riparian integrity in San Geronimo Creek
- 8.1.2.3. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.

## 9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

- 9.1.1.1. **Action Step:** Reduce embedment levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)
- 9.1.1.2. **Action Step:** Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations
- 9.1.1.3. **Action Step:** Implement recommendations of completed sediment source surveys (See ROADS for specific actions)

## 10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

- 10.1.1.1. **Action Step:** Implement recovery actions where indicators rated poor or fair in high potential value areas.
- 10.1.1.2. **Action Step:** Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions
- 10.1.1.3. **Action Step:** Operation of the Lagunitas life cycle station should continue (Gallagher and Gallagher 2005).

10.1.2. **Recovery Action:** Increase spatial structure and diversity

10.1.2.1. **Action Step:** Continue to work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.2.2. **Action Step:** Annually capture or retain (during rescue efforts) - adequate numbers of fish from streams in Marin County for purposes of broodstock

10.1.2.3. **Action Step:** Utilize captured fish in a within-basin program for an immediate short term augmentation strategy at established facility(s), for release as adults, to avoid near term extinction (within 6 years).

10.1.2.4. **Action Step:** Support operation of outmigrant traps

10.1.3. **Recovery Action:** Increase spawner density

10.1.3.1. **Action Step:** Pursue longer term intervention strategies through establishing a river specific facility if populations do not rebound within six years, to avoid extinction and ensure long-term genetic diversity within the population.

## 11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Determine site-specific recommendations, including incentives, to remedy high temperatures and implement accordingly (CDFG 2004) .

11.1.1.2. **Action Step:** Focus on restoration efforts that deal with riparian canopy, shelter ratings and any other impaired key habitat attribute indicator that relates specifically to instream temperature.

11.1.2. **Recovery Action:** Improve stream water quality conditions

11.1.2.1. **Action Step:** Fully implement practices consistent with the SFRWQCB pathogen and sediment TMDLs.

## THREAT ABATEMENT ACTIONS

### 12. Threat- Agricultural Practices

12.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

12.1.1.1. **Action Step:** Assist in the development and support implementation of sediment TMDL to assure water quality conditions for coho salmon are improved and fine sediment loads are decreased to baseline conditions.

12.1.2. **Recovery Action:** Prevent impairment to riparian species and composition

12.1.2.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

12.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

12.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

12.2.1.1. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels (see Roads for specific actions/areas)

12.2.2. **Recovery Action:** Prevent impairment to riparian

12.2.2.1. **Action Step:** Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

12.2.2.2. **Action Step:** Keep agricultural activities from within 100 feet of the edge of the stream

12.2.3. **Recovery Action:** Prevent impairment to habitat complexity

12.2.3.1. **Action Step:** Avoid the removal of large wood and other shelter components from the stream system

12.2.4. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

12.2.4.1. **Action Step:** Complete Farm Conservation Plans (through the SRCD, NRCS, or Fish Friendly Farming programs) to reduce sediment sources and restore riparian habitat and forest health

12.2.5. **Recovery Action:** Prevent impairment to hydrology

12.2.5.1. **Action Step:** Work with the agricultural community to develop water conservation strategies protective of salmonids while allowing ongoing agricultural land uses (i.e., off-channel storage ponds).

### **13. Threat- Channel Modification**

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment to habitat complexity

13.1.1.1. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.

13.1.1.2. **Action Step:** Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.(Evaluate the Tocaloma reach of the lower Lagunitas mainstem)

13.1.1.3. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.

13.1.1.4. **Action Step:** Implement DS level recommendations

**14. Threat- Disease/Predation/Competition**

No species-specific actions were developed.

**15. Threat- Fire/Fuel Management**

No species-specific actions were developed.

**16. Threat- Fishing/Collecting**

No species-specific actions were developed.

**17. Threat- Hatcheries**

No species-specific actions were developed.

**18. Threat- Livestock**

18.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

18.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

18.1.1.1. **Action Step:** Establish conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.

18.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.2.1.1. **Action Step:** Exclude livestock from riparian areas, specifically on State and Federal Park and private lands (e.g. Devils Gulch).

18.2.1.2. **Action Step:** Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.

18.2.1.3. **Action Step:** Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.

18.2.1.4. **Action Step:** Manage rotational grazing to aid in the reduction of noxious weeds.

18.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

18.2.2.1. **Action Step:** Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.

18.2.2.2. **Action Step:** Implement DS level recommendations

- 18.2.3. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)
- 18.2.3.1. **Action Step:** To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes
- 18.2.3.2. **Action Step:** Where necessary, establish predetermined stream crossings when herding cattle between pastures.
- 18.2.4. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)
- 18.2.4.1. **Action Step:** Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.
- 18.2.4.2. **Action Step:** Aid landowners willing to fence off riparian areas with development of offstream alternative water sources

## 19. [Threat- Logging](#)

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to RIPARIAN

19.1.1.1. **Action Step:** Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations

19.1.1.2. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.1.3. **Action Step:** Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels

19.1.1.4. **Action Step:** Implement DS level recommendations

## 20. [Threat- Mining](#)

No species-specific actions were developed.

## 21. [Threat- Recreation](#)

No species-specific actions were developed.

## 22. [Threat- Residential/Commercial Development](#)

22.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.1.1. **Recovery Action:** Prevent impairment to riparian species and composition

22.1.1.1. **Action Step:** Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating CCC coho salmon.

22.1.1.2. **Action Step:** Support the Marin County Streamside Conservation Area Ordinance. Evaluate current moratorium in San Geronimo Valley for pertinent action items.

22.1.1.3. **Action Step:** Enforce existing building permit programs to minimize unpermitted construction.

- 22.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range
- 22.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)
- 22.2.1.1. **Action Step:** Address failing septic systems in rural areas
- 22.2.1.2. **Action Step:** Improve water quality where necessary by addressing residential and commercial pollutant sources.
- 22.2.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)
- 22.2.2.1. **Action Step:** See WATER DIVERSIONS for specific actions and areas
- 22.2.2.2. **Action Step:** Encourage the use and provide incentives for rooftop water storage and other conservation devices
- 22.2.3. **Recovery Action:** Prevent impairment to riparian species and composition
- 22.2.3.1. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.
- 22.2.3.2. **Action Step:** Encourage FishNet 4C to facilitate instream and riparian restoration and management workshops with a specific focus on problems and opportunities in the Lagunitas Watershed.
- 22.2.3.3. **Action Step:** Work with private landowners to 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.
- 22.2.3.4. **Action Step:** Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.

### 23. Threat- Roads/Railroads

- 23.1. **Objective:** Address the inadequacy of existing regulatory mechanism
- 23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
- 23.1.1.1. **Action Step:** Establish a moratorium on 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.
- 23.1.1.2. **Action Step:** Support the MMWD in their efforts to reduce sedimentation from lands in the Lagunitas Creek watershed. MMWD will also coordinate with the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to make sure that educational materials about non-point source pollution are available to homeowners in the San Geronimo Valley.

23.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.2.1.2. **Action Step:** In the Olema Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources.

23.2.1.3. **Action Step:** In the Lagunitas Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsliping roads, ditch relief culverts, and installing rolling dips.

23.2.1.4. **Action Step:** Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.2.1.5. **Action Step:** Decommission or treat the road sites on the priority list of 20 road sites within the San Geronimo subwatershed based on amount of sediment discharge.

23.2.1.6. **Action Step:** Implement DS level recommendations

23.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.2.2.1. **Action Step:** Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.2.3. **Recovery Action:** Prevent impairment to riparian species and composition

23.2.3.1. **Action Step:** Evaluate the potential of road widening projects (e.g. Sir Francis Drake Rd) on riparian corridors, and discourage encroachment into riparian zone.

## 24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.

24.1.1.2. **Action Step:** Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.

24.1.1.3. **Action Step:** See WATER DIVERSIONS for other specific actions/areas

24.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.2.1. **Recovery Action:** Prevent impairment to hydrology

24.2.1.1. **Action Step:** Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.

24.2.1.2. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

24.2.1.3. **Action Step:** Dedicate appropriate water rights to instream flow in Olema Creek watershed (NPS is currently evaluating opportunities in this watershed).

24.2.1.4. **Action Step:** Evaluate and assess impacts of local groundwater withdrawals in San Geronimo Creek watershed.

24.2.1.5. **Action Step:** Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).

24.2.1.6. **Action Step:** Avoid reductions of flow <8 cfs below major dams in the summer

24.2.1.7. **Action Step:** Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

24.2.1.8. **Action Step:** See DS level Recovery Actions

24.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

24.2.2.1. **Action Step:** Evaluate and implement rainfall capture from impervious surfaces for irrigation use to protect water quality and reduce water demand in summer.

24.2.3. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.2.3.1. **Action Step:** Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas

## 25. [Threat- Water Diversion/Impoundment](#)

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Avoid reductions of flow <8 cfs below major dams in the summer

25.1.1.2. **Action Step:** Provide consistent fishery flows below Peter's Dam by improving gauging at SP Taylor Park

25.1.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.2.1. **Action Step:** Encourage enforcement of SWRCB Order 95-17 (specifically in the warm summer months)

25.1.2.2. **Action Step:** Discourage the transfer of water from Nicasio Reservoir to Kent Lake which could degrade water quality releases into Lagunitas Creek

25.1.2.3. **Action Step:** Discourage the proposed water diversion through Groundwater Well by North Marin Water District which could adversely affect stream flows

25.1.3. **Recovery Action:** Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)

25.1.3.1. **Action Step:** Develop riffles and/or spawning channels below Kent Dam to increase spawner distribution and success

25.1.4. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.4.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Minimize take attributable to diversion of stream flow through alternatives such as: the operation of off-stream reservoirs, development of infrastructure necessary for conjunctive use of stream flow, and use of reclaimed water.

25.2.1.2. **Action Step:** Implement DS level recommendations.

## **26. [Threat- Watershed Process](#)**

No species-specific actions were developed.

**Table 3: Implementation Schedule ~ Lagunitas Creek**

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-1.1	Objective	Estuary	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-1.1.1	Recovery Action	Estuary	Improve estuarine freshwater inflow										
LaC-CCC-1.1.1.1	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	2	10	RWQCB, SWRCB, Water Agencies	7.50	7.50				15	Cost for continuous water quality monitoring gauges estimated at \$5,000/unit. Assume minimum of 3 for lagoon. Cost does not account for maintenance or data management.
LaC-CCC-1.1.1.2	Action Step	Estuary	Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen)	2	12	CDFG, County Planning, NMFS, RWQCB, Tomales Bay Watershed Council, USACE						TBD	
LaC-CCC-1.1.2	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										
LaC-CCC-1.1.2.1	Action Step	Estuary	Evaluate alterations to diking and leveeing which has reduced shoreline complexity and natural function	3	10	California Coastal Conservancy, CDFG, County Planning, NMFS HCD, Tomales Bay Watershed Council, USACE	137.00	137.00				274	Cost based on estuary use monitoring estimated at \$273,212
LaC-CCC-1.1.2.2	Action Step	Estuary	Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements	3	10	CA Coastal Commission, California Coastal Conservancy, CDFG						TBD	Costs associated with removal of structures will depend on the number and type of structures identified and cannot be accurately determined at this time.
LaC-CCC-1.2	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-1.2.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
LaC-CCC-1.2.1.1	Action Step	Estuary	Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary	3	50	CDFG, County Planning, RWQCB, USACE						In-Kind	
LaC-CCC-1.2.1.2	Action Step	Estuary	Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay (CDFG 2004).	3	10	MMWD, Tomales Bay Watershed Council						In-Kind	Cost likely accounted for in estuary monitoring.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-1.2.1.3	Action Step	Estuary	Per a completed limiting factors assessment, and utilizing adaptive management guidelines, develop restoration projects in areas which have high value physical and chemical properties for rearing salmonids	2	15	California Coastal Conservancy, CDFG, NMFS, Private Consultants, Tomales Bay Watershed Council						TBD	
LaC-CCC-1.2.2	Recovery Action	Estuary	Increase and enhance habitat complexity features										
LaC-CCC-1.2.2.1	Action Step	Estuary	Restore estuarine wetlands and sloughs, develop floodplain and backwater habitat projects, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.	2	10	CA Coastal Commission, California Coastal Conservancy, CDFG, Private Landowners	625	625				1,250	Cost based on treating 5% of total estuarine habitat at a rate of \$272,120/acre.
LaC-CCC-2.1	Objective	Floodplain Connectivity	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
LaC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Evaluate potential acquisition of easements to protect floodplain function on lower Lagunitas Creek.	3	5	NPS, Private Landowners							
LaC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Where existing infrastructure exists within historical floodplains or offchannel habitats, and where restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	25							TBD	Conservation easements can be a powerful tool for conservation. Associated costs per acre can be highly variable. Costs for timberlands ranged from \$54 to \$279 per acre (DFG 2004). Costs in Marin County are likely much higher and cannot be accurately determined at this time.
LaC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Evaluate undeveloped and developed floodplain property for potential function and acquisition potential.	3	3	MMWD, NPS, SPAWN							
LaC-CCC-2.1.1.4	Action Step	Floodplain Connectivity	Evaluate potential of modification to the Olema Ranch Campground to accommodate improved floodplain function on Olema Creek.	3	10	NPS, Private Landowners, State Parks						In-Kind	
LaC-CCC-2.1.1.5	Action Step	Floodplain Connectivity	Evaluate existing road and transportation networks and identify measures to reduce interaction of transportation infrastructure on tributary, mainstem and estuarine floodplain process.	3	5	Marin County, MMWD, NPS, State Parks							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-2.1.1.6	Action Step	Floodplain Connectivity	Implement Marin County Flood Zone activities for the improvement of coho salmon habitat	3	-1	Marin County, MMWD						0	Implementation of existing program activities are unlikely to increase costs associated with recovery.
LaC-CCC-2.2	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
LaC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	5	Marin County, MMWD, NPS, State Parks	40.00					40	This is a GIS exercise with ground truthing, and costs are expected to be fairly low.
LaC-CCC-2.2.1.2	Action Step	Floodplain Connectivity	Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).	2	10	Private Consultants, Private Landowners, Sonoma County	56.00	56.00				112	Cost for fish/habitat monitoring estimated at \$111,192/project.
LaC-CCC-2.2.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	60	CDFG, Marin County, MMWD, NMFS, NPS, State Parks						TBD	Costs to promote and support restoration efforts (e.g. technical assistance) depend on level of technical assistance provided and the types of projects proposed.
LaC-CCC-2.2.1.4	Action Step	Floodplain Connectivity	Evaluate the acquisition of easements for the improvement of refuge habitat	3		Marin County, Marin RCD							
LaC-CCC-2.2.2	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
LaC-CCC-2.2.2.1	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	10	Marin County, Marin RCD, MMWD, NPS, State Parks	270.00	270.00				540	Cost based on treating 22 miles (assume 1 project/mile in 25% High IP) at a rate of \$25,000/mile.
LaC-CCC-2.2.2.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement projects that will function between winter base flow and flood stage.	2	60	Marin County, MMWD, NMFS, NPS, State Parks						TBD	Cost accounted for in above action steps. Costs depend on level of technical assistance required and types of projects proposed. Many salmon recovery efforts and management programs are currently ongoing by a variety of agencies and stakeholders. It is possible that there could be additional salmon restoration costs identified; however, at this time we do not have sufficient information to estimate those potential costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-2.2.2.3	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches (e.g. Olema Ranch Campground). Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity, develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats.	2	50	Farm Bureau, NMFS HCD, Public Works, RCD						TBD	
LaC-CCC-3.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve pool shelter rating										
LaC-CCC-3.1.1.1	Action Step	Habitat Complexity	Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	10		540	540				1,079	Cost based on placing LWD for 43 miles of stream (assume 1 project/mile in 50% High IP) at a rate of \$25,000/mile.
LaC-CCC-3.1.1.2	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) by installing multiple log structures in select reaches of Larsen, San Geronimo, Woodacre, and Olema Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited							Cost accounted for in increase shelter ratings in 75% of streams.
LaC-CCC-3.1.1.3	Action Step	Habitat Complexity	Focus efforts to restore channel complexity in the Tocaloma reach of the Lagunitas mainstem to improve smolt survival.	2	10	MMWD, NPS						0	Costs are expected to be included in implementation of LWD placements actions.
LaC-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
LaC-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase pool frequency in 25% of streams within the watershed to improve conditions for adults, and summer/winter juveniles	2	10		270.00	270.00				540	Cost based on treating 22 miles (assume 1 project/mile of 25% High IP) at a rate of \$25,000/mile. Cost may vary if ELJ or placement of boulders is preferred.
LaC-CCC-3.1.2.2	Action Step	Habitat Complexity	Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Olema, Woodacre and San Geronimo Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						TBD	Cost accounted for in increase pool frequency in 25 % of streams.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-3.1.2.3	Action Step	Habitat Complexity	Hold restoration workshops to specifically focus on restoration techniques that promote winter rearing juvenile habitat complexity in the Tocaloma reach of the lower Lagunitas mainstem. In addition, focus on restoration techniques that specifically address declining pool frequency and shelter ratings for summer rearing juveniles.	3	20	Marin County, Marin RCD, NOAA RC, SPAWN						In-Kind	
LaC-CCC-3.1.2.4	Action Step	Habitat Complexity	Analyze whether summertime low-flow pools (perceived to be a limiting factor) are filling up with fine sediment from San Geronimo Creek between flow events that have enough power to scour the pools. This could be examined by surveying selected pools in detail several times a year (long enough to cover several potential scour and fill events), as was conducted in 1981.	3	10	MMWD, NPS, SPAWN						TBD	Cost accounted for in fish/habitat monitoring.
LaC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool:rifle:flatwater ratio										
LaC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase riffle frequency in 25% of streams within the watershed to improve conditions for spawning adults	2	10								Cost accounted for as part of increase frequency of primary pools.
LaC-CCC-3.1.3.2	Action Step	Habitat Complexity	Increase riffle frequency to achieve optimal conditions (20% riffles) by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of San Geronimo Creek	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners						TBD	Cost accounted for as part of increase pool frequency.
LaC-CCC-3.1.3.3	Action Step	Habitat Complexity	In the San Geronimo Creek sub-watershed, continue public outreach and education for private landowners, residents, commercial, public utility and county workers regarding best management practices to control erosion, protect riparian vegetation, retain LWD, and minimize disturbance to coho salmon from domestic animals.	3	5	Marin County, SPAWN							Continue ongoing efforts.
LaC-CCC-3.1.4	Recovery Action	Habitat Complexity	Increase large wood frequency										
LaC-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2									Cost accounted for in previous action steps.
LaC-CCC-3.1.4.2	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in select reaches of Olema Creek	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners						TBD	Cost likely accounted for in other action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-3.1.4.3	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Larsen, Woodacre, San Geronimo, and Devils Gulch Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						TBD	Cost likely accounted for in other action steps.
LaC-CCC-3.1.4.4	Action Step	Habitat Complexity	Expand on the efforts of the Regional Water Quality Control Board and Marin Municipal Water District efforts retain LWD.	2	10	MMWD, RWQCB, SPAWN, Trout Unlimited						In-Kind	Cost to maintain LWD is expected to be minimal.
LaC-CCC-3.1.4.5	Action Step	Habitat Complexity	Install structures with multiple logs and root balls because they are more effective than structures with only one log.	3	10	CDFG, Marin County, MMWD, NPS, SPAWN						TBD	Cost likely accounted for in other action steps.
LaC-CCC-3.2	Objective	Habitat Complexity	Address other natural or manmade factors affecting the species' continued existence										
LaC-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve habitat complexity										
LaC-CCC-3.2.1.1	Action Step	Habitat Complexity	Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations	2	5		10.00					10	Cost based on beaver reintroduction estimated at \$10,000/beaver family translocation.
LaC-CCC-4.1	Objective	Hydrology	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
LaC-CCC-4.1.1.1	Action Step	Hydrology	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	60	CDFG, Gold Ridge RCD, Marin County, Marin RCD, MMWD, NMFS						In-Kind	Technical assistance is ongoing.
LaC-CCC-4.1.1.2	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 §1707 (CDFG 2004).	2	10	DWR, Marin County, NMFS, SWRCB						TBD	
LaC-CCC-4.2	Objective	Hydrology	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
LaC-CCC-4.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
LaC-CCC-4.2.1.1	Action Step	Hydrology	Develop rearing habitat curves to identify optimal base flow conditions	3	10	CDFG, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at \$63,005/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-4.2.1.2	Action Step	Hydrology	Continue to support efforts to model flows and water usage	3	5	CDFG, NMFS HCD, Private Consultants, Private Landowners, RCD, UC Extension						TBD	
LaC-CCC-4.2.1.3	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	5	CDFG, NMFS HCD, Private Consultants, Private Landowners, RCD						In-Kind	
LaC-CCC-4.2.2	Recovery Action	Hydrology	Minimize redd scour										
LaC-CCC-4.2.2.1	Action Step	Hydrology	Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries including San Geronimo Creek	2	10	California Conservations Corps, CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						tbd	Cost accounted for in other recovery actions. See habitat complexity and floodplain connectivity.
LaC-CCC-4.2.2.2	Action Step	Hydrology	Manage riparian areas for their site potential composition and structure.	3	60	Marin County, MMWD, Tomalis Bay Watershed Council						In-Kind	
LaC-CCC-4.2.2.3	Action Step	Hydrology	Improve spawning success and egg survival through improving channel configuration, sediment dynamics, and channel roughness and stability	2	20								Cost accounted for in fish/habitat monitoring.
LaC-CCC-5.1	Objective	Landscape Patterns	<b>Address the present or threatened destruction, modification, or curtailment of the species habitat or range</b>										
LaC-CCC-5.1.1	Recovery Action	Landscape Patterns	Prevent impairment to watershed hydrology										
LaC-CCC-5.1.1.1	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.	3	100							In-Kind	
LaC-CCC-5.1.1.2	Action Step	Landscape Patterns	Conserve water resources by implementing Water Diversion Recommendations	2	100							In-Kind	
LaC-CCC-5.1.2	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-5.1.2.1	Action Step	Landscape Patterns	Decommission and or re-locate riparian roads upslope to achieve desirable riparian road density criteria (<0.1 to 0.4 Miles/Square Mile)	2	10	Private Landowners, RCD	200.00	200.00				400	Cost based on decommissioning 33 miles of riparian road network at a rate of \$12,000/mile.
LaC-CCC-5.1.2.2	Action Step	Landscape Patterns	Improve sediment transport by implementing Road Recommendations	2									
LaC-CCC-5.1.2.3	Action Step	Landscape Patterns	Implement DS level recommendations	3									
LaC-CCC-6.1	Objective	Passage	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
LaC-CCC-6.1.1	Recovery Action	Passage	Improve access of spawning adults and juveniles										
LaC-CCC-6.1.1.1	Action Step	Passage	Restore fish passage at Roy's Pools to facilitate unimpeded passage for all life stages into the San Geronimo Creek	2	5	SPAWN	800					800	This action would provide access to the San Geronimo Valley Core area for all lifestages.
LaC-CCC-6.1.1.2	Action Step	Passage	Remove all barriers in the Woodacre, Arroyo, Larsen and Montezuma and San Geronimo subwatersheds	2	10	Marin County, SPAWN, Trout Unlimited	750	750				1,500	Cost based on treating 25% of remaining structures assuming 1 barrier/5 miles High IP at a rate of \$367,732/unit. This action would provide access to the most productive subwatershed in this system. Many barriers have been addressed, however some continue to limit access to habitat.
LaC-CCC-6.1.1.3	Action Step	Passage	Removal all remaining barriers in the Cheda, Devil's Gulch and Olema subwatersheds.	2	10	Marin County, MMWD, NPS, State Parks							Cost accounted for as part of remove all barriers assuming 1 barrier/5 miles of High IP.
LaC-CCC-6.1.1.4	Action Step	Passage	Work with MMWD to evaluate alternatives/feasibility to provide passage over Seeger Dam (Nicasio Reservoir).	3	30	CDFG, Marin County, NMFS OLE						TBD	Cannot determine at this time. Cost will depend on method of passage.
LaC-CCC-8.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
LaC-CCC-8.1.1.1	Action Step	Riparian	Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects on State and Federal park and private lands (e.g., Devil's Gulch).	2	10	Marin County, Marin RCD, MMWD, NPS, SPAWN, State Parks						In-Kind	Livestock damage has severe effects in the Olema Core area, but is less of an issue in the other areas of the watershed.
LaC-CCC-8.1.1.2	Action Step	Riparian	Plant native riparian species and native conifers/hardwoods in the riparian zone within the central portion of the watershed (Olema and lower Lagunitas Creek mainstem) to increase overall tree diameter	2	20	CDFG, NOAA RC, Private Consultants, Private Landowners, RCD	603	603	603	603		2,410	Cost based on treating 1.5 miles (assume 80 acres/mile in 5% High IP) at a rate of \$20,057/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-8.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).	3	50	City Planning, Land Trusts, Sonoma County						In-Kind	
LaC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
LaC-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	20		10.25	10.25	10.25	10.25		41	Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of \$20,058/mile. Cost may be lower if overlapped with improved canopy cover.
LaC-CCC-8.1.2.2	Action Step	Riparian	Implement the SGVSEP to protect riparian integrity in San Geronimo Creek	2	20	Marin County, Private Landowners						In-Kind	
LaC-CCC-8.1.2.3	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	3	10	Board of Forestry, Private Consultants, Private Landowners	18.50	18.50				37	Cost based on treating 13 miles (assume 80 acres/mile in 15% High IP) at a rate of \$1,422/mile.
LaC-CCC-9.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										
LaC-CCC-9.1.1.1	Action Step	Sediment	Reduce embeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)	2	50							TBD	Fish/habitat monitoring should identify areas with increased embeddness levels.
LaC-CCC-9.1.1.2	Action Step	Sediment	Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations	3	10	Private Consultants, Private Landowners, RCD, Tomales Bay Watershed Council	106.50	106.50				213	Cost for erosion assessment (assume 25% of total watershed acres) estimated at \$12./acre.
LaC-CCC-9.1.1.3	Action Step	Sediment	Implement recommendations of completed sediment source surveys (See ROADS for specific actions)	2	5	CDFG, Private Landowners, Public Works, RCD, Tomales Bay Watershed Council, Trout Unlimited						TBD	
LaC-CCC-10.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
LaC-CCC-10.1.1.1	Action Step	Viability	Implement recovery actions where indicators rated poor or fair in high potential value areas.	2	50								
LaC-CCC-10.1.1.2	Action Step	Viability	Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions	3	10	NMFS						TBD	
LaC-CCC-10.1.1.3	Action Step	Viability	Operation of the Lagunitas life cycle station should continue (Gallagher and Gallagher 2005).	3	10	CDFG, Marin County, MMWD, NMFS, NPS, SPAWN, State Parks	375.00	375.00				750	Includes juvenile surveys, smolt outmigration, and adult carcass surveys at 75k per year for 10 years.
LaC-CCC-10.1.2	Recovery Action	Viability	Increase spatial structure and diversity										
LaC-CCC-10.1.2.1	Action Step	Viability	Continue to work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, MMWD, NMFS, NPS, SPAWN, State Parks							Existing operations
LaC-CCC-10.1.2.2	Action Step	Viability	Annually capture or retain (during rescue efforts) - adequate numbers of fish from streams in Marin County for purposes of broodstock	1	10	CDFG, MMWD, NMFS, NPS, SPAWN							existing operations
LaC-CCC-10.1.2.3	Action Step	Viability	Utilize captured fish in a within-basin program for an immediate short term augmentation strategy at established facility(s), for release as adults, to avoid near term extinction (within 6 years).	1	6	CDFG, MMWD, NMFS, NPS, USACE						TBD	Costs estimated for these activities are not high and are being absorbed through the implementation of other programs and existing staff resources.
LaC-CCC-10.1.2.4	Action Step	Viability	Support operation of outmigrant traps	3	20	CDFG, NMFS, Trout Unlimited, UC Extension						TBD	Costs estimated for these activities are not high and are being absorbed through the implementation of other programs and existing staff resources.
LaC-CCC-10.1.3	Recovery Action	Viability	Increase spawner density										
LaC-CCC-10.1.3.1	Action Step	Viability	Pursue longer term intervention strategies through establishing a river specific facility if populations do not rebound within six years, to avoid extinction and ensure long-term genetic diversity within the population.	1	12	CDFG, MMWD, NMFS, NPS, USACE						TBD	Cost cannot be determined at this time. More specific methods in development will determine cost.
LaC-CCC-11.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-11.1.1.1	Action Step	Water Quality	Determine site-specific recommendations, including incentives, to remedy high temperatures and implement accordingly (CDFG 2004) .	2	5	Marin County, MMWD, NPS, State Parks						TBD	Existing programs could be copied for implementation, so costs are expected to be minimal.
LaC-CCC-11.1.1.2	Action Step	Water Quality	Focus on restoration efforts that deal with riparian canopy, shelter ratings and any other impaired key habitat attribute indicator that relates specifically to instream temperature.	2	5	Marin County, MMWD, NPS, State Parks						TBD	Existing programs could be copied for implementation, so costs are expected to be minimal.
LaC-CCC-11.1.2	Recovery Action	Water Quality	Improve stream water quality conditions										
LaC-CCC-11.1.2.1	Action Step	Water Quality	Fully implement practices consistent with the SFRWQCB pathogen and sediment TMDLs.	3	10	Marin County, MMWD, NPS, RWQCB, State Parks						0	Implementation of the TMDL is mandated by the Clean Water Act, and additional costs associated with recovery are not expected.
LaC-CCC-12.1	Objective	Agricultural Practices	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-12.1.1.1	Action Step	Agricultural Practices	Assist in the development and support implementation of sediment TMDL to assure water quality conditions for coho salmon are improved and fine sediment loads are decreased to baseline conditions.	3	5							In-Kind	Costs are expected to be minimal, however technical assistance from several agencies will be needed.
LaC-CCC-12.1.2	Recovery Action	Agricultural Practices	Prevent impairment to riparian species and composition										
LaC-CCC-12.1.2.1	Action Step	Agricultural Practices	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2	50	City Planning, County Planning, RWQCB						In-Kind	site specific
LaC-CCC-12.2	Objective	Agricultural Practices	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
LaC-CCC-12.2.1	Recovery Action	Agricultural Practices	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-12.2.1.1	Action Step	Agricultural Practices	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels (see Roads for specific actions/areas)	2	60	County Planning, Private Landowners, RCD, USACE						In-Kind	Stringent review by permitting agencies is expected to reduce costs associated with poorly planned and poorly located developments.
LaC-CCC-12.2.2	Recovery Action	Agricultural Practices	Prevent impairment to riparian										
LaC-CCC-12.2.2.1	Action Step	Agricultural Practices	Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	3	30	County Planning, Land Trusts						TBD	Cost difficult to determine because of fair market value and rate of turnover.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-12.2.2.2	Action Step	Agricultural Practices	Keep agricultural activities from within 100 feet of the edge of the stream	3	5	CDFG, NMFS, NRCS, RCD, SWRCB, USACE						In-Kind	Streamlining permit processing is not expected to cost much, and may save money through future efficiencies.
LaC-CCC-12.2.3	Recovery Action	Agricultural Practices	Prevent impairment to habitat complexity										
LaC-CCC-12.2.3.1	Action Step	Agricultural Practices	Avoid the removal of large wood and other shelter components from the stream system	3	50							In-Kind	
LaC-CCC-12.2.4	Recovery Action	Agricultural Practices	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-12.2.4.1	Action Step	Agricultural Practices	Complete Farm Conservation Plans (through the SRCD, NRCS, or Fish Friendly Farming programs) to reduce sediment sources and restore riparian habitat and forest health	3	10	CDFG, Farm Bureau, NMFS, Private Landowners, RCD						TBD	Cost is TBD since the vagaries of the plan are unknown at this time.
LaC-CCC-12.2.5	Recovery Action	Agricultural Practices	Prevent impairment to hydrology										
LaC-CCC-12.2.5.1	Action Step	Agricultural Practices	Work with the agricultural community to develop water conservation strategies protective of salmonids while allowing ongoing agricultural land uses (i.e., off-channel storage ponds).	3	10	CDFG, Farm Bureau, NMFS, NRCS, Private Landowners, RCD						In-Kind	Soliciting cooperation not expected to cost much outside of already existing federal and state and local salaries.
LaC-CCC-13.1	Objective	Channel Modification	<b>Address the present or threatened destruction, modification, or curtailment of the species habitat or range</b>										
LaC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to habitat complexity										
LaC-CCC-13.1.1.1	Action Step	Channel Modification	Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.	3	50	County Planning, RCD						TBD	
LaC-CCC-13.1.1.2	Action Step	Channel Modification	Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows. (Evaluate the Tocaloma reach of the lower Lagunitas mainstem)	2	10	CDFG, County Planning, NOAA RC, NRCS, Private Landowners, USACE	390.00	390.00				780	Cost based on treating 22 miles (assume 1 project/mile in 25% High IP) at a rate of \$36,046/mile.
LaC-CCC-13.1.1.3	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.	3	50	CDFG, NMFS PRD, USACE						In-Kind	
LaC-CCC-13.1.1.4	Action Step	Channel Modification	Implement DS level recommendations	3									
LaC-CCC-18.1	Objective	Livestock	<b>Address the inadequacy of existing regulatory mechanisms</b>										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-18.1.1	Recovery Action	Livestock	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-18.1.1.1	Action Step	Livestock	Establish conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.	3	50	NRCS, RCD						In-Kind	
LaC-CCC-18.2	Objective	Livestock	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-18.2.1	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
LaC-CCC-18.2.1.1	Action Step	Livestock	Exclude livestock from riparian areas, specifically on State and Federal Park and private lands (e.g. Devils Gulch).	2	50							In-Kind	This recommendation should be considered standard practice.
LaC-CCC-18.2.1.2	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	60	NRCS, RCD						TBD	
LaC-CCC-18.2.1.3	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	2	30	NRCS, RCD						In-Kind	
LaC-CCC-18.2.1.4	Action Step	Livestock	Manage rotational grazing to aid in the reduction of noxious weeds.	3	60	NRCS, RCD						TBD	
LaC-CCC-18.2.2	Recovery Action	Livestock	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-18.2.2.1	Action Step	Livestock	Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.	3	60	NRCS, RCD						In-Kind	
LaC-CCC-18.2.2.2	Action Step	Livestock	Implement DS level recommendations	3									
LaC-CCC-18.2.3	Recovery Action	Livestock	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-18.2.3.1	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes	2	60	NRCS, RCD						In-Kind	

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-18.2.3.2	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	60	NRCS, RCD						TBD	
LaC-CCC-18.2.4	Recovery Action	Livestock	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-18.2.4.1	Action Step	Livestock	Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.	2	10	Marin RCD, NPS, Private Landowners, State Parks						TBD	Costs for required infrastructure (e.g. mobile water trailers, tanks, etc.) will be the responsibility of individual landowners or supporting agencies, but cannot be determined at this time.
LaC-CCC-18.2.4.2	Action Step	Livestock	Aid landowners willing to fence off riparian areas with development of offstream alternative water sources	3	30	NRCS, RCD						TBD	
LaC-CCC-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
LaC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to RIPARIAN										
LaC-CCC-19.1.1.1	Action Step	Logging	Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations	3	60	CDFG, NMFS, RCD, State Parks						TBD	Impossible to anticipate where and how much land will come available for purchase in the future.
LaC-CCC-19.1.1.2	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	60	Board of Forestry, CDFG, County Planning, NMFS, State Parks, USEPA						In-Kind	Costs cannot be determined at this time, due to an unknown number of variables and research priorities.
LaC-CCC-19.1.1.3	Action Step	Logging	Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	3	60	Board of Forestry, County Planning, NMFS, Private Landowners, State Parks, US EPA						In-Kind	Recruitment of LWD to the stream is critical. This action is mainly a policy issue, with little or no direct costs.
LaC-CCC-19.1.1.4	Action Step	Logging	Implement DS level recommendations	3									
LaC-CCC-22.1	Objective	Residential/Commercial Development	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating CCC coho salmon.	3	20	Marin County, MMWD, NPS, State Parks						TBD	Costs may vary with methods and extent of assessments and actions taken to address impacts, and cannot be determined at this time.
LaC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Support the Marin County Streamside Conservation Area Ordinance. Evaluate current moratorium in San Geronimo Valley for pertinent action items.	3a	10	CDFG, Marin County, NPS, SPAWN, State Parks						0	Costs associated with support and evaluation are expected to be minimal.
LaC-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	20	Marin County, USACE						In-Kind	Additional costs associated with recovery are not expected.
LaC-CCC-22.2	Objective	Residential/Commercial Development	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
LaC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Address failing septic systems in rural areas	3	10	City Planning, County Planning, RWQCB						TBD	
LaC-CCC-22.2.1.2	Action Step	Residential/Commercial Development	Improve water quality where necessary by addressing residential and commercial pollutant sources.	2	10	Private Landowners, Public Works, RCD, RWQCB						TBD	Cost accounted for in water quality monitoring. If additional sites are needed, cost will increase. It is anticipated Marin County would know of current pollutant sources.
LaC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	See WATER DIVERSIONS for specific actions and areas	3									
LaC-CCC-22.2.2.2	Action Step	Residential/Commercial Development	Encourage the use and provide incentives for rooftop water storage and other conservation devices	2		County Planning, Private Consultants, Private Landowners						TBD	
LaC-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										
LaC-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	3	60	Marin RCD, MMWD, NPS, Private Landowners, State Parks						In-Kind	It is possible that there could be additional salmon restoration costs identified based on recovery needs of the species; however, at this time NMFS does not have sufficient information to estimate those potential costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-22.2.3.2	Action Step	Residential/Commercial Development	Encourage FishNet 4C to facilitate instream and riparian restoration and management workshops with a specific focus on problems and opportunities in the Lagunitas Watershed.	3	5	CDFG, FishNet 4C, Marin County, MMWD, NMFS, NPS, SPAWN, State Parks							
LaC-CCC-22.2.3.3	Action Step	Residential/Commercial Development	Work with private landowners to promote the revegetation 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.	3	60	CDFG, Marin RCD, NPS, Private Landowners, State Parks						In-Kind	Costs depend on level of technical assistance provided and the types of projects proposed.
LaC-CCC-22.2.3.4	Action Step	Residential/Commercial Development	Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.	3									
LaC-CCC-23.1	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanism										
LaC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-23.1.1.1	Action Step	Roads/Railroads	Establish a moratorium on 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.	3	20	Marin County, USACE						In-Kind	Existing authorities of permitting agencies facilitate implementation at minimal costs.
LaC-CCC-23.1.1.2	Action Step	Roads/Railroads	Support the MMWD in their efforts to reduce sedimentation from lands in the Lagunitas Creek watershed. MMWD will also coordinate with the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to make sure that educational materials about non-point source pollution are available to homeowners in the San Geronimo Valley.	3b	10	Marin RCD, MMWD, RWQCB						In-Kind	Outreach and education are ongoing, and additional costs are expected to be minimal.
LaC-CCC-23.2	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-23.2.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	10	CalTrans, Marin County						TBD	Costs associated with assessment and redesign cannot be determined at this time, however some assessment has already been conducted.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Entire Duration	Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-23.2.1.2	Action Step	Roads/Railroads	In the Olema Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources.	2	20	Private Consultants, Private Landowners, Public Works, RCD						TBD	
LaC-CCC-23.2.1.3	Action Step	Roads/Railroads	In the Lagunitas Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outcropping roads, ditch relief culverts, and installing rolling dips.	2	30	Private Consultants, Private Landowners, Public Works, RCD, State Parks						TBD	
LaC-CCC-23.2.1.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	20	Private Landowners, Public Works						TBD	Cost depend on feasibility and need of adequate spoils storage sites.
LaC-CCC-23.2.1.5	Action Step	Roads/Railroads	Decommission or treat the road sites on the priority list of 20 road sites within the San Geronimo subwatershed based on amount of sediment discharge.	2b	20	Marin County, Marin RCD, SPAWN	9.00	9.00	9.00	9.00		36	Cost based on decommissioning 3 miles of road network at a rate of \$12,000/mile.
LaC-CCC-23.2.1.6	Action Step	Roads/Railroads	Implement DS level recommendations	3									
LaC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
LaC-CCC-23.2.2.1	Action Step	Roads/Railroads	Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	100	Private Landowners, Public Works						In-Kind	
LaC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to riparian species and composition										
LaC-CCC-23.2.3.1	Action Step	Roads/Railroads	Evaluate the potential of road widening projects (e.g. Sir Francis Drake Rd) on riparian corridors, and discourage encroachment into riparian zone.	3	50							In-Kind	
LaC-CCC-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
LaC-CCC-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 CCC coho salmon recovery needs.	3	20							In-Kind	

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-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.	3	20	Marin County, Marin RCD, NPS, Private Landowners, SPAWN, State Parks						TBD	Costs cannot be determined due to an unknown number of unauthorized users, and unknown level of enforcement that would be required.
LaC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	See WATER DIVERSIONS for other specific actions/areas	2									
LaC-CCC-24.2	Objective	Severe Weather Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
LaC-CCC-24.2.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
LaC-CCC-24.2.1.1	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	3	10							TBD	Cost accounted for from stream flow model.
LaC-CCC-24.2.1.2	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	2	10	CDFG, MMWD, NPS, RWQCB, State Parks						TBD	Costs are expected to be minimal as some of these efforts will be part of existing programs, however some technical assistance may be necessary from a variety of agencies.
LaC-CCC-24.2.1.3	Action Step	Severe Weather Patterns	Dedicate appropriate water rights to instream flow in Olema Creek watershed (NPS is currently evaluating opportunities in this watershed).	2	7	NPS, RWQCB						In-Kind	No costs specific to recovery are associated with this effort.
LaC-CCC-24.2.1.4	Action Step	Severe Weather Patterns	Evaluate and assess impacts of local groundwater withdrawals in San Geronimo Creek watershed.	3	20	Marin RCD, MMWD, Private Landowners, RWQCB, SPAWN						TBD	
LaC-CCC-24.2.1.5	Action Step	Severe Weather Patterns	Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	2	20	CDFG, Marin County, NMFS, Private Landowners, SPAWN						TBD	Costs associated with operations are expected to be minimal, however structural modifications to facilitate appropriate operations may be costly.
LaC-CCC-24.2.1.6	Action Step	Severe Weather Patterns	Avoid reductions of flow <8 cfs below major dams in the summer	2		NMFS HCD, SWRCB							
LaC-CCC-24.2.1.7	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	3									
LaC-CCC-24.2.1.8	Action Step	Severe Weather Patterns	See DS level Recovery Actions	3									
LaC-CCC-24.2.2	Recovery Action	Severe Weather Patterns	Prevent impairment to watershed hydrology										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25			
LaC-CCC-24.2.2.1	Action Step	Severe Weather Patterns	Evaluate and implement rainfall capture from impervious surfaces for irrigation use to protect water quality and reduce water demand in summer.	3	10	CDFG, Marin County, Marin RCD, MMWD, NPS, SPAWN, State Parks						TBD	Costs cannot be determined due to an unknown number of participants and types of modifications required for implementation.	
LaC-CCC-24.2.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)											
LaC-CCC-24.2.3.1	Action Step	Severe Weather Patterns	Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas	2	20	CDFG, NOAA RC, Private Landowners, RCD							Cost accounted for in riparian.	
LaC-CCC-25.1	Objective	Water Diversion/Impoundment	Address the present or threatened destruction, modification or curtailment of the species habitat or range											
LaC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)											
LaC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Avoid reductions of flow <8 cfs below major dams in the summer	2	50	NMFS HCD, SWRCB							See SEVERE WEATHER PATTERNS.	
LaC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Provide consistent fishery flows below Peter's Dam by improving gauging at SP Taylor Park	2	5	NMFS HCD, State Parks	1.00					1	Cost for stream flow gauge estimated at \$1000/gauge. Cost does not account for maintenance or data management.	
LaC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)											
LaC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Encourage enforcement of SWRCB Order 95-17 (specifically in the warm summer months)	2	50	NMFS HCD, SWRCB							In-Kind	
LaC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Discourage the transfer of water from Nicasio Reservoir to Kent Lake which could degrade water quality releases into Lagunitas Creek	2	50	NMFS HCD, SWRCB							In-Kind	
LaC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Discourage the proposed water diversion through Groundwater Well by North Marin Water District which could adversely affect stream flows	2	20	NMFS HCD, SWRCB							In-Kind	
LaC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)											
LaC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Develop riffles and/or spawning channels below Kent Dam to increase spawner distribution and success	2	5	CDFG, MMWD, NMFS HCD, Trout Unlimited	25.00						25	Cost based on treating 1.0 miles at a rate of \$25,000/mile for LWD placement. Cost may be higher if incorporate other habitat features such as boulders, channel grading, and riparian vegetation.
LaC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity											

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
LaC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100							In-Kind	This recommendation should be considered standard practice.
LaC-CCC-25.2	Objective	Water Diversion/Impoundment	Address the inadequacy of existing regulatory mechanisms										
LaC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Minimize take attributable to diversion of stream flow through alternatives such as: the operation of off-stream reservoirs, development of infrastructure necessary for conjunctive use of stream flow, and use of reclaimed water.	2	30	CDFG, Marin RCD, MMWD, Private Landowners						TBD	Costs associated with development of alternatives cannot be determined due to the unknown number and types of alternatives that might be proposed.
LaC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Implement DS level recommendations	3									