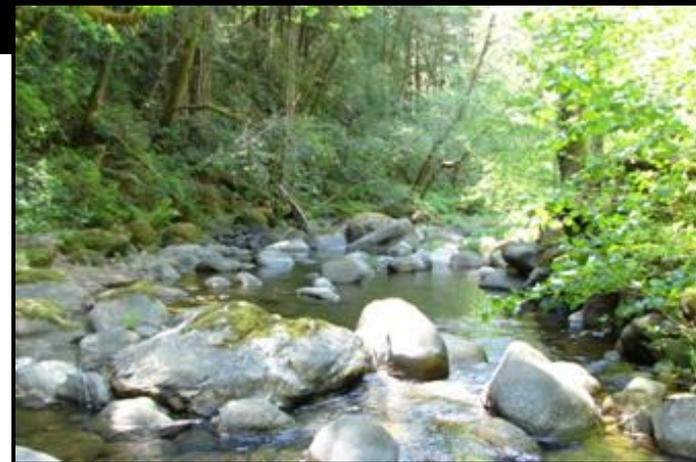


Waddell Creek



Waddell Creek
Photo by Jerry Smith, SJSU

Location	• Santa Cruz County
Watershed Area	• 24.0 Square Miles
Potential Habitat	• 8.0 Stream Miles
Vegetation	• 85% Coniferous • 14% Shrubland
Erodability	• Moderate to High
Ownership Patterns	• 14% Private; 86% Public
Dominant Land Uses	• Recreation, Agricultural
Housing Density	• Low
TMDL Pollutants	• None

Waddell Creek Coho Salmon: Nearly Extirpated



Recovery Goals

- ✓ Eliminate fish kills in upper watershed
- ✓ Conduct surveys to determine occupancy in watershed

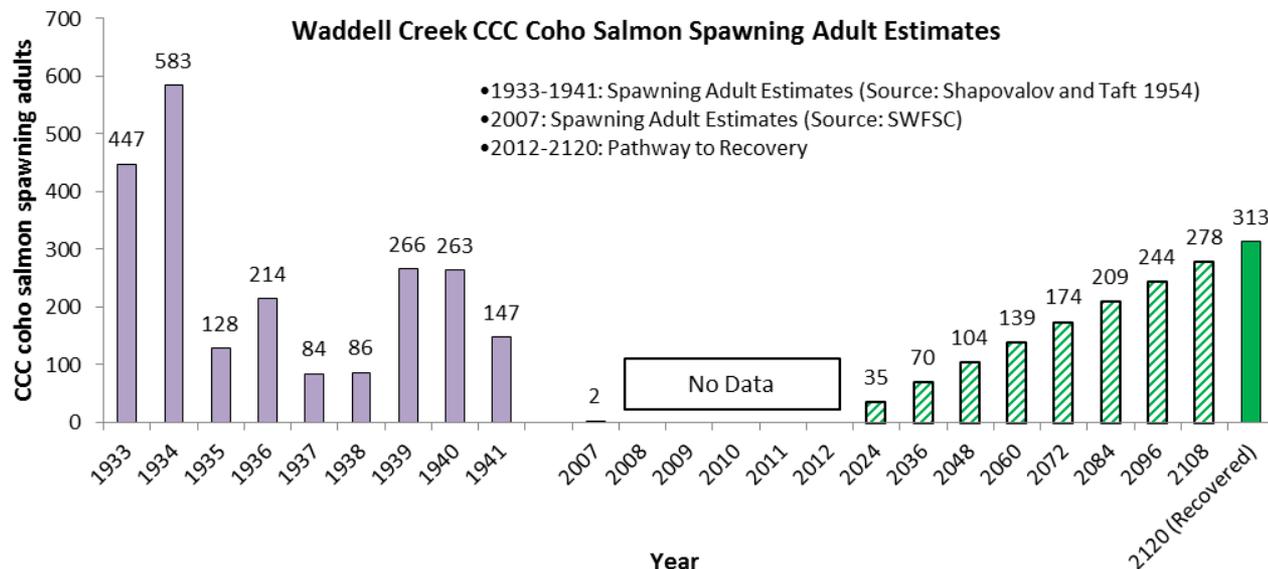
Waddell Creek Adult Spawner Targets

Downlisting to Threatened
157

Recovery
313

STEELHEAD: YES
CHINOOK SALMON: NO

Waddell Creek CCC Coho Salmon Spawning Adult Estimates



Current Instream, Watershed and Population Conditions



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Identify source of ongoing fish kills in East Branch Waddell Creek and implement appropriate remediation and restoration actions
- Continue annual, standardized juvenile surveys in the watershed

Priority 2 & 3: Long-Term Restoration Actions

- Promote and evaluate alternatives to the proposed Highway One bridge replacement to improve estuary function
- Implement changes to restore natural function to river mouth dynamics
- Retain LWD for instream enhancement projects
- Place instream structures to improve gravel retention and habitat complexity
- Decommission or upgrade roads



Recovery Partners

California State Parks;
Waddell Creek Association



Future Threats



Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Immediately implement appropriate sediment control measures following completion of fire suppression
- Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Existing areas with floodplains or off channel habitats should be protected from future development of any kind



Waddell Creek
Photo by Jerry Smith, SJSU

Priority 2 & 3: Long-Term Threat Abatement Actions

- Conduct annual inspections of all roads prior to winter and correct conditions that are likely to deliver sediment to streams
- Limit winter use of unsurfaced roads and recreational trails
- Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques
- Ensure adequate water temperatures are maintained during droughts
- Protect sources of cool water input from future diversions
- Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion

Conservation Highlights

- Seminal work on the life history of coho salmon and steelhead occurred in Waddell Creek from 1933 to 1942 (Shapavolof and Taft 1954).
- Annual juvenile abundance surveys conducted by San Jose State University faculty and students provides important population data on coho salmon in the Waddell Creek watershed.

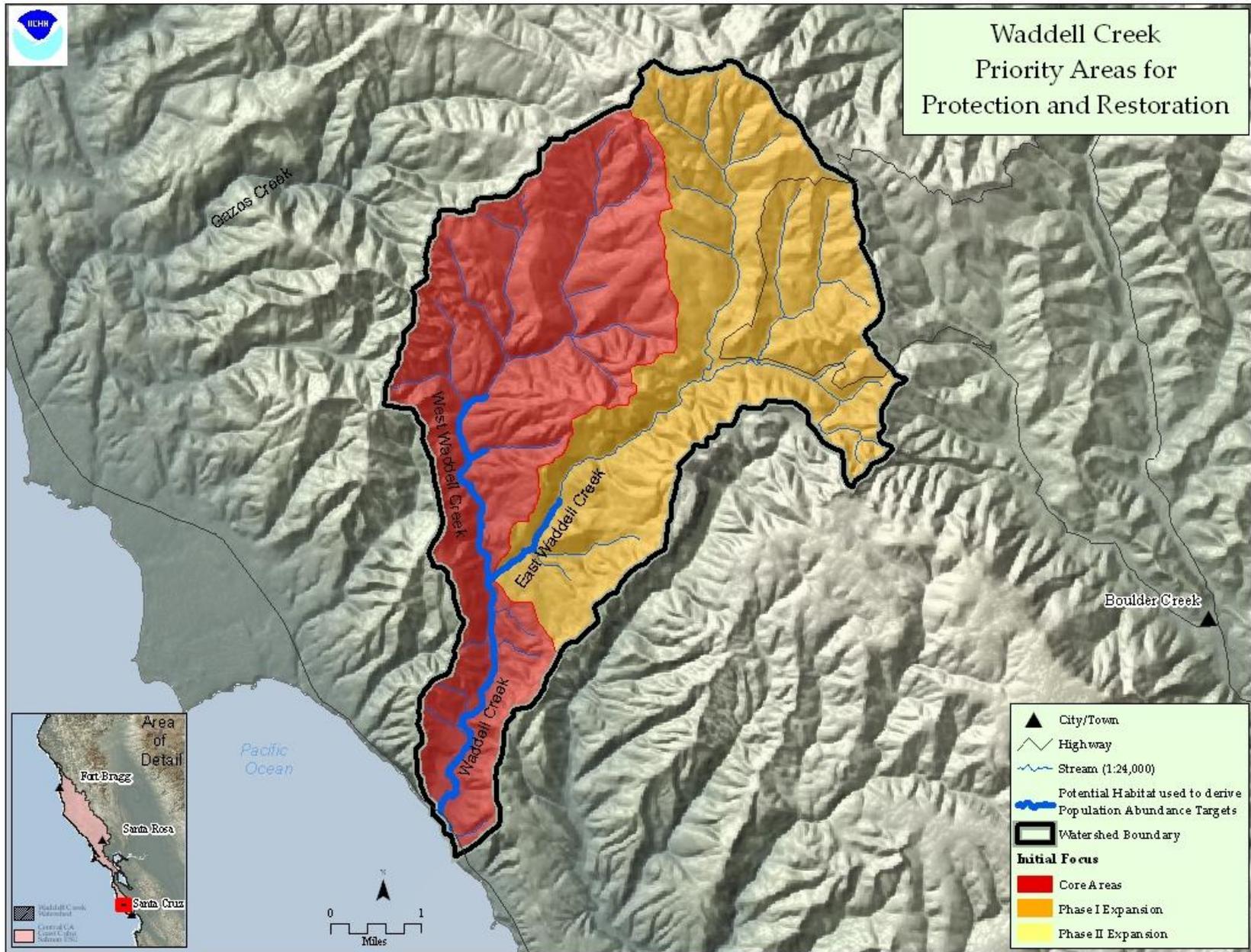


Figure 1: Map of Waddell Creek

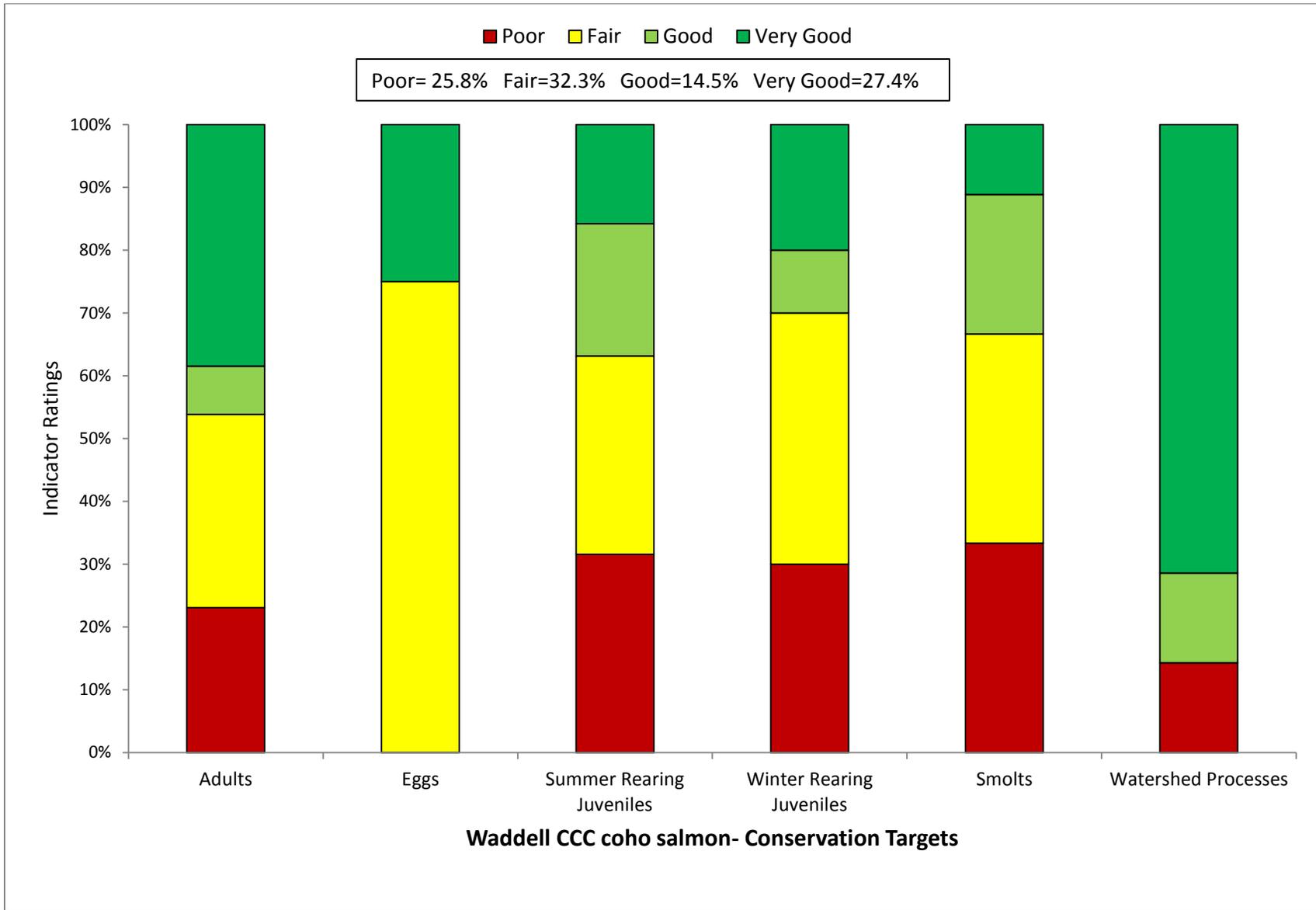


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Waddell Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	4 to 6 Key Pieces/100m	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	8.8 Key Pieces/100m	Very Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	40% streams 51% IP-km (>30% Pools; >20% Riffles)	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	14% streams 1% IP-km (>80 stream average)	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	Risk Factor Score =33	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	>90% of IP-km accessible	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	100% of IP-km accessible	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	NA	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	70-79% Density rating "D" across IP-km	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	>90% of IP-km accessible	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	>80% Response Reach Connectivity	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	Sublethal or Chronic	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	<1 spawner per IP-km	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score =25	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	Risk Factor Score =75	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	15-17% (0.85mm) and <30% (6.4mm)	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	60% streams 52% 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)	4 to 6 Key Pieces/100m	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	8.8 Key Pieces/100m	Very Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	40% streams 51% IP	Poor	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	40% streams 51% 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	14% streams 1% 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 =42	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	Risk Factor Score 35-50	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	2.17 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	>90% of IP-km accessible	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	100% 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	86% streams 79% IP-km (>85% average stream canopy)	Good	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)	NA	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	70-79% Density rating "D" across IP-km	Fair	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	60% streams 52% IP	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 (MWT)	50 to 74% IP km (<16 C MWT)	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWT)
Summer Rearing Juveniles	Water Quality	Toxicity	Acute	Poor	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	75% to 90% of streams/ IP-km maintains severity score of 3 or lower	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	<50-74% of Historical Range	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	4 to 6 Key Pieces/100m	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	8.8 Key Pieces/100m	Very Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	40% streams 51% 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	14% streams 1% 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	100% 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)	NA	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	70-79% Density rating "D" across IP-km	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	60% streams 52% IP	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	>80% Response Reach Connectivity	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	Acute	Poor	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	Impaired but functioning	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	14% streams 1% IP-km (>80 stream average)	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	2.17 Diversions/10 IP-km	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	Risk Factor Score =50	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	>90% of IP-km accessible	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	75-90% IP-km (>6 and <14 C)	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	Acute	Poor	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	Abundance leading to high risk spawner density = 0	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	0.17% of Watershed in Impervious Surfaces	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	0.317% of Watershed in Agriculture	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	<15% of Watershed in Timber Harvest	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	1% of watershed >1 unit/20 acres	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	>75% Intact Historical Species Composition	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	2.0 Miles/Square Mile	Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	2.3 Miles/Square Mile	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

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

Central CA Coast Coho Salmon ~ Waddell Creek

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

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

1.1.1. **Recovery Action:** Rehabilitate natural river mouth dynamics

1.1.1.1. **Action Step:** Promote and evaluate alternatives to the current Highway One bridge to improve estuary function.

1.1.1.2. **Action Step:** Evaluate alterations to river mouth dynamics and implement changes to restore natural function

1.1.2. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.2.1. **Action Step:** Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.

2. Restoration- Floodplain Connectivity

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

2.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity.

2.1.1.1. **Action Step:** Address channel incision issues and reduced stream complexity between the Highway one bridge (stream mile 0) and the footbridge (stream mile 8).

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:** Increase large wood frequency

3.1.1.1. **Action Step:** Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.2. **Recovery Action:** Improve shelter rating

3.1.2.1. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem Waddell Creek.

3.1.2.2. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts. Create winter velocity refuge between stream mile 4 and 8 (footbridge). Create winter velocity refuge in stream above and below tramway springs.

4. Restoration- Hydrology

No species-specific actions were developed.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. [Restoration- Passage](#)

No species-specific actions were developed.

7. [Restoration- Pool Habitat](#)

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

8. [Restoration- Riparian](#)

No species-specific actions were developed.

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

9.1.1.1. **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

9.1.1.2. **Action Step:** Place instream structures to improve gravel retention and habitat complexity.

9.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

9.1.1.4. **Action Step:** Remediate slides and gullies delivering sediment to stream channels.

9.1.1.5. **Action Step:** Remediate near stream sediment sources such as streamside landings, roads, and failing banks using appropriate techniques.

9.1.1.6. **Action Step:** Establish and/or maintain continuous and properly functioning native riparian buffers.

10. [Restoration- Viability](#)

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

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

10.1.1.1. **Action Step:** Establish life cycle station in the Waddell Creek watershed, and utilize it to compare productivity with existing historical data for the watershed (Gallagher and Gallagher 2005).

10.1.1.2. **Action Step:** Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.

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

10.1.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

11. [Restoration- Water Quality](#)

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

11.1.1. **Recovery Action:** Reduce toxicity and pollutants.

11.1.1.1. **Action Step:** Identify source of ongoing low fish abundance in upper East Waddell Creek and implement appropriate remediation and restoration actions.

11.1.1.2. **Action Step:** Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals or other associated practices into East Branch Waddell.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address disease or predation

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

14.1.1.1. **Action Step:** Evaluate impacts of striped bass predation in the Waddell estuary to juvenile and smolting salmonids and implement abatement strategies if appropriate.

15. Threat- Fire/Fuel Management

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

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

15.1.1.1. **Action Step:** Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.

15.1.3. **Recovery Action:** Prevent impairment to instream substrate

15.1.3.1. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

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

- 15.2.1.1. **Action Step:** Avoid use of aerial fire retardants and foams with 300 feet of riparian areas. To the maximum extent feasible, orient air drops so that the drop lands perpendicular to streams.
- 15.2.1.2. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.
- 15.2.1.3. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

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

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

23.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.1.2. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

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

23.1.2.1. **Action Step:** Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

23.1.2.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.3.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanism

23.2.1. **Recovery Action:** Prevent impairment to instream substrate

23.2.1.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.

23.2.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.2.1.3. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

24. Threat- Severe Weather Patterns

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

24.1.1. **Recovery Action:** Prevent impairment to the estuary

24.1.1.1. **Action Step:** Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.

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

24.1.2.1. **Action Step:** Ensure adequate water temperatures are maintained during drought periods.

24.1.2.2. **Action Step:** Protect sources of cool water input from future diversions.

24.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.3.1. **Action Step:** Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical coho watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.

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

24.1.4.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions. Critical flow values during droughts should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.

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

24.1.5.1. **Action Step:** Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.5.2. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

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Table 3: Implementation Schedule ~ Waddell 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		
WadC-CCC-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
WadC-CCC-1.1.1	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
WadC-CCC-1.1.1.1	Action Step	Estuary	Promote and evaluate alternatives to the current Highway One bridge to improve estuary function.	2	10	CalTrans, CDFG, State Parks, USACE, USFWS	156.00	156.00				312	The current bridge is planned for a rebuild by Caltrans. A new bridge should account for sandbar formation and likely impacts to lagoon function. A new structure should be constructed to have minimal influence on sandbar opening and closing during all potential water years. Cost could not be determined at this time due to unknown financial considerations being evaluated by Caltrans for bridge design and reconstruction. The bridge location may have resulted in some channel incision which isolates the channel from the marsh and results in a lack of backwater habitat in the estuary. Cost for estuary use estimated at \$311,467/project.
WadC-CCC-1.1.1.2	Action Step	Estuary	Evaluate alterations to river mouth dynamics and implement changes to restore natural function	2	10	CalTrans, State Parks						TBD	The current bridge and parking lot configuration should be closely evaluated and adverse impacts remediated to improve sand bar dynamics. A proposed rebuild of the Waddell Highway 1 bridge provides a rare opportunity within the range of CCC coho salmon to reclaim historical estuary dynamics. The sandbar closure frequency has changed, and these changes impact estuary productivity for rearing juvenile. Shapovalov and Taft (1954) documented that the sandbar closed the lagoon in eight of nine years during their study in the 1930s/early 1940s, while Smith (2010) documented that since at least 1995 the sandbar only formed in 2008 and 2009. This change in closure frequency has likely reduced the overall salmonid carrying capacity in Waddell Creek. Reasons for the change in closure frequency are not entirely clear, but Smith (2010) provided possible reasons, including changes to beach sand dynamics that may include possible interactions with the confined channel at the Highway 1 Bridge and/or Highway 1 berm and the State Park parking lot, and increases in the frequency of illegal breachings. Determining and correcting the reasons behind the changes to sandbar closure would provide essential information to guide future restoration and threat abatement measures. As at nearby Scott Creek, the California Department of Transportation is evaluating bridge replacement over US Route 1. If the bridge and/or parking lot are affecting sandbar closure dynamics, the problem should be considered and corrected during future bridge reconstruction.

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		
WadC-CCC-1.1.2	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
WadC-CCC-1.1.2.1	Action Step	Estuary	Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.	2	10	CDFG, IWRP, Santa Cruz RCD, State Parks	310.00	310.00				620	Costs may vary depending on the total number of structures and necessary engineering. Due to the lack of instream infrastructure (after the Highway 1 bridge is replaced) it is likely that relatively little engineering will be necessary. Permitting costs are anticipated to be negligible to likely use of programmatic permits. Cost for treating 2 acres (assume 5% of total estuarine acres) at a rate of \$310,216/acre.
WadC-CCC-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification or curtailment of the species habitat or range.										
WadC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Prevent impairment to floodplain connectivity.										
WadC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Address channel incision issues and reduced stream complexity between the Highway one bridge (stream mile 0) and the footbridge (stream mile 8).	2	10		278.50	278.50				557	Costs are based on \$28,500/mile for stream complexity actions and \$41,092/mile for floodplain projects because the projects will work in concert with each other over the 8 mile section.
WadC-CCC-3.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
WadC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										

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		
WadC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	10	IWRP, State Parks	71.25	71.25				143	Despite fair LWD ratings for Waddell Creek, only one percent of the instream shelter values measured scored >80 and (thus rated Poor). This may suggest instream shelter is compromised due to high sediment loading (embeddedness values also rated Poor) which may reduce the function and capacity of instream wood to create adequate shelter habitat. To improve shelter rating, LWD input should be evaluated in specific stream reaches where improvements are anticipated to result in benefits such as reaches with softer banks, and reaches where LWD rated below Very Good. Cost estimate based on DFG 2004, at approximately \$28,500/mile, and assuming approximately 5 miles would be treated. Costs will be higher if engineered large wood placement approaches are used. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody debris should be targeted to reach density and volume outlined in the Viability table in this document. Cost for treating 5 miles with large wood placement is \$142,500 and \$576,384 for Engineered Log Jams, respectively.
WadC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating										
WadC-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem Waddell Creek.	2	10		100.00	100.00				200	Cost based on \$28,500/mile for 7 miles of mainstem Waddell Creek. Cost of improving shelter rating could be part of increasing large wood frequency.
WadC-CCC-3.1.2.2	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts. Create winter velocity refuge between stream mile 4 and 8 (footbridge). Create winter velocity refuge in stream above and below tramway springs.	2	100	CDFG, IWRP, State Parks						TBD	Cost accounted for in above action steps.
WadC-CCC-9.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WadC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
WadC-CCC-9.1.1.1	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	CDFG, IWRP, State Parks	27.00	27.00				54	Cost for erosion assessment estimated at \$13.90/acre (assume 25% of total watershed acres).

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		
WadC-CCC-9.1.1.2	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	10	CDFG, IWRP, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	642	642				1,284	DFG estimated LWD structures cost approximately \$25,680/mile each (DFG 2004). Assumed 50 structures would be needed. However, cost saving could be realized if existing sources of large wood are used. Wood in Waddell Creek is clumped into a few areas and has the potential to act as migration barriers. Redistribution of wood into key stream reaches could improve overall gravel quality and reduce the potential threat of temporal migration barriers.
WadC-CCC-9.1.1.3	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	California Coastal Conservancy, CalTrans, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	15.73	15.73				31	Cost based on \$13,680/mile for 2.3 miles of riparian road.
WadC-CCC-9.1.1.4	Action Step	Sediment	Remediate slides and gullies delivering sediment to stream channels.	3	20	IWRP, State Parks							
WadC-CCC-9.1.1.5	Action Step	Sediment	Remediate near stream sediment sources such as streamside landings, roads, and failing banks using appropriate techniques.	2	30	IWRP, State Parks						TBD	
WadC-CCC-9.1.1.6	Action Step	Sediment	Establish and/or maintain continuous and properly functioning native riparian buffers.	3	100	State Parks							Riparian buffers adjacent to agricultural field in the lower watershed should be carefully monitored over time. Any encroachment into the existing riparian buffer should be discouraged.
WadC-CCC-10.1	Objective	Viability	Address the inadequacy of existing regulatory mechanisms.										
WadC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
WadC-CCC-10.1.1.1	Action Step	Viability	Establish life cycle station in the Waddell Creek watershed, and utilize it to compare productivity with existing historical data for the watershed (Gallagher and Gallagher 2005).	3	6	CDFG, NOAA SWFSC, Private Landowners, State Parks	1,338	268				1,605	Although Waddell is rated as a Dependent watershed and other monitoring is occurring in an adjacent Dependent watershed (Scott Cr), Waddell is of particular historical importance to assessing long term trends of coastal salmonids due to the past work of Shapovalov and Taft (1954) during the 1930's. However, due to the ongoing effort in nearby Scott Creek, a lifecycle station in Waddell was rated as a lower priority. Cost for life cycle monitoring station estimated at \$267,444.

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		
WadC-CCC-10.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.	1	20	NOAA SWFSC, Private Consultants, State Parks	94.00	94.00	94.00	94.00		376	Juvenile monitoring has been ongoing in Waddell Creek since 1988 and provides one of the longest continuous monitoring datasets in the CCC ESU. Monitoring should continue. Cost for annual juvenile distribution survey estimated at \$18,823/year for Santa Cruz Mtns. Diversity Stratum.
WadC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
WadC-CCC-10.1.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20		28.00	28.00	28.00	28.00		112	Standardized surveys should not occur until a small sustained run of CCC coho salmon is re-established in the watershed. Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum. Redd monitoring using (GTRS sampling design) may be less expensive than establishing life cycle station to count migrating adults and smolts. All assessments should use standardized methods. Methods should be consistent across the ESU or at a minimum the Santa Cruz Mtns Diversity Stratum. Cost for spawner surveys are estimated at \$56,470/year.
WadC-CCC-11.1	Objective	Water Quality	Address the inadequacy of existing regulatory mechanisms.										
WadC-CCC-11.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants.										
WadC-CCC-11.1.1.1	Action Step	Water Quality	Identify source of ongoing low fish abundance in upper East Waddell Creek and implement appropriate remediation and restoration actions.	1	3	CDFG, NMFS OLE, State Parks	50.00					50	Installation of continuous monitoring water quality gauges should begin as soon as possible. Relatively few threats exist in the watershed and habitat quality is better than many streams in the Santa Cruz Mountains. Nonetheless, fish density is very low compared to historical conditions and coho are nearly extirpated. Dr. Jerry Smith has sampled the watershed since 1988 and believes the low density is due to episodic dumping of toxic chemicals or other substance that has severely degraded water quality conditions for successful juvenile rearing in East Waddell Creek. NMFS OLE special agents and DFG game wardens investigated the watershed in 2008 but failed to detect potential toxin sources. Other habitat alterations (such as major landslides) have also been evaluated, but to date no other apparent causes leading to low juvenile densities have been detected. Cost for continuous water quality stations estimated at \$5,000/station. Assume a minimum of 10. Cost does not account for maintenance or data management.

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		
WadC-CCC-11.1.1.2	Action Step	Water Quality	Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals or other associated practices into East Branch Waddell.	1	5	CDFG, NMFS OLE, Private Landowners, RWQCB, State Parks						TBD	
WadC-CCC-14.1	Objective	Disease/Predation/Competition	Address disease or predation										
WadC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
WadC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in the Waddell estuary to juvenile and smolting salmonids and implement abatement strategies if appropriate.	3	10	CDFG, IWRP, Private Consultants, State Parks	65.00	65.00				130	Final reports should include a series of recommendations and the feasibility of implementing these recommendations. Accurate implementation cost cannot be determined until all potential control methods are evaluated and total magnitude of the impact of anadromous salmonids ascertained. Some researchers believe striped bass are not a major constraint. Total duration of predator control efforts may be longer depending on recommendations of plan. Cost for abundance/distribution surveys estimated at \$129,391/project.
WadC-CCC-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
WadC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to hydrology										
WadC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, State Parks							Require all water truck/tenders be fitted with DFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lowering stream flows during water drafting.
WadC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
WadC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.	3	5	CalFire, CDFG, Santa Cruz County, Santa Cruz RCD, USFWS							
WadC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate										

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		
WadC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	1	100	CalFire							This should be considered a standard practice by firefighting organizations
WadC-CCC-15.2	Objective	Fire/Fuel Management	Address the inadequacies of regulatory mechanisms.										
WadC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WadC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams with 300 feet of riparian areas. To the maximum extent feasible, orient air drops so that the drop lands perpendicular to streams.	2	100	CalFire							
WadC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	3	5	CalFire, State Parks							
WadC-CCC-15.2.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	1	100	CalFire, CDFG, NMFS, USFWS							The resource agencies can provide guidance regarding critical resources in areas that may be affected by firefighting actions.
WadC-CCC-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WadC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
WadC-CCC-23.1.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	2	10		28.04	28.04				56	Road densities are high throughout the watershed and are estimated at 2.0 miles of road per square mile of watershed area, and at 2.3 miles per square mile of riparian area. However, although road densities are high, they are generally lower than most target watershed in the Santa Cruz Mountains. Roads parallel many of the waterways within Waddell Creek and restrict channel migration and other fluvial processes. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on \$13,680/mile for decommissioning 4.1 miles of road (10% of 41 miles of road network).
WadC-CCC-23.1.1.2	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	20		89.78	89.78	89.78	89.78		359	Cost based on \$71,820/unit with 5 of the 11 crossings being treated. The complexity of the crossings could result in each unit costing \$1,152,540, resulting in an estimate of \$5,762,700.

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		
WadC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WadC-CCC-23.1.2.1	Action Step	Roads/Railroads	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	100	CalFire, State Parks							
WadC-CCC-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	10	IWRP, Santa Cruz RCD, State Parks	43.50	43.50				87	Cost accounted for erosion assessment. Cost for road inventory estimated at \$1,056/mile.
WadC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WadC-CCC-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, NRCS, Private Landowners, State Parks							
WadC-CCC-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanism										
WadC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
WadC-CCC-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.	2	100	CalFire, Santa Cruz County, State Parks							Hydrologically disconnect roads where appropriate.
WadC-CCC-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	State Parks							
WadC-CCC-23.2.1.3	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	3	100	CalFire, PG&E, Santa Cruz County							
WadC-CCC-24.1	Objective	Severe Weather Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
WadC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary										
WadC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	2	100								New bridges and upgrades to parking lots should evaluate future impacts associated with sea level rise. Cost accounted for in ESTUARY.

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		
WadC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
WadC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Ensure adequate water temperatures are maintained during drought periods.	2	100	IWRP, Private Landowners, SWRCB							
WadC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Protect sources of cool water input from future diversions.	2	100	CDFG, State Parks, SWRCB							Sources of cool water input should not be diverted, particularly during drought periods.
WadC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WadC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical coho watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	20		136.71	136.71	136.71	136.71		547	Cost based on increasing from <50% to >80% of 186 acres of floodplain (=56 acres). Waddell Creek is low urban impact, therefore assume the lower cost of recovery of \$9,765/acre for 56 acres.
WadC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
WadC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions. Critical flow values during droughts should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFG, NMFS HCD, State Parks, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at \$63,005/project.
WadC-CCC-24.1.5	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WadC-CCC-24.1.5.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	California Geological Survey, Santa Cruz County, State Parks							Heavy rainfall and extreme flood events could result in major erosion in upslope locations. Much of the watershed is comprised of steep topography in erodible geology. High instream sediment concentration can fill pools, smother spawning gravel, and generally simplify instream habitat complexity.
WadC-CCC-24.1.5.2	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	California Geological Survey, CalTrans, Private Landowners, Santa Cruz County, USACE						In-Kind	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. Cost cannot be determined at this time due to a lack of information regarding where these existing habitats remain in juxtaposition to future development.