

Aptos Creek



Location	• Santa Cruz County
Watershed Area	• 24.5 Square Miles
Potential Habitat	• 26.0 Stream Miles
Vegetation	• 68% Coniferous • 11% Oak Woodland
Erodability	• Low to Moderate
Ownership Patterns	• 52% Private; 48% Public
Dominant Land Uses	• Rural Residential, Timber, Agricultural
Housing Density	• Moderate to High
TMDL Pollutants	• Pathogens, Sediment



Rio Del mar Beach lagoon,
Santa Cruz Sentinel

Aptos Creek Coho Salmon: Nearly Extirpated



Recovery Goals

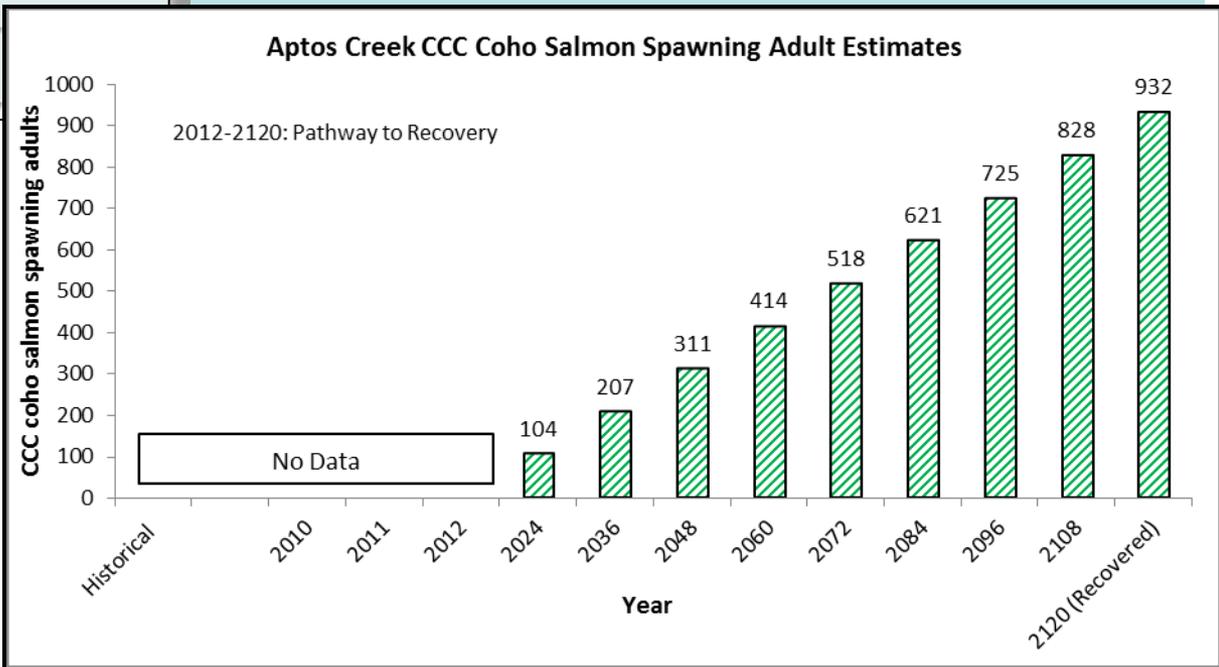
- ✓ CCC coho range recently extended to include Aptos Creek
- ✓ Maintaining genetic diversity of this southernmost population
- ✓ Improve estuary lagoon management

**Aptos Creek
Adult Spawner Targets**

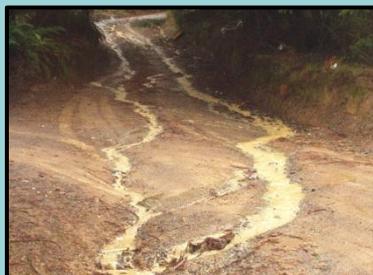
**Downlisting to Threatened
466**

**Recovery
932**

**STEELHEAD: YES
CHINOOK SALMON: NO**



Current Instream, Watershed and Population Conditions



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Preclude new construction within remaining portions of the estuary
- Educate landowners, land managers, and County and municipal staffs on the importance of LWD
- Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements
- Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds

Priority 2 & 3: Long-Term Restoration Actions

- Ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws
- Post interpretive signs to discourage breaching of the lagoon
- Enhance aquatic cover and substrate in estuary
- Create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Incorporate large woody material into stream bank protection projects
- Implement a monitoring program
- Monitor instream summer water temperatures



Recovery Partners

California State Parks, Santa Cruz RCD,
County of Santa Cruz, Coastal Watershed
Council



Future Threats



Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Design new development to allow streams to meander in historical patterns
- Discourage forest conversions to vineyards or rural residential housing
- Design new development and roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions
- Ensure current and future water supply demands can be met without impacting surface flow

Priority 2 & 3: Long-Term Threat Abatement Actions

- Eliminate the use of gabion baskets and undersized rock within the bankfull channel
- Implement sedimentation reduction techniques in concert with prescribed and fire suppression techniques
- Monitor the river mouth until river flows naturally breach the sandbar
- Ensure roads, hiking trails, and biking paths are winterized
- Educate landowners regarding the importance of maintaining instream large wood materials
- Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded



Culvert in Valencia Creek prior to being retrofitted with a new fish ladder in 2007, photo by Ross Taylor and Associates

Conservation Highlights

- The Coastal Watershed Council monitors the Aptos Creek watershed and has conducted a watershed assessment.
- Fish passage improvement at Valencia Creek culvert has been completed and improvements to a pipeline crossing are proposed which will improve fish passage. Culvert improvements were partially funded by fine monies from a NOAA enforcement case.

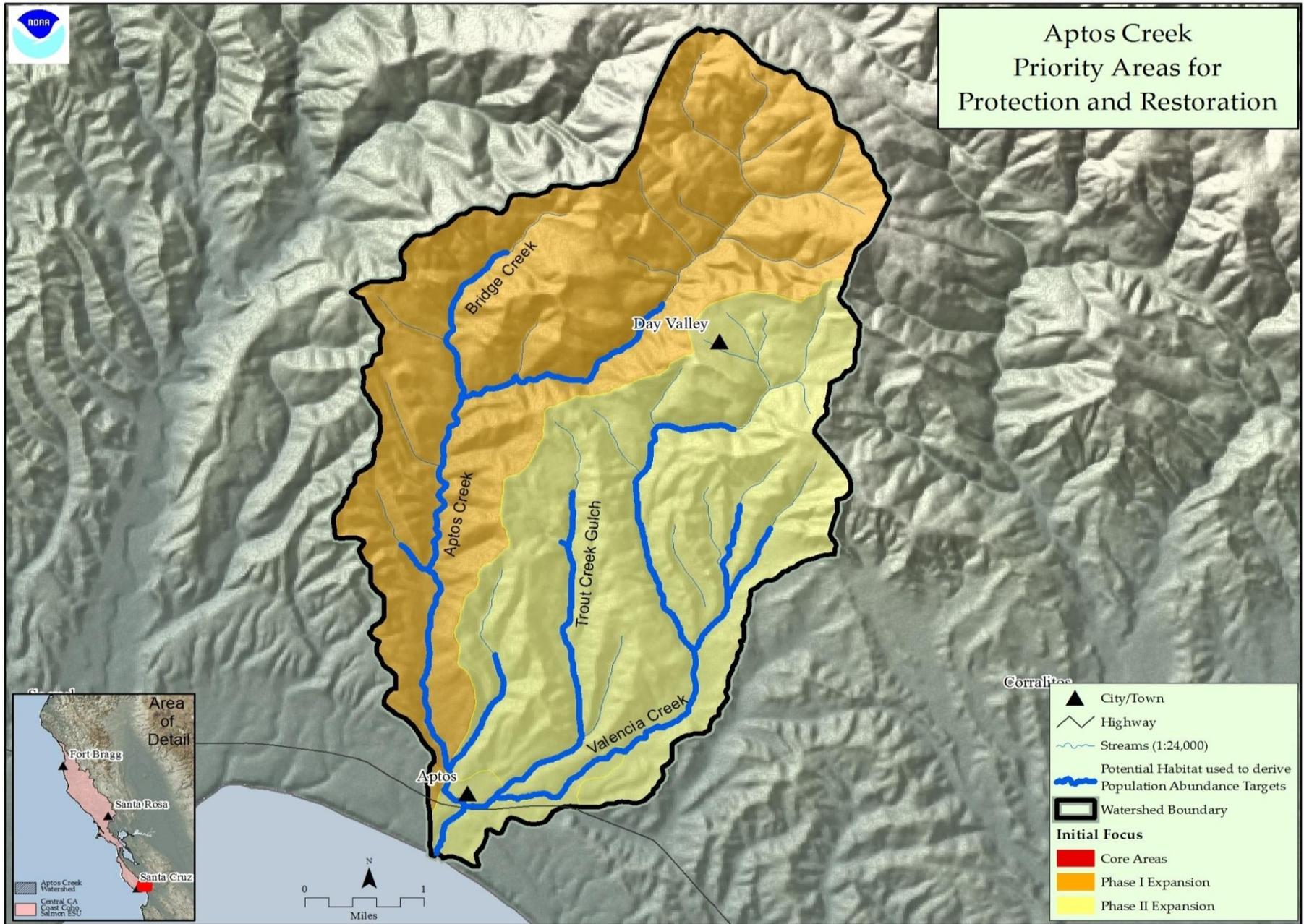


Figure 1: Map of Aptos Creek

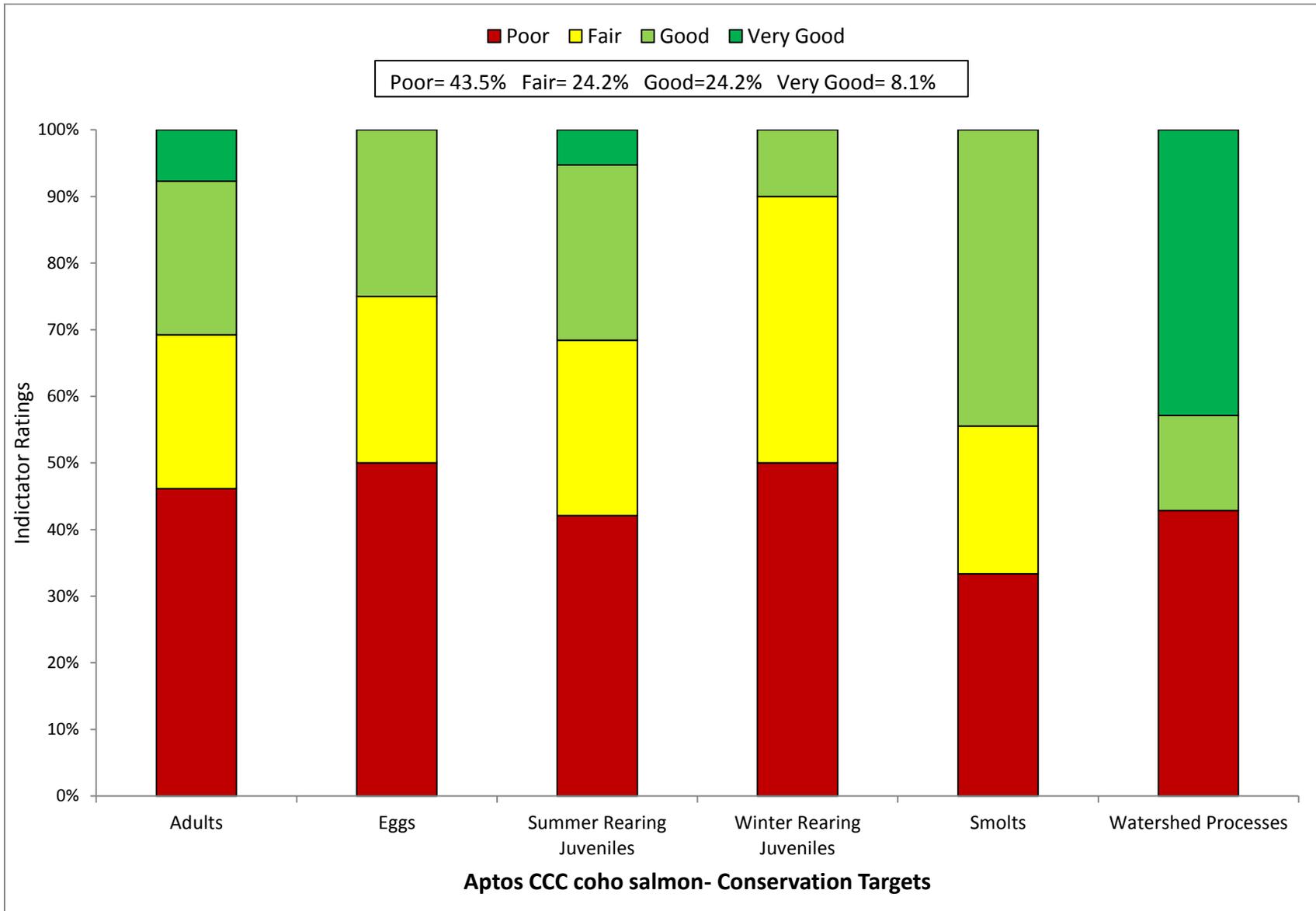


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Aptos 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)	1.3 to 4 Key Pieces/100m	Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	25% streams 49% IP (>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	0% streams/ 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 <35	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	75% of IP-km to 90% of IP-km accessible	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	75 to 90% of IP-km accessible	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	<50% of IP-km or <16 IP-km accessible	Poor	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	Poor	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% of streams/ IP-km maintains severity score of 3 or lower	Poor	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 =42	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)	>17% (0.85mm) and >30% (6.4mm)	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	25% streams 7% IP (>50% stream average scores of 1 & 2)	Poor	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 and not functioning	Poor	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)	1.3 to 4 Key Pieces/100 meters	Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	25% streams 47 IP (>49% of pools are primary pools)	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	25% streams 47% IP (>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/ 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 35-50	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	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	0.37 Diversions/10 IP-km	Good	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	50% of IP-km to 74% of IP-km accessible	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	87% of streams/IP with average canopy >85%	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)	25% streams 7% IP (>50% stream average scores of 1 & 2)	Poor	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	Sublethal or Chronic	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor	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% 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)	1.3 to 4 Key Pieces/100 meters	Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	25% streams 47% IP (>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/ 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	50% of IP-km to 74% of IP-km accessible	Fair	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)	25% streams 7% IP (>50% stream average scores of 1 & 2)	Poor	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	Sublethal or Chronic	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor	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	0% streams/ 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	0.37 Diversions/10 IP-km	Good	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	75% of IP-km to 90% of IP-km accessible	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	75-90% IP-km (>6 and <16 C)	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	Sublethal or Chronic	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	<50% of streams/ IP-km maintains severity score of 3 or lower	Poor	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	1.74% of Watershed in Impervious Surfaces	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	2.117% of Watershed in Agriculture	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	7% of Watershed in Timber Harvest	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	51% Historical Species Composition	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	51-74% Intact Historical Species Composition	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	3.7 Miles/Square Mile	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	4.6 Miles/Square Mile	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

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

Central CA Coast Coho Salmon ~ Aptos 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:** Increase the extent of estuarine habitat
 - 1.1.1.1. **Action Step:** Evaluate restoration benefits to tidal prism by reducing the size of the Esplanade Parking Lot.
 - 1.1.1.2. **Action Step:** Narrow Moosewood Drive and/or State Parks property down to one lane to expand overall tidal prism.
 - 1.1.1.3. **Action Step:** Develop and implement other strategies to increase the current extent of the estuary/lagoon in efforts to increase high value habitat for migrating and rearing salmonids.
 - 1.1.2. **Recovery Action:** Develop and implement programs to address water quality concerns.
 - 1.1.2.1. **Action Step:** Isolate and correct source of impaired water quality in the lower Aptos Creek watershed.
 - 1.1.2.2. **Action Step:** Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.
 - 1.1.2.3. **Action Step:** Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.
 - 1.1.2.4. **Action Step:** Enhance streambed aquatic cover and substrate in estuary.
 - 1.1.2.5. **Action Step:** Encourage repaving and application of petrochemicals in the early summer to allow penetration and drying before fall rains.
 - 1.1.2.6. **Action Step:** Use gull-proof lids on refuse cans at and around the lagoon and beach.
 - 1.1.2.7. **Action Step:** Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary
 - 1.1.2.8. **Action Step:** Develop and implement programs to address ongoing poor water quality in Aptos Lagoon.
 - 1.1.3. **Recovery Action:** Reduce frequency of artificial breaching events
 - 1.1.3.1. **Action Step:** Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.
 - 1.1.4. **Recovery Action:** Reduce extent of estuarine shoreline development
 - 1.1.4.1. **Action Step:** Preclude, prohibit or prevent the construction of new buildings and associated infrastructure within remaining open areas of the Aptos estuary tidal prism.

- 1.1.5. **Recovery Action:** Improve the quality of each estuarine habitat zone
 - 1.1.5.1. **Action Step:** Evaluate and implement programs to enhance native riparian and wetland flora, reducing habitat related effects of past or present land-uses.
- 1.1.6. **Recovery Action:** Increase and enhance habitat complexity features
 - 1.1.6.1. **Action Step:** Identify key locations and install large wood structures (or other appropriate surrogate) targeting increased pool depth and shelter within the estuary.
- 1.1.7. **Recovery Action:** Reduce toxicity and pollutants
 - 1.1.7.1. **Action Step:** Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewer systems and storm drains.
 - 1.1.7.2. **Action Step:** Evaluate and repair private sewer laterals, particularly in areas subject to high groundwater adjacent or upstream of the estuary.
 - 1.1.7.3. **Action Step:** Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.
- 1.1.8. **Recovery Action:** Increase freshwater lagoon elevation during seasonal closures
 - 1.1.8.1. **Action Step:** Evaluate and implement possible structural improvements to maintain lagoon water surface elevations during the summer through the late fall.
 - 1.1.8.2. **Action Step:** Evaluate benefits of installation of a flume to control water surface elevation in the lagoon during summer and fall.
- 1.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
 - 1.2.1. **Recovery Action:** Reduce frequency of artificial breaching events
 - 1.2.1.1. **Action Step:** Encourage State Parks and County of Santa Cruz to fence off lagoon with temporary fencing rather than breach lagoon as a precaution to protect public health and safety.
 - 1.2.1.2. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.
 - 1.2.1.3. **Action Step:** Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Aptos Creek lagoon.
 - 1.2.1.4. **Action Step:** Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.

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:** Rehabilitate and enhance floodplain connectivity

- 2.1.1.1. **Action Step:** Institutionalize programs to purchase land/conservation easements to encourage the re-establishment of natural riparian communities. Prioritize Phase I areas (mainstem Aptos Creek) as well as the lagoon.
- 2.1.1.2. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.
- 2.1.1.3. **Action Step:** Target habitat restoration and enhancement projects that will function between winter baseflow and flood stage.

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 large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.1.2. **Action Step:** Incorporate large woody material into stream bank protection projects, where appropriate.

3.1.1.3. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.

3.1.1.4. **Action Step:** Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.1.5. **Action Step:** Encourage retention of large woody debris for all historical coho salmon rearing habitats in Aptos Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.1.6. **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.

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

3.1.2.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.1.3. **Recovery Action:** Increase frequency of primary pools

3.1.3.1. **Action Step:** Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (DFG 2004).

3.1.4. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.4.1. **Action Step:** Increase the frequencies of riffle habitat in 75% of the streams within the watershed

4. Restoration- Hydrology

No species-specific actions were developed.

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:** Reduce adverse impacts to watershed processes associated with urbanization
 - 5.1.1.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources
 - 5.1.2. **Recovery Action:** Reduce adverse impacts to watershed processes associated with streamside road density (< 100 meters)
 - 5.1.2.1. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas
 - 5.1.2.2. **Action Step:** Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements
 - 5.1.2.3. **Action Step:** Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.

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:** Reduce turbidity and suspended sediment
 - 9.1.1.1. **Action Step:** Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into Aptos Creek.
 - 9.1.2. **Recovery Action:** Improve instream gravel quality
 - 9.1.2.1. **Action Step:** Prioritize and treat erosion sources in Table 11 of the Aptos Geomorphic and Erosion Source Technical Report.
 - 9.1.2.2. **Action Step:** Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

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:** 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.

10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.

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

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

10.2.1.1. **Action Step:** Initiate juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

10.2.2. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.2.2.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. The upper portion of Aptos Creek should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2.2.2. **Action Step:** Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.

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

10.2.3.1. **Action Step:** Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery

10.2.3.2. **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 present or threatened destruction, modification, or curtailment of the species range or habitat

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

11.1.1.1. **Action Step:** Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.

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

11.1.2.1. **Action Step:** Remove invasive exotic vegetation at problematic sites, such as the Old Mill site, and revegetate with native plants.

11.1.2.2. **Action Step:** Install continuous water quality samplers in and adjacent to Mangels Gulch, Trout Gulch, and Valencia Creek.

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

11.1.3.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

11.1.3.3. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

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 instream substrate

13.1.1.1. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.1.1.2. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.

13.1.1.3. **Action Step:** Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.

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

13.1.2.1. **Action Step:** Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.

14. Threat- Disease/Predation/Competition

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

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

14.1.1.1. **Action Step:** Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation (i.e., eucalyptus, acacia, cape ivy) within the stream and riparian corridor.

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

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

14.2.1.1. **Action Step:** Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where 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 instream substrate/food productivity

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

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

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.5. **Action Step:** Encourage CalFire to provide plan to all non-County fire fighters when providing firefighting assistance in the Aptos Creek watershed (and all other watersheds in the County).

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

15.1.2.1. **Action Step:** Work with County planners to define future impacts of proposed rural development on fire suppression and fuel load buildup.

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

15.1.3.1. **Action Step:** Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.

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

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

15.2.1.2. **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. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

- 15.2.1.3. **Action Step:** Avoid use of toxic aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.
- 15.2.1.4. **Action Step:** Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to site water quality and the structure of the biological community.
- 15.2.1.5. **Action Step:** Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.

16. [Threat- Fishing/Collecting](#)

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

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

- 16.1.1.1. **Action Step:** Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.
- 16.1.1.2. **Action Step:** Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.
- 16.1.1.3. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) of fishing regulations low flow minimum flow closure for Aptos Creek.

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](#)

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

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

- 21.1.1.1. **Action Step:** Encourage development of a trail management plan/maintenance guidelines for Forest of Nisene Marks State Park. Use plan to develop a program to reduce erosion, decommission illegal or duplicate trails, and keep users on designated trails.
- 21.1.1.2. **Action Step:** Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

21.1.1.3. **Action Step:** Place educational materials/signage at stream crossings and interpretive centers about salmon and how to minimize impacts.

21.1.1.4. **Action Step:** Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.

22. Threat- Residential/Commercial Development

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

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

22.1.1.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

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

22.1.2.1. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.

22.1.2.2. **Action Step:** Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.

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

22.1.3.1. **Action Step:** Design new development to allow streams to meander in historical patterns, protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

22.1.3.2. **Action Step:** Santa Cruz County should adopt a policy of “managed retreat” (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from flooding.

22.1.3.3. **Action Step:** Evaluate watershed for infrastructure for high risk of flooding.

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

22.1.4.1. **Action Step:** Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

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

22.1.5.1. **Action Step:** Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.5.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

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

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

22.2.1.1. **Action Step:** Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.

22.2.2. **Recovery Action:** Prevent impairment to water quality

22.2.2.1. **Action Step:** Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the Aptos Creek Watershed.

22.2.2.2. **Action Step:** Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.

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

22.2.3.1. **Action Step:** Implement ordinances and policies so new development meets a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.

22.2.3.2. **Action Step:** As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.

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

22.2.4.1. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.4.2. **Action Step:** Discourage Counties from rezoning forestlands to rural residential.

22.2.4.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

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

22.2.5.1. **Action Step:** Minimize redevelopment within the 100 year floodplain.

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 stream hydrology (impaired water flow)

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

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

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

- 23.1.2.2. **Action Step:** Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.
- 23.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
- 23.1.3.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).
- 23.1.3.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment and runoff related problems and determine level of hydrologic connectivity.
- 23.1.3.3. **Action Step:** Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.
- 23.1.3.4. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.
- 23.1.3.5. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.
- 23.1.3.6. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.
- 23.1.3.7. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.
- 23.1.3.8. **Action Step:** Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.
- 23.1.3.9. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.
- 23.1.3.10. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.
- 23.1.4. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)
- 23.1.4.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.
- 23.1.5. **Recovery Action:** Prevent impairment to passage and migration
- 23.1.5.1. **Action Step:** Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

- 23.1.5.2. **Action Step:** All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.
- 23.1.5.3. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

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

23.1.6.1. **Action Step:** Discourage or eliminate unwanted vegetation types and species and promote desirable (native) vegetation.

23.1.6.2. **Action Step:** Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

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

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

23.2.1.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

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

23.2.2.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.2.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.2.2.3. **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.

23.2.2.4. **Action Step:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

23.2.2.5. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

23.2.2.6. **Action Step:** Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.

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 projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).
- 24.1.1.2. **Action Step:** Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).
- 24.1.1.3. **Action Step:** Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.
- 24.1.2. **Recovery Action:** Prevent impairment to hydrology (impaired water flow)
 - 24.1.2.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions.
 - 24.1.2.2. **Action Step:** Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.
 - 24.1.2.3. **Action Step:** Ensure all water diversions in the watershed are in compliance with all applicable laws and policies.
 - 24.1.2.4. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.
- 24.1.3. **Recovery Action:** Prevent impairment to water quality
 - 24.1.3.1. **Action Step:** Ensure tolerable water temperatures are maintained during drought periods.
 - 24.1.3.2. **Action Step:** Implement performance standards in Stormwater Management Plans.
- 24.1.4. **Recovery Action:** Prevent impairment to passage and migration
 - 24.1.4.1. **Action Step:** Work with CDFG, County of Santa Cruz and knowledgeable biologists to develop emergency rules and adopt implementation agreements.
 - 24.1.4.2. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.
 - 24.1.4.3. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could negatively impact coho salmon.

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 the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.

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

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.

25.1.2.3. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.2.4. **Action Step:** Promote irrigation efficiency projects for agricultural uses in the watershed.

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in Aptos Creek.

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

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

25.1.4.1. **Action Step:** Ensure existing water diversions do not impair water temperatures in Aptos Creek.

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:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.2. **Action Step:** Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.

25.2.1.3. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.4. **Action Step:** Minimize new or increased summer diversions.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Aptos Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
ApC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
ApC-CCC-1.1.1.1	Action Step	Estuary	Evaluate restoration benefits to tidal prism by reducing the size of the Esplanade Parking Lot.	3	20	CA Coastal Commission, IWRP, Santa Cruz RCD, State Parks						In-Kind	A feasibility and benefits analysis should be conducted, prior to proceeding further with this recommendation. Reducing the size of the parking lot next to the estuary could increase the total quantity of lagoon habitat. Lagoon habitat could include greater wetted area or installation of a buffer zone. A buffer could benefit the lagoon by trapping some pollutants prior to entering the water. Reducing the size of the parking lot would likely be expensive and costs are uncertain due to unknown infrastructure constraints that would likely result in increased expenditures above a typical road decommissioning project. Additionally, this parking lot is popular with the local community because it provides easy beach access and parking is free.
ApC-CCC-1.1.1.2	Action Step	Estuary	Narrow Moosewood Drive and/or State Parks property down to one lane to expand overall tidal prism.	3	20	Santa Cruz County Department of Public Works, State Parks						TBD	Opportunities to improve estuarine function in Aptos estuary are extremely limited due to significant infrastructure located within the historical estuary tidal prism. Narrowing the drive may be infeasible due to political and social constraints. The ecological benefits should be carefully evaluated prior to moving forward with this recommendation. Prior to implementing this alternative, a feasibility and benefits analysis should be conducted. Narrowing the road could increase the total quantity of lagoon habitat. Lagoon habitat could include greater wetted area or installation of a riparian buffer zone. A riparian buffer could benefit the lagoon by trapping some pollutants prior to entering the water and increase shading which would help to reduce water temperature during the summer. The road narrowing would likely be expensive and costs are uncertain due to unknown infrastructure constraints that would likely result in increased expenditures above a typical road decommissioning project in a less impacted location.
ApC-CCC-1.1.1.3	Action Step	Estuary	Develop and implement other strategies to increase the current extent of the estuary/lagoon in efforts to increase high value habitat for migrating and rearing salmonids.	3	30	CA Coastal Commission, IWRP, Santa Cruz County, State Parks							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.2	Recovery Action	Estuary	Develop and implement programs to address water quality concerns.										
ApC-CCC-1.1.2.1	Action Step	Estuary	Isolate and correct source of impaired water quality in the lower Aptos Creek watershed.	3	10	RWQCB, Santa Cruz County							Swanson Hydrology and Geomorphology et al. (2003), in a review of water quality monitoring information from the Santa Cruz Health Dep, identified elevated levels of nutrients entering the lower portion of the watershed, primarily from Valencia Creek. Source is unknown but it has been hypothesized that a leaking sewer pipe may be a major source of contamination. Additional efforts should include working with landowners in the Valencia watershed to ensure septic systems are in compliance with State standards. All identified sources of water quality degradation should be corrected.
ApC-CCC-1.1.2.2	Action Step	Estuary	Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.	3	100	Santa Cruz County							Maintain existing programs for prompt cleanup of sewage spills and correction of problems with private sewer laterals that cause chronic leaks.
ApC-CCC-1.1.2.3	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	10	CDFG, Central Water District, NMFS, Private Landowners, SWRCB						In-Kind	Work would entail SWRCB reviewing all existing water diversions and contacting diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to bring into compliance which is reflected in the tentative cost estimate.
ApC-CCC-1.1.2.4	Action Step	Estuary	Enhance streambed aquatic cover and substrate in estuary.	2	15	Santa Cruz County, Santa Cruz RCD	103.33	103.33	103.33			310	Recommendation derived from the Lower San Lorenzo River and Lagoon Management Plan (Swanson Hydrology & Geomorphology et al. 2002) but is applicable to Aptos Creek. This recommendation includes installations of two types of structures: (1) log/boulder structures and (2) cobble and cattail bulrush structures. Although the site is heavily constrained, implementation of these recommendations would benefit water quality by reducing temperature, providing cover to juvenile salmonids, and improving water quality. Cost based on treating 1 acre (assume 25% of 4 acres of estuary) at a rate of \$310,216/acre.
ApC-CCC-1.1.2.5	Action Step	Estuary	Encourage repaving and application of petrochemicals in the early summer to allow penetration and drying before fall rains.	3	100	CalTrans, Santa Cruz County, State Parks							In-Kind

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.2.6	Action Step	Estuary	Use gull-proof lids on refuse cans at and around the lagoon and beach.	3	50	State Parks	1.00	1.00	1.00	1.00	1.00	10	Use enough refuse containers to satisfy the demand for refuse disposal. Gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria (Alley 2009). Cost based on increasing and replacing refuse containers.
ApC-CCC-1.1.2.7	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	3	10	IWRP, Santa Cruz County	75.00	75.00				150	Urban encroachment has adversely affected the overall hydrology and water chemistry of the estuary. Urbanization has also lead to the estuary being affected by poor water quality from upstream sources and unauthorized lagoon breaching,. Water quality assessment based on a cost of \$5000/site for continuous monitoring, with a minimum of 3 sites within the lagoon. Cost could be significantly higher if additional sites are needed to identify source of pollution to estuarine water quality.
ApC-CCC-1.1.2.8	Action Step	Estuary	Develop and implement programs to address ongoing poor water quality in Aptos Lagoon.	3	15	IWRP, Public, RWQCB, Santa Cruz County, Santa Cruz RCD, State Parks, USEPA							Available information suggests the water quality in the lagoon is compromised due to sewage water input etc. Poor water quality, under current conditions, is more of a threat to human health than fish health. However, human health concerns often promulgate desires to artificially breach the sand bar as a way to remove impaired water from the lagoon. Cost for water quality assessment already accounted for.
ApC-CCC-1.1.3	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ApC-CCC-1.1.3.1	Action Step	Estuary	Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.	2	5	CDFG Law Enforcement, IWRP, NMFS OLE, Santa Cruz County, State Parks, USFWS	312.00					312	Breaching of the lagoon is not a common and the impacts are likely significant to listed salmonids and tidewater goby. Cost for estuary use is estimated to be \$311,467.
ApC-CCC-1.1.4	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										

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		
ApC-CCC-1.1.4.1	Action Step	Estuary	Preclude, prohibit or prevent the construction of new buildings and associated infrastructure within remaining open areas of the Aptos estuary tidal prism.	1	100	Santa Cruz County, State Parks, USACE						In-Kind	Aptos estuary has been reduced in size following European arrival and especially after the development of Rio Del Mar in the 1930's. The Aptos estuary was extensively converted from a functional estuary to urban uses and most of the historical tidal prism has been reduced due to infill from permanent infrastructure (hardscape). Urban development in the tidal prism of the lagoon has severely constricted the area to a width of approximately 70 feet between two vertical concrete levees that extend from the high water line of the ocean upstream approximately 300 feet (CWC and SHG 2003).
ApC-CCC-1.1.5	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
ApC-CCC-1.1.5.1	Action Step	Estuary	Evaluate and implement programs to enhance native riparian and wetland flora, reducing habitat related effects of past or present land-uses.	3	10	IWRP, Santa Cruz RCD, State Parks	975	975				1,950	Areas at the upper end of the estuary should be initially targeted. Improved riparian vegetation composition could benefit lagoon conditions by reducing water temperature and providing a source of macroinvertebrate production. Cost based on treating 0.4 miles (assume 80 acres/mile in 5% High IP and high cost with a minimum of 1 mile) at a rate of \$60,975/acre.
ApC-CCC-1.1.6	Recovery Action	Estuary	Increase and enhance habitat complexity features										
ApC-CCC-1.1.6.1	Action Step	Estuary	Identify key locations and install large wood structures (or other appropriate surrogate) targeting increased pool depth and shelter within the estuary.	2	10	IWRP, Santa Cruz County, Santa Cruz RCD, State Parks, USFWS	115.00	115.00				230	Cost based on treating 1 mile of estuary at a rate of \$115,276/ELJ. Installation of ELJ should be in concert with increasing other elements such as aquatic cover, instream boulders, and riparian vegetation to reduce the redundancy of design and permitting.
ApC-CCC-1.1.7	Recovery Action	Estuary	Reduce toxicity and pollutants										
ApC-CCC-1.1.7.1	Action Step	Estuary	Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewer systems and storm drains.	3	20	Santa Cruz County							
ApC-CCC-1.1.7.2	Action Step	Estuary	Evaluate and repair private sewer laterals, particularly in areas subject to high groundwater adjacent or upstream of the estuary.	3	10	Santa Cruz County						TBD	An inventory of stormwater sewer systems will identify problematic sewer laterals. It is likely Santa Cruz County has this information.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.7.3	Action Step	Estuary	Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.	3	100	RWQCB, Santa Cruz County							Cost already accounted for water quality assessment.
ApC-CCC-1.1.8	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										
ApC-CCC-1.1.8.1	Action Step	Estuary	Evaluate and implement possible structural improvements to maintain lagoon water surface elevations during the summer through the late fall.	3	10	CA Coastal Commission, California Coastal Conservancy, IWRP, Santa Cruz County, Santa Cruz RCD, State Parks						TBD	Evaluation should include input from scientists familiar with coastal watershed dynamics. Cost cannot be determined until evaluation of potential structural improvements is completed. Anticipate estuary assessment will identify structural improvements.
ApC-CCC-1.1.8.2	Action Step	Estuary	Evaluate benefits of installation of a flume to control water surface elevation in the lagoon during summer and fall.	3	10	CA Coastal Commission, IWRP, Santa Cruz County, Santa Cruz RCD, State Parks, USFWS						TBD	Nearby Soquel Creek estuary flume operated by the City of Capitola should serve as a model for evaluation. Operation of the flume by the City of Capitola costs approximately \$70,000 per year (this includes a monitoring component). Flume installation could allow sanctioned and effective management of Aptos Creek lagoon and minimize annual "emergency" declarations by beach front landowners.
ApC-CCC-1.2	Objective	Estuary	Address the inadequacy of existing regulatory mechanisms										
ApC-CCC-1.2.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ApC-CCC-1.2.1.1	Action Step	Estuary	Encourage State Parks and County of Santa Cruz to fence off lagoon with temporary fencing rather than breach lagoon as a precaution to protect public health and safety.	3	3	CDFG, Santa Cruz County, State Parks						In-Kind	Costs will vary and will depend on variation in river mouth configuration.
ApC-CCC-1.2.1.2	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	5	Santa Cruz County, Santa Cruz RCD, State Parks	3.00					3	Additional educational signage along the estuary should be included with this recommendation. Signage should explain estuarine function and the benefits to endangered species and water quality of a properly functioning estuary. Cost of signs varies widely depending on materials used and content. Assume average cost of sign being \$1,000/sign with a minimum of 3 posted near estuary.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.2.1.3	Action Step	Estuary	Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Aptos Creek lagoon.	2	10	CDFG Law Enforcement, NMFS, NMFS OLE, State Parks							Homeowners with property adjacent to the estuary often request local government agencies to address the meandering channel mouth when it may potentially threaten their beachside homes which often results in further encroachment into what remains of the natural estuary. Financial rewards may act as a deterrent to those involved in the unauthorized breaching of the lagoon. The lagoon has a long history of illegal breaches and to date no one has been successfully prosecuted for this activity. Breaching is believed to result in significant adverse impacts to steelhead rearing in the lagoon. Cost accounted for in above recovery action.
ApC-CCC-1.2.1.4	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.	2	100	NMFS, Santa Cruz County, State Parks						In-Kind	Close coordination by all parties would likely comprise the majority of the costs. Other methods should also be evaluated such as installation of cameras that provide real time oversight.
ApC-CCC-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
ApC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
ApC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment of natural riparian communities. Prioritize Phase I areas (mainstem Aptos Creek) as well as the lagoon.	2	100	CDFG, Santa Cruz County, Santa Cruz County Land Trust, The Nature Conservancy, Trust for Public Lands						TBD	Costs associated with development and implementation of this program are currently difficult to determine. Costs will vary significantly depending on market conditions, landowner participation, and programs actually used.
ApC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, USACE	82.50	82.50				165	Costs will vary significantly depending on site specific constraints and type of structure constructed. Many of the historical floodplain areas have been built upon. Remaining floodplains should be considered a high priority for preservation and enhancement actions. Assuming base application of restoring floodplain, cost based on treating 4 miles (assume 1 project/mile in 25% High IP) at a rate of \$41,092/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
ApC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement projects that will function between winter baseflow and flood stage.	3	5	CDFG, NOAA RC, Private Landowners, Santa Cruz RCD, USACE	130.00						130	An evaluation of these habitat features is needed in order to develop a reasonable cost estimate. Costs of an evaluation could be partially offset by leveraging past survey information and Aptos Creek watershed assessment. Cost for fish/habitat restoration implementation estimated at \$126,758.
ApC-CCC-3.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.											
ApC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency											
														Cost based on treating 3 miles (assume 1 project/mile in 25% High IP) at a rate of \$115,276/ELJ. Aptos Creek has approx. 16 km of IP habitat but it is assumed that many reaches will not be treated due to concerns over existing infrastructure. Available information indicates large woody material may not be limiting in upper Aptos and therefore we recommend initial efforts be directed at the lower reach, which may respond to LWD input. Costs are higher when 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 material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the watershed was allowed to stay in place. Unsecured LWD input should be evaluated for the portion of Aptos managed by State Parks and if feasible, significant cost saving could result over engineered structures. These actions will improve juvenile summer rearing, winter

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	10	IWRP, Private Landowners, Santa Cruz County, State Parks	175.00	175.00				350	rearing, and smolt survival by increasing the instream channel complexity in potential rearing and migration reaches. Additionally, it could improve egg survival by reducing redd scour in streams characterized by high bedload mobility. Existing documents (DFG stream survey records and Aptos Creek Watershed Assessment) could be used to identify key areas lacking or scarce in LWLD. If additional information is needed and site specific surveys required, the costs will likely increase significantly. LWLD should be properly sized and installed to viability table targets.
ApC-CCC-3.1.1.2	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate.	2	100	CalTrans, NMFS PRD, Private Landowners, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD, USACE							Costs will vary depending on site specific conditions, wood availability, and frequency of instream bank hardening projects.
ApC-CCC-3.1.1.3	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWLD to coho survival and recovery, and watershed processes.	1	5	CalFire, CDFG, NMFS, NRCS, Private Consultants, Santa Cruz County Department of Public Works, Santa Cruz RCD, USACE						In-Kind	Costs would likely be minimal, consisting of staff time for public outreach and outreach materials.
ApC-CCC-3.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	NOAA RC, NRCS, Private Landowners, RWQCB, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks, USACE						In-Kind	Cost should be minimal. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects.
ApC-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage retention of large woody debris for all historical coho salmon rearing habitats in Aptos Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CalFire, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	Manipulation of Large Woody Material should not occur until evaluated by the County of Santa Cruz staff and hydrologist and/or qualified biologist familiar with Central Coast streams. State Parks should approach LWM manipulation with caution due to the importance of upper Aptos as a source of LWM recruitment.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
ApC-CCC-3.1.1.6	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.	3	100	CDFG, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						In-Kind	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Valencia Creek and its tributaries should be the focus on these LWM supplementation projects.
ApC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating										
ApC-CCC-3.1.2.1	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, NRCS, Private Landowners, RPFs, Santa Cruz County, Santa Cruz RCD	97.50	97.50				195	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost could be minimal if incorporated into ongoing timber harvest plans. The upper portion of the watershed is managed by State Parks and much of the riparian zone is in later serial age classes. Cost for treating 1.5 miles (assume 80 acre/mile in 15% High IP) at a rate of \$1,621/acre.
ApC-CCC-3.1.3	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
ApC-CCC-3.1.3.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (DFG 2004).	2	10		255.00	255.00				510	Cost based on treating 10% of 5 miles of stream at a rate of \$101,120/ELJ.
ApC-CCC-3.1.4	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
ApC-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase the frequency of riffle habitat in 75% of the streams within the watershed	2	20							TBD	Cost accounted for in above action steps (i.e. increase frequency of primary pools).
ApC-CCC-5.1	Objective	Landscape Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ApC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with urbanization										
ApC-CCC-5.1.1.1	Action Step	Landscape Patterns	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						In-Kind	

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-5.1.2	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with streamside road density (< 100 meters)										
ApC-CCC-5.1.2.1	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	1	100	CalFire, California Geological Survey, CDFG, NMFS, RWQCB, Santa Cruz County, USACE							In-Kind This recommendation should be considered standard practice.
ApC-CCC-5.1.2.2	Action Step	Landscape Patterns	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	1	100	Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks							TBD Cost are difficult to determine due to feasibility of conservation easements, participation of landowners, current fair market value, and rate of turnover.
ApC-CCC-5.1.2.3	Action Step	Landscape Patterns	Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County							Applications are currently approved without appropriate review.
ApC-CCC-9.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
ApC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
ApC-CCC-9.1.1.1	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into Aptos Creek.	3	10	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz County Parks and Cultural Resources	55.00	55.00					110 Ultimate reasons for bank failure should be identified and addressed. Bank and landslide stabilization should evaluate a full range of options to address instability such as setting back or removing problematic infrastructure (roads, etc.). Bioengineering should be the first stabilization method assessed. Bank hardening is not a preferred alternative. Initial efforts should be directed along the mainstem of Aptos Creek. A sediment assessment is estimated to cost \$108,085 (assume 5% of total watershed acres at a rate of \$1,578/acre).
ApC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-9.1.2.1	Action Step	Sediment	Prioritize and treat erosion sources in Table 11 of the Aptos Geomorphic and Erosion Source Technical Report.	2	15	California Geological Survey, CDFG, NMFS, NRCS, Santa Cruz RCD						TBD	Review Table 11 to develop appropriate recovery actions.
ApC-CCC-9.1.2.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, California Geological Survey, CDFG, NMFS, RWQCB, Santa Cruz County, USACE						In-Kind	This should be considered a standard practice by all regulatory agencies.
ApC-CCC-10.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ApC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
ApC-CCC-10.1.1.1	Action Step	Viability	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.	3	100	CDFG, NMFS, NOAA SWFSC, Private Consultants, Santa Cruz County						In-Kind	
ApC-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.	2	10							TBD	Re-introduction should only occur in subwatersheds where instream habitat conditions are suitable for all coho salmon life stages. Prioritize upper mainstem Aptos Creek in the Forest of Niesene Marks. Conditions evaluated should include summer flow conditions, cover, winter refugia, pools depths, instream temperature, and gravel quality. Determine suitable areas and numbers to repopulate Aptos Creek.
ApC-CCC-10.2	Objective	Viability	Address the inadequacy of existing regulatory mechanisms										
ApC-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
ApC-CCC-10.2.1.1	Action Step	Viability	Initiate juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	3	10	CDFG, Private Consultants	95.00	95.00				190	Presence absence surveys using visual sampling methods should be given highest priority. Cost for annual juvenile sampling in Santa Cruz diversity stratum estimated at \$18,823/year.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-10.2.2	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
ApC-CCC-10.2.2.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. The upper portion of Aptos Creek should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	20	CDFG, NOAA RC, Private Consultants, Santa Cruz County							Cost for fish/habitat monitoring could be incorporated in other recovery actions.
ApC-CCC-10.2.2.2	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	3	10	Public, State Parks						In-Kind	
ApC-CCC-10.2.3	Recovery Action	Viability	Increase spawner density										
ApC-CCC-10.2.3.1	Action Step	Viability	Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery	3	10	CDFG, NMFS	270.00	270.00				540	Cost for life cycle monitoring estimated at \$267,444 (assume minimum of 10 years of operation).
ApC-CCC-10.2.3.2	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	21	CDFG, NOAA SWFSC, Private Consultants	285.71	285.71	285.71	285.71	57.14	1,200	Monitoring adult abundance in Aptos Creek is not as high a priority as in other watersheds in the Santa Cruz Mountains Diversity Stratum due to the watershed's designation as "Dependent" and the existing monitoring currently occurring in the Stratum. Periodic monitoring should have sufficient funding to document size of all three cohorts and should occur concurrently with smolt monitoring when possible. Cost for annual spawner surveys in Santa Cruz Mtns. diversity stratum estimated at \$56,470/year.
ApC-CCC-11.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species range or habitat										
ApC-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)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-11.1.1.1	Action Step	Water Quality	Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.	2	5	CDFG, NMFS, Public, State Parks	5.00					5	Temperature monitoring is relatively inexpensive. A thermograph should be installed in each tributary and in mainstem locations above and below each major confluence. Results should be compiled in one document and submitted to all participants and appropriate regulatory agencies on a yearly basis. Standard presentations should be used. Cost for stream temperature monitoring estimated at \$500/gauge with a minimum of 10. Cost do not account for maintenance or data management.
ApC-CCC-11.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants										
ApC-CCC-11.1.2.1	Action Step	Water Quality	Remove invasive exotic vegetation at problematic sites, such as the Old Mill site, and revegetate with native plants.	3	20	IWRP, RWQCB, Santa Cruz County, Santa Cruz RCD	900	900	900	900		3,600	Costs will vary depending on degree of infestation and landowner participation. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP) at a rate of \$45,114/acre.
ApC-CCC-11.1.2.2	Action Step	Water Quality	Install continuous water quality samplers in and adjacent to Mangels Gulch, Trout Gulch, and Valencia Creek.	2	6	IWRP, RWQCB, Santa Cruz County, Santa Cruz RCD	66.67	13.33				80	This is a high priority action in the Aptos Creek Watershed Assessment (CVC and SHG 2003), due to known water quality issues. Cost based on installation of continuous monitoring gauges (2) in Aptos Creek at a rate of \$20,000 each; cost does not account for maintenance and operation.
ApC-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.
ApC-CCC-11.1.3.1	Action Step	Water Quality	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100							TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.

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		
ApC-CCC-11.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10							In-Kind	
ApC-CCC-11.1.3.3	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100							In-Kind	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort.
ApC-CCC-13.1	Objective	Channel Modification	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
ApC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to instream substrate										
ApC-CCC-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Department of Mines and Geology, CalTrans, FEMA, NRCS, Private Landowners, Santa Cruz RCD, State Parks, USACE							Costs will vary depending on extent and location of streambank work. Gabions and undersized rock are often used because they are cheaper than larger and more stable rock features. USDA estimated stream bank protection projects in general coast about 125 dollars per square foot in California. This recommendation should be considered standard practice.
ApC-CCC-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	3	100	CalTrans, FEMA, RWQCB, Santa Cruz County							This recommendation should be adopted as standard practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation.
ApC-CCC-13.1.1.3	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	3	100	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Public, Santa Cruz County, Santa Cruz RCD							This should become standard practice for all agencies and consulting firms engaged in constructing and designing solutions to address channel stability.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to habitat complexity										
ApC-CCC-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.	3	100	CalFire, California Geological Survey, CalTrans, CDFG, FEMA, NRCS, Private Landowners, Santa Cruz RCD, State Parks, USACE							A significant portion of the estuary has been lost due to channel modification. Any additional proposals within the extant estuary should result in a net gain in habitat complexity. Additional actions that further impair estuarine extent or function should not be sanctioned by regulatory agencies.
ApC-CCC-14.1	Objective	Disease/Predation/Competition	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
ApC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
ApC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation (i.e., eucalyptus, acacia, cape ivy) within the stream and riparian corridor.	3	100	Private Landowners, Santa Cruz RCD							Initial efforts should be directed at landowners in Mangels Gulch and the Valencia Creek watershed. These areas have the greatest concentration of rural residential landowners most likely to foster exotic invasives. Cost accounted for in WATER QUALITY.
ApC-CCC-14.2	Objective	Disease/Predation/Competition	Address disease or predation										
ApC-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
ApC-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.	3	10	NOAA SWFSC	130.00	130.00				260	Cost for abundance/distribution estimated at \$128,268/project.
ApC-CCC-15.1	Objective	Fire/Fuel Management	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
ApC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity										
ApC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire							In-Kind This recommendation should be considered a standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
ApC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, State Parks							TBD	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
ApC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire							In-Kind	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out.
ApC-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire							In-Kind	Standard business practice.
ApC-CCC-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing firefighting assistance in the Aptos Creek watershed (and all other watersheds in the County).	2	100	CalFire							In-Kind	Cost of providing the plan is minimal.
ApC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance											
ApC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed rural development on fire suppression and fuel load buildup.	2	10	CalFire, Santa Cruz County							In-Kind	
ApC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)											
ApC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire								
ApC-CCC-15.2	Objective	Fire/Fuel Management	Address the inadequacy of existing regulatory mechanisms											
ApC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality											
ApC-CCC-15.2.1.1	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.	2	2	CalFire, NMFS, RWQCB								

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		
ApC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, Santa Cruz County						In-Kind	
ApC-CCC-15.2.1.3	Action Step	Fire/Fuel Management	Avoid use of toxic aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.	2	100							In-Kind	
ApC-CCC-15.2.1.4	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to site water quality and the structure of the biological community.	3	10	CalFire, CDFG, NMFS, RWQCB						In-Kind	
ApC-CCC-15.2.1.5	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire						In-Kind	
ApC-CCC-16.1	Objective	Fishing/Collecting	Address the inadequacy of existing regulatory mechanisms										
ApC-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
ApC-CCC-16.1.1.1	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFG, NMFS						In-Kind	
ApC-CCC-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CDFG						In-Kind	If river mouth has been artificially breached without appropriate authorization, prohibitions on offshore fishing should continue until appropriate flows occur.
ApC-CCC-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) of fishing regulations low flow minimum flow closure for Aptos Creek.	2	3	CDFG, NMFS						In-Kind	Low flow closures are needed for Aptos Creek and should be based on flow conditions from a watershed in the Santa Cruz Mountains (the San Lorenzo River would likely suit this requirement). Additionally, due to later (recent) migration patterns of CCC coho salmon in the streams south of the Golden Gate, the date of opening season should be pushed forward in the fishing season (currently fishing season starts on December 15) to at least January 15. Consideration should be given to pushing forward the entire fishing season so that the total number of angling days is not reduced significantly.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-21.1	Objective	Recreation	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
ApC-CCC-21.1.1	Recovery Action	Recreation	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ApC-CCC-21.1.1.1	Action Step	Recreation	Encourage development of a trail management plan/maintenance guidelines for Forest of Nisene Marks State Park. Use plan to develop a program to reduce erosion, decommission illegal or duplicate trails, and keep users on designated trails.	2	4	Santa Cruz RCD, State Parks						In-Kind	Development of a management plan should be relatively inexpensive if it draws from existing guidelines and sediment reduction protocols.
ApC-CCC-21.1.1.2	Action Step	Recreation	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	2	10	CalFire, RWQCB, Santa Cruz County Land Trust, Santa Cruz County Parks and Cultural Resources, Santa Cruz RCD, State Parks	14.00	14.00				28	Cost will vary depending on trail location and accessibility. Cost based on decommissioning 2 miles of trail at a rate of \$13,680/mile. Cost may be lower for trails due to overall size and footprint and may range from \$3,000 per mile to \$23,000 per mile according to estimates in the State Coho Recovery Plan.
ApC-CCC-21.1.1.3	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about salmon and how to minimize impacts.	2	5	NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	10.00					10	Cost for signs vary widely depending on materials used and content of signs. Assume signs average \$500/sign for 20 signs.
ApC-CCC-21.1.1.4	Action Step	Recreation	Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.	2	100	CalFire, Farm Bureau, Private Landowners, State Parks						TBD	Costs will vary depending on access, prior weatherization practices, and severity of the problem. These data are currently unavailable.
ApC-CCC-22.1	Objective	Residential/Commercial Development	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
ApC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
ApC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100	RWQCB, Santa Cruz County						In-Kind	This recommendation should be considered as a higher priority in subbasins with highly erodible soils (e.g., Valencia Creek sub-watershed).
ApC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
ApC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.	2	100	FEMA, NMFS, Private Landowners, Santa Cruz County							In-Kind	
ApC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100								In-Kind	General recommendation that should be applied to all pre-existing and future landuse activities in the watershed.
ApC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)											
ApC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Design new development to allow streams to meander in historical patterns, protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	RWQCB, Santa Cruz County							In-Kind	Costs would be minimal if this concept is adopted early in the planning process.
ApC-CCC-22.1.3.2	Action Step	Residential/Commercial Development	Santa Cruz County should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from flooding.	2	100	FEMA, Santa Cruz County							In-Kind	
ApC-CCC-22.1.3.3	Action Step	Residential/Commercial Development	Evaluate watershed for infrastructure for high risk of flooding.	3	10	FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks								Most of these structures have likely been identified. Cost associated with ground truthing and site specific evaluation. Sediment assessment accounted for in SEDIMENT.
ApC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure											
ApC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	10	Santa Cruz County							In-Kind	Outreach to landowners already occurs from many of the municipalities and water districts in the watershed.
ApC-CCC-22.1.5	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance											
ApC-CCC-22.1.5.1	Action Step	Residential/Commercial Development	Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	Santa Cruz County							In-Kind	This action encourages implementation of many existing policies.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
ApC-CCC-22.1.5.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	1	100	FEMA, Santa Cruz County, Santa Cruz County Land Trust							In-Kind	
ApC-CCC-22.2	Objective	Residential/Commercial Development	Address the inadequacy of existing regulatory mechanisms											
ApC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure											
ApC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	2	5	Santa Cruz County								The weakness of the County of Santa Cruz's existing riparian ordinance stems from exemptions allowed for pre-existing development. County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs. mainstem. Incentives should be investigated to encourage landowners in key areas to allow establishment of a riparian buffer.
ApC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality											
ApC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the Aptos Creek Watershed.	2	100	RWQCB, Santa Cruz County, USEPA								This recommendation should be carefully balanced against expansion of rural residential development over a wider landscape.
ApC-CCC-22.2.2.2	Action Step	Residential/Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	3	100	RWQCB, Santa Cruz County, USEPA								In-Kind
ApC-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology											
ApC-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.	2	10	RWQCB, Santa Cruz County								In-Kind
ApC-CCC-22.2.3.2	Action Step	Residential/Commercial Development	As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	3	15	RWQCB, Santa Cruz County								Implementation of this recommendation will help reduce rates of channel incision, increase aquifer recharge, and reduce the likelihood of redd scour.
ApC-CCC-22.2.4	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance											

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
ApC-CCC-22.2.4.1	Action Step	Residential/Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	100	FEMA, HUD, Santa Cruz County							In-Kind	
ApC-CCC-22.2.4.2	Action Step	Residential/Commercial Development	Discourage Counties from rezoning forestlands to rural residential.	1	100	Santa Cruz County								
ApC-CCC-22.2.4.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County							0	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality.
ApC-CCC-22.2.5	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity.											
ApC-CCC-22.2.5.1	Action Step	Residential/Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	Santa Cruz County								The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection.
ApC-CCC-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range											
ApC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to stream hydrology (impaired water flow)											
ApC-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalTrans, Santa Cruz County							TBD	Cost of implementation will likely be high due to the large amount of existing infrastructure. This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides rather than maintained and highly traveled surface roads. Due to the friable geology in the Valencia Creek, major benefits to sediment remediation could be achieved if roads are properly decommissioned in this sub-watershed.
ApC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology											
ApC-CCC-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	10	CalTrans, NRCS, RWQCB, Santa Cruz County, State Parks, USACE	650	650					1,300	All new and replacement culverts should be sized to accommodate a 100 year flow event. Cost based on treating five stream crossings at a rate of \$254,278/unit.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.2.2	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	2	10	CalFire, CDFG, NOAA RC, Santa Cruz County, Santa Cruz RCD	15.00	15.00				30	This action encourages implementation of many existing policies.
ApC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
ApC-CCC-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, NRCS, Private Landowners, RPFs, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	On many roads, located on both public and private lands in the Aptos watershed, periodic maintenance occurs but does not address chronic, localized erosion problems. In these circumstances, the grading of poorly drained roads and repair of failed fills and stream crossings can lead to continued and even exacerbated rate of fine sediment delivery.
ApC-CCC-23.1.3.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment and runoff related problems and determine level of hydrologic connectivity.	3	10	CalFire, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks	62.00	62.00				124	Initial assessment efforts should target Valencia Creek and lower mainstem Aptos Creek. Existing assessments should be used when possible. Excessive inputs of fine sediment in Aptos Creek watershed have compromised spawning and rearing habitat which directly impact the egg and adult lifestages. High instream sediment levels were identified as the most likely limiting factor to salmonids on both a watershed and individual reach scale (CWC and SHG 2003). Pool filling appears to have resulted from fine sediment transport from upslope sources with Valencia Creek having worse conditions than Aptos Creek. Roads are the largest contributor of chronic fine sediment into Aptos Creek (CWC and SHG 2003) although erosion from urban development (in the lower mainstem and Valencia Creek) and recreational trails are also a concern. Cost partially accounted for in SEDIMENT. Cost for road inventory estimated at \$1,056/mile (assume 75% of road network).
ApC-CCC-23.1.3.3	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	20	Private Landowners, Santa Cruz County						In-Kind	Many road associations are inadequately funded. A road improvement fund for the Aptos watershed could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.3.4	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	30	CalFire, CalTrans, NRCS, Santa Cruz County, Santa Cruz RCD						TBD	Cost are likely accounted for with culvert replacement.
ApC-CCC-23.1.3.5	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Private Landowners, Santa Cruz County						TBD	Santa Cruz public works has been largely unsuccessful at finding spoils sites. A recent effort to locate potential sites in each major watershed failed to identify locations with willing landowners. Future efforts may require incentives to increase landowner participation.
ApC-CCC-23.1.3.6	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, Santa Cruz County						TBD	Roadside berms are common on many private and county roads in Santa Cruz County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails). Road inventory should identify roadside berms that are increasing runoff.
ApC-CCC-23.1.3.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County						TBD	The road inventory should identify the number and type of energy dissipaters needed.
ApC-CCC-23.1.3.8	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalTrans, FEMA, Private Landowners, Santa Cruz County, State Parks						TBD	Cost difficult to determine but may result in a long term cost savings. Current economic conditions will likely delay implementation of this recommendation, if adopted.
ApC-CCC-23.1.3.9	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.3.10	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, CalTrans, RWQCB, Santa Cruz County, State Parks	35.00	35.00	35.00	35.00		140	Road densities are high throughout the watershed, estimated at 3.7 miles of road per square mile of watershed area and 4.6 miles per square mile of riparian area. Actual road densities may be even higher as this estimate does not include seasonal roads used for timber harvest. Many of these roads are poorly situated, constructed, and improperly maintained. Legacy roads from past logging activity, having been adopted as year-round roads and recreational trails, continue to impact the Aptos watershed. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed (CWC and SHG 2003). This recommendation will be difficult to implement due to the extensive development in the Aptos Creek watershed. Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards in areas with erodible geology and/or near high risk landslides rather than maintained and highly traveled surface roads. Targeted areas should include sub watersheds with high erosion potential (e.g., Valencia Creek). Initial efforts should focus on infrequently used seasonal and unsurfaced roads in Valencia Creek. Roads in urbanized areas will be very difficult to decommission; roads in more remote areas, particularly those used for timber harvest will likely be much easier to target for decommissioning. 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 decommissioning 2 miles of riparian and 8 miles of road network at a rate of \$13,680/mile.
ApC-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCC-23.1.4.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, FEMA, IWRP, NRCS, State Parks						In-Kind	This recommendation should be considered standard practice.
ApC-CCC-23.1.5	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.5.1	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	10	CalTrans, IWRP, Santa Cruz County	1,700	1,700				3,400	According to CDFG (2004) cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. Cost based on providing passage (assume urban land use) at 2 total barriers at a rate of \$1,124,448/unit and 2 partial barriers at a rate of \$562,219/unit.
ApC-CCC-23.1.5.2	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	3	100	CalFire, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, USACE						In-Kind	Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001).
ApC-CCC-23.1.5.3	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, Santa Cruz County, USACE						In-Kind	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
ApC-CCC-23.1.6	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										
ApC-CCC-23.1.6.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation types and species and promote desirable (native) vegetation.	3	100	CalFire, Private Landowners, Santa Cruz County, State Parks						TBD	The road inventory should identify species and extent of removal of unwanted vegetation.
ApC-CCC-23.1.6.2	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalTrans, Santa Cruz County							
ApC-CCC-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
ApC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.2.1.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CalTrans, FEMA, Private Landowners, Santa Cruz County, State Parks, USACE						In-Kind	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
ApC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
ApC-CCC-23.2.2.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, CalTrans, Private Landowners, Santa Cruz County, State Parks						TBD	Road inventory cost accounted for in other recovery actions.
ApC-CCC-23.2.2.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	Private Landowners, Santa Cruz County, State Parks						In-Kind	
ApC-CCC-23.2.2.3	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							
ApC-CCC-23.2.2.4	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFG, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, Santa Cruz County, USACE, USFWS						In-Kind	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
ApC-CCC-23.2.2.5	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	CalFire, Private Landowners, RPFs, RWQCB						In-Kind	Monitoring should occur throughout the periods between re-entry. Initial focus should occur in the highly erosive Valencia subwatershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration		
ApC-CCC-23.2.2.6	Action Step	Roads/Railroads	Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	Santa Cruz County							In-Kind	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the Aptos Creek watershed and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils in Valencia Creek are some of the largest contributors to degraded streambed conditions in the watershed.
ApC-CCC-24.1	Objective	Severe Weather Patterns	Address the present or threatened destruction, modification, or curtailment of the species habitat or range											
ApC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary											
ApC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	CA Coastal Commission, FEMA, Santa Cruz County, State Parks, USACE								Cost accounted for in estuary.
ApC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	FEMA, Santa Cruz County, Santa Cruz RCD, State Parks, USACE								Cost accounted for in ESTUARY.
ApC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, Santa Cruz County, Santa Cruz RCD, State Parks, USACE								Cost accounted for in ESTUARY.
ApC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology (impaired water flow)											

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions.	3	5	CDFG, IWRP, SWRCB	72.00					72	Many stream reaches in the Valencia watershed have water diversions and it is likely that downstream reaches experience impacts during the summer months. Cost for stream flow modeling estimated at \$71,825/project.
ApC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Critical flow values 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, IWRP, SWRCB						In-Kind	
ApC-CCC-24.1.2.3	Action Step	Severe Weather Patterns	Ensure all water diversions in the watershed are in compliance with all applicable laws and policies.	2	5	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						In-Kind	The SWRCB should conduct periodic sweeps of diversions in Aptos Creek to ensure they are in compliance with annual reporting requirements and annual water usage is accurately reported.
ApC-CCC-24.1.2.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	2	20	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						TBD	Determine critical low flow levels and adopt protective measures to maintain viable rearing habitat for juveniles. Cost vary depending on landowner participation and feasibility of protective measures.
ApC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality										
ApC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	2	100	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB							Water temperatures during drought will likely be directly affected by ongoing surface water diversions in Aptos Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost accounted for in WATER QUALITY.
ApC-CCC-24.1.3.2	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						In-Kind	
ApC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		Entire Duration
ApC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Work with CDFG, County of Santa Cruz and knowledgeable biologists to develop emergency rules and adopt implementation agreements.	3	10	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						In-Kind	
ApC-CCC-24.1.4.2	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	3	10	CDFG Law Enforcement, NMFS OLE						In-Kind	Costs are anticipated to be absorbed into ongoing activities.
ApC-CCC-24.1.4.3	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, Caltrans, other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could negatively impact coho salmon.	3	15	CalFire, CalTrans, CDFG, NMFS, RWQCB, SWRCB						TBD	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
ApC-CCC-25.1	Objective	Water Diversion/Impoundment	Address the present or threatened destruction, modification or curtailment of the species habitat or range										
ApC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										
ApC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	1	20	Santa Cruz County, SWRCB						TBD	Cost accounted for stream flow modeling in SEVERE WEATHER PATTERNS.
ApC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
ApC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	20	Santa Cruz County, SWRCB						TBD	Cost for stream flow modeling already accounted for.
ApC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	2	10	CDFG, IWRP, Santa Cruz County, SWRCB						TBD	Studies should include determining critical flow levels for stream reaches impacted by diversions, both current and future diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions would also be needed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)						Comments		
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration			
ApC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	2	30	CDFG, IWRP, Santa Cruz County, SWRCB							In-Kind	Costs may be significant depending on site conditions and number of devices installed	
ApC-CCC-25.1.2.4	Action Step	Water Diversion/Impoundment	Promote irrigation efficiency projects for agricultural uses in the watershed.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD									
ApC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration												
ApC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in Aptos Creek.	2	100	CDFG, IWRP, Santa Cruz County, SWRCB								In-Kind	Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in Aptos lagoon by improving water quality. Costs cannot be estimated because the location of illegal diversions are not known, and the quantities of water diverted are unknown. The willingness of those diverting water to come into compliance with State Law is also unknown. Particular attention should be directed towards the large number of private wells in the Aptos groundwater basin. County of Santa Cruz estimates there are 250 private wells in the Aptos/Valencia watersheds.
ApC-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFG, IWRP, Santa Cruz County, SWRCB								In-Kind	This recommendation should be considered standard practice.
ApC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)												
ApC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure existing water diversions do not impair water temperatures in Aptos Creek.	2	100	CDFG, IWRP, Santa Cruz County, SWRCB								In-Kind	As part of future 1600 agreement, CDFG should require installation of temperature thermographs upstream and downstream of diversions. These results should be reviewed on a yearly basis by the SWRCB and CDFG.
ApC-CCC-25.2	Objective	Water Diversion/Impoundment	Address the inadequacy of existing regulatory mechanisms												
ApC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)												

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs (\$K)					Comments	
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		Entire Duration
ApC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	100	SWRCB						In-Kind	
ApC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFG, NMFS, SWRCB						TBD	
ApC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	2	5	CDFG, SWRCB						In-Kind	
ApC-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Minimize new or increased summer diversions.	2	100	CDFG, SWRCB						In-Kind	