9. Interior Coast Range Biogeographic Population Group

"Assessment at the group level indicates a priority for securing inland populations in southern Coast Ranges and Transverse Ranges, and a need to maintain not just the fluvial-anadromous life-history form, but also lagoon-anadromous and freshwater-resident forms in each population."

NOAA Fisheries Technical Recovery Team
Viability Criteria for South-Central and Southern California, 2007

9.1 LOCATION AND PHYSICAL CHARACTERISTICS

The Interior Coast Range BPG region is the largest of the four BPG regions in SCCCS Recovery Planning Area and includes the east-facing (interior) slopes of the Central Coast Ranges (Santa Lucia Mountains)and Santa Cruz Mountains and the west-facing slopes of the Inner Coast Range (Diablo, Gabilan, Caliente, and Temblor ranges) (Figure 9-1). This region extends 180 miles across the entire length of (north-to-south) the SCCCS Recovery Planning Area and includes portions of Santa Clara, San Benito, Monterey, and San Luis Obispo counties. This BPG region consists of two major watersheds, the Pajaro River and Salinas River, which flow into the Pacific Ocean at Monterey Bay. The Pajaro River watershed includes the Uvas Creek sub-watershed. The Salinas River watershed is the largest coastal watershed south of San Francisco, covering over 2.8 million acres (4,426 square miles) and contains two major sub-basins: the Lower Salinas sub-basin, which includes the Gabilan Creek and

Arroyo Seco watersheds, and the Upper Salinas sub-basin, which includes the San Antonio River and Nacimiento River watersheds (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Pajaro River

Tectonic activity associated with the northwest-trending San Andreas Fault has created a parallel series of northwest-

southeast trending basins and ranges in this part of California. The mainstem of the Salinas River runs through the center of most of this BPG region and two major tributaries, the San Antonio and Nacimiento rivers are unusual in that they flow southward for most of their length before their confluence with the Salinas River, which flows northwest (Figure 9-1).

Salinas River

San Antonio River

Average annual precipitation in this region is relatively low and shows high spatial variability. In general, the higher elevations get more moisture, but because of the "rain shadow" effect created by the coastal slope of the Central Coast Range, the eastern half of the Interior Coast Range BPG receives significantly less precipitation than the western half. The upper reaches of the Pajaro River watershed extend into the redwood coniferous forests of the Santa Cruz Mountains and receive significantly more rainfall than do other portions of the Interior Coast Range BPG.

Uvas Creek – Pajaro River Tributary

Although the highly dissected terrain contributes to a very large total stream length in this region (7,773 miles), the majority of drainages exhibit seasonal surface flow or have extensive seasonal reaches because of highly variable patterns of precipitation (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

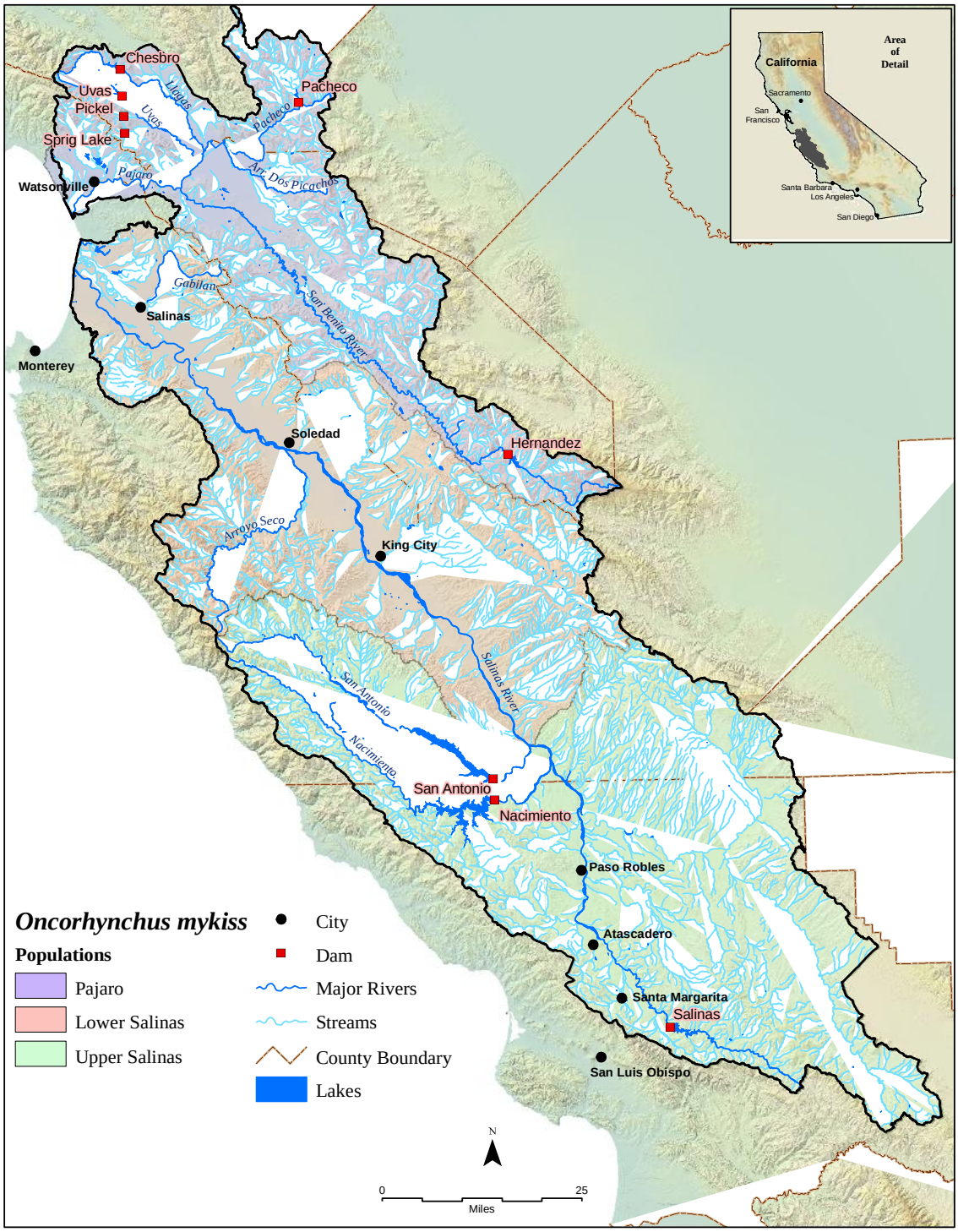

Figure 9-1. The Interior Coast Range BGP region. Seven populations/watersheds were analyzed in this region: two in the Pajaro River watershed (mainstem Pajaro River and Uvas Creek); three in the Lower Salinas River watershed (mainstem Salinas, Gabilan Creek, Arroyo Seco), and two in the Upper Salinas River watershed (San Antonio River and Nacimiento River, including the Salinas mainstem).

9.2 LAND USE

Table 9-1 summarizes land use and population density in the Interior Coast Range BPG region. Although human population density is relatively low for the region as a whole (averaging about 100 persons/square mile), population centers such as Atascadero, Paso Robles, and Salinas are growing rapidly and are surrounded by large tracts of semi-developed rural land. Most of the land in the Pajaro River watershed, along the mainstem of the Salinas River (*i.e.,* the Salinas Valley), and throughout the eastern half of the BPG region, is privately owned. Public ownership of land is concentrated in the Los Padres National Forest and military reservations, such as Fort Hunter-Liggett and Camp Roberts, located in the western portions of this BPG region. Additionally, several rivers have been evaluated for consideration as federally-designated Wild and Scenic Rivers, including Arroyo Seco and Tassajara Creek (tributaries to the Salinas River within the Los Padres National Forest).

Arroyo Seco –Salinas River Tributary

Agriculture (row crop orchard cultivation, livestock ranching and increasingly vineyards within the Salinas River watershed), are important land uses that directly or indirectly affect watershed processes throughout this BPG region. A major consequence of agricultural activity in this region is reservoir development (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b; see also, Central Coast Salmon Enhancement 2008, Grossinger *et al.* 2008, U.S. Army 2007, Harris *et al.* 2006, Upper Salinas-Las Tablas Resource Conservation District 2004, Newman et al. 2003, Watson *et al*. 2000, California Regional Water Quality Control Board 1999, Stephenson and Calcarone 1999, California Department of Water Resources 1978).

Agriculture – Confluence of Arroyo Seco and Salinas River

There are at least 37 dams in this region that are large enough to be regulated by the California Department of Water Resources and/or Department of Defense (Figure 9-1 shows nine of the most significant dams). These dams are owned and operated by federal, state, public utility, local government, or private interests for irrigation, flood control and storm water management, recreation, municipal water supply, hydroelectric power generation, fire protection, farm ponds, or a combination of these purposes (California Department of Fish and Game 2011b, California Department of Water Resources 1988).

San Antonio Dam

The largest reservoirs in this region, San Antonio Lake (on the San Antonio River), Lake Nacimiento (on the Nacimiento River), and Santa Margarita Lake (on the Upper Salinas River mainstem), receive extensive recreational use. The larger dams such as Uvas, San Antonio, Nacimiento, and Salinas are do not provide upstream fish passage, though may inadvertently allow downstream fish migration from areas above the reservoirs. Several of the smaller dams such as Sprig and Pickle have been modified to allow fish passage: in the case of Sprig Dam, it is no longer in operation and has been permanently drained, with an open portal at its base; Pickel Dam has an open port at its base as well as a fish ladder.

Instream gravel mining operations are also significant land uses in both the Pajaro and Salinas River watershed (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Rock Quarry Operation – Salinas River

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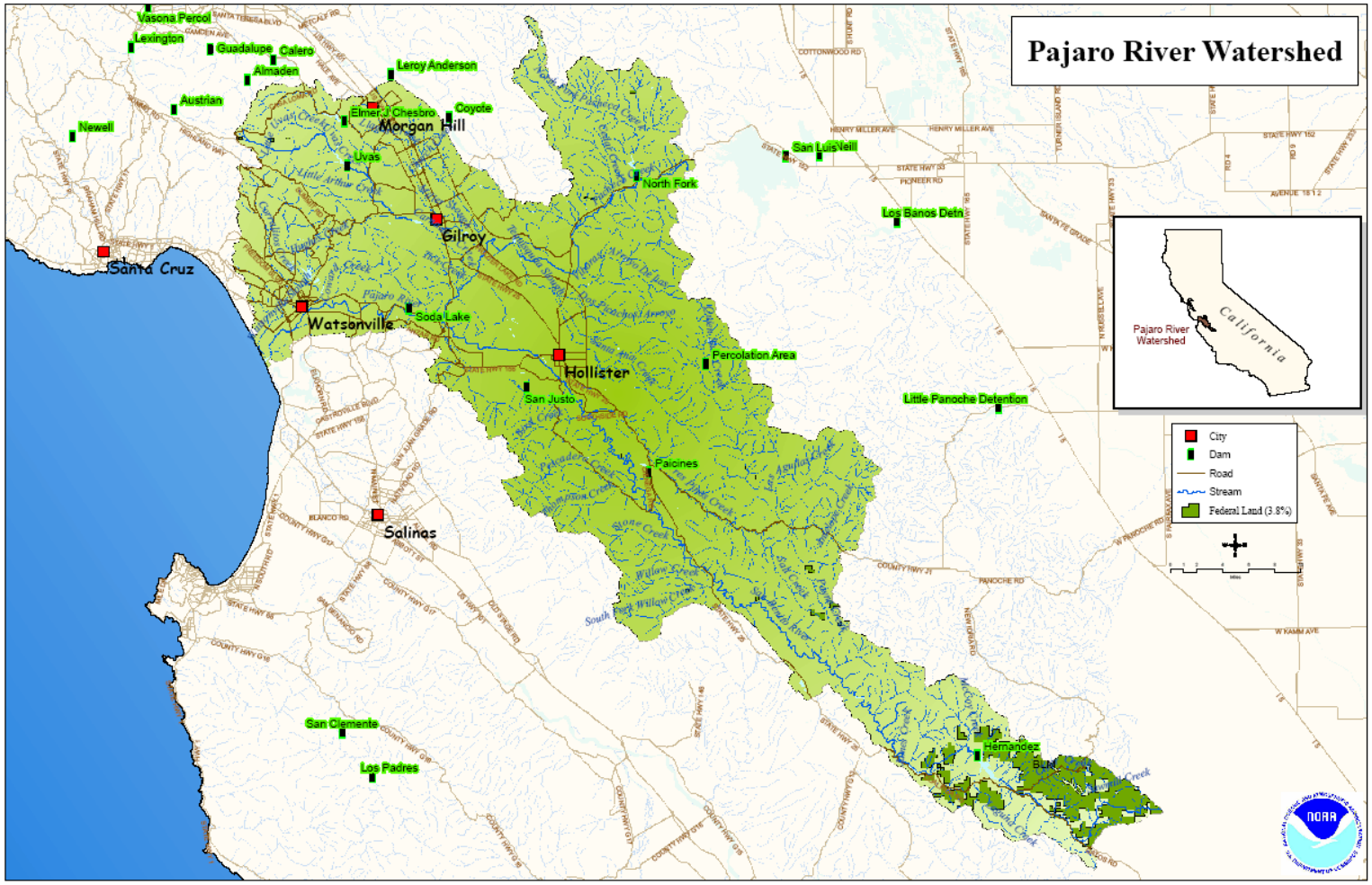

Figure 9-2. Federal and Non-Federal Land Ownership within the Pajaro River Watershed.

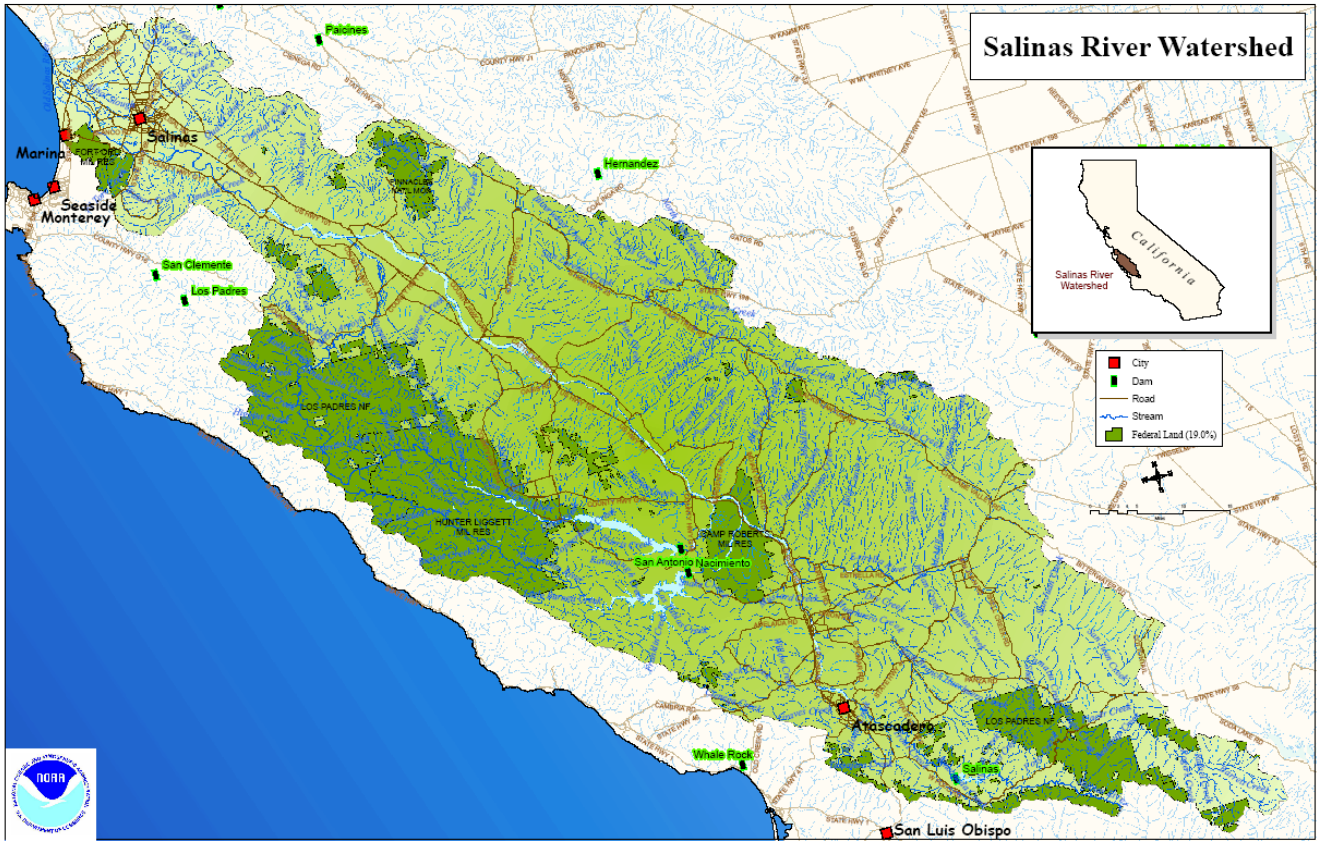

Figure 9-3. Federal and Non-Federal Land Ownership within the Salinas River Watershed.

9.3 CURRENT WATERSHED CONDITIONS

Watershed conditions were assessed for the mainstems of the two major rivers and for five sub-watersheds in the Interior Coast Range BPG region. The mainstem and major tributaries of most of the drainages in this BPG region offer fair to poor habitat conditions for anadromous *O. mykiss*. Habitat conditions were rated as "Fair" in the Uvas Creek, Gabilan Creek, Arroyo Seco, and Nacimiento River watersheds, and "Poor" in the Pajaro River, Salinas River, and San Antonio River watersheds (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b; see also, Casagrande 2011, 2010, 2003, 2001, Casagrande and Watson 2006, Casagrande and Hagar 2003, Central Coast Salmon Enhancement 2008, Upper Salinas-Las Tablas Resource Conservation District 2004, Harris *et al*. 2006, Hagar Environmental Science 2001, Hager 2001, Stephenson and Calcarone 1999, Harvey & Stanley Associates 1983, Londquist 2001, Santa Clara Valley Water District 2006, San Benito County Water District 2006, Smith 2007a, Unites States Army 2007). Habitat quality in Uvas Creek generally improves downstream, with lower turbidity, improved substrate quality, and invertebrate production associated with winter flows contributed by downstream unregulated tributaries and the distance from Uvas Dam (Casagrande 2010a). However, the Gabilan Creek watershed is adversely impacted with fine sediment and water diversions, and upstream passage is restricted by downstream fish passage barriers (Casagrande 2010a, 2020b).

Pajaro River Valley- Agricultural Development

Each of the watersheds included in this BPG are subject to one or more instream, riparian, or upland land use conditions that pose significant threats to steelhead. In general, habitat quality declines in a downstream direction through each of these watersheds. The upper watersheds tend to be in relatively good condition, and the mainstems tend to be in fair to very poor condition. The major concern in this BPG region is that the mainstems of the two primary drainages, the Pajaro and Salinas rivers, are severely impaired by intensive anthropogenic activities related to agriculture, recreation, and residential development and associated water development and management (see discussion below). The mainstems of these rivers provide the conduits that connect the ocean, estuary, and upper watershed habitats needed by anadromous *O. mykiss* to complete their life-cycle.

Salinas River Valley – Residential Development

In other instances, major tributary watersheds, such as Arroyo Seco provide excellent spawning and rearing habitat for steelhead, though sections have ephemeral flows, particularly in the lower reaches affected by irrigation for agricultural development. Additionally, portions of the upper reaches of the San Antonio and Nacimiento rivers, provide generally seasonal habitat for salmonids, but receive low ratings because they are highly constrained by passage barriers along their lower reaches including dams and/or seasonally dry reaches (*e.g.*, in the Salinas River). Dams and dam operations, particularly in the upper tributaries to the Pajaro and Salinas River systems have had a number of significant adverse effects on hydrologic processes which are essential to creating and maintaining suitable steelhead habitats. These facilities have altered the timing, duration and magnitude of flows which are not only essential to provide migration opportunities for both adult and juvenile steelhead between the ocean and upstream spawning and rearing habitats, but also in providing appropriate sized sediment necessary for spawning and maintaining ecologically functioning riparian habitats.

Agricultural activities (including agricultural effluents) have also significantly impacted steelhead habitats through encroachment into the riparian corridor which has reduced channel complexity, reduced groundwater level through extensive water extraction for irrigation, and degraded water quality through the elevation of fine sediments and the application of agricultural pesticides and fertilizers. Instream mining operations have also degraded habitats in the Salinas River. Instream gravel mining operations in both the Pajaro and Salinas River watersheds have also contributed to degraded habitat conditions, particularly mainstem habitats.

Pajaro River Estuary

Estuarine habitat loss is also a significant threat source to anadromous *O. mykiss* populations in the Interior Coast Range BPG. Despite the large geographic size of this BPG region, its major watersheds share a single estuarine complex that has been substantially altered and reduced by a variety of agricultural and urban developments. Today, the mouths of the Pajaro River and the Salinas River at the Pacific Ocean are separated from each other by less than 10 miles. Historically, the lower reaches of these drainages meandered across a broad coastal plain to create a single estuarine complex that extended from Watsonville in the north to Marina in the south. Less than 50% of the Pajaro River estuary remains extant and the Salinas River estuary has been reduced in size by over 91%. Estuaries provide favorable rearing habitats for juvenile O. mykiss, and have been show in some cases to provide a disproportionate number of the returning anadromous adult O. mykiss in some systems (Hayes et al. 2008, Bond 2006). Such severe

losses affect anadromous *O. mykiss* populations in widely separated tributaries of the Salinas River, such as Arroyo Seco and the San Antonio and Nacimiento Rivers (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Hagar 2005a, 2005b, Casagrande 2003, Gilchrist 1997).

Salinas River Estuary – Old Salinas River Channel

Fire frequency in the Interior Coast Range BPG region is relatively low compared to other BPGs (*e.g.,* the Big Sur Coast BPG to the south). Wildland fires are not a currently a significant threat source for anadromous *O. mykiss* in the Pajaro River, Gabilan Creek, and lower Salinas River watersheds. However, the Summit Fire in 2008 within the Pajaro watershed did burn a significant portion of the Corralitos, Browns Valley, and the upper Uvas Creek sub-watersheds within the Pajaro River system. Additionally, wildfires pose a moderate to severe threat in the Arroyo Seco and upper Salinas River drainages, where 15 percent and 27 percent of the watershed has burned within the past 25 years, respectively. Increased road density allows greater access to many parts of these watersheds, and increased population density in fire-prone areas has increased fire frequency. Increased fire frequency can increase slope erosion and sediment deposition into streams, resulting in long-term changes to substrate composition and embeddedness, water quality (*e.g.,* turbidity), and water temperature (loss of riparian canopy cover).

Despite widespread and varied habitat degradation to the coastal and middle mainstems of all these watersheds, native non-anadromous *O. mykiss* populations still inhabit the relatively high-quality habitats that persist upstream of the dams in this region, and small numbers of anadromous *O. mykiss* attempt to enter and spawn in each of the watersheds of the Interior Coast Range BPG when flow conditions are suitable.

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Table 9-1. Physical and Land-Use Characteristics of Watersheds in the Interior Coast Range BPG. Sub-watersheds are shown in parentheses).

PHYSICAL CHARACTERISTICS					**LAND USE**				
WATERSHEDS (north to south)	**Area** (acres)[1]	**Area** (sq.miles)[1]	**Stream Length**[2] (miles)	**Ave. Ann. Rainfall**[3] (inches)	**Total Human Population**[4]	**Public Ownership***	**Urban Area**[5]	**Agriculture/ Barren**[5]	**Open Space**[5]
Pajaro River	838,776	1,311	1,843	16.9	235,807	7%	4%	14%	83%
Lower Salinas Basin	1,255,902	1,962	2,598	16.5	286,853	14%	3%	19%	78%
(Gabilan Creek)	(99,929)	(156)	(247)	(18.9)	(154,907)	(0%)	---	---	---
(Arroyo Seco)	(196,430)	(307)	(477)	(18.5)	(920)	(58%)	---	---	---
Upper Salinas Basin	1,576,869	2,464	3,332	16.4	95,399	24%	1%	4%	94%
(San Antonio River and Nacimiento River combined)	(456,758)	(714)	(1,030)	(17.4)	(4,598)	(55%)	---	---	---
TOTAL or AVERAGE	**3,671,547****	**5,737****	**7,773****	**17.4**	**778,484****	**15%****	**3%**	**12%**	**85%**

[1] From: CDFFP CalWater 2.2 Watershed delineation, 1999 (www.ca.nrcs.usda.gov/features/calwater/)
[2] From: CDFG 1:1,000,000 Routed stream network, 2003 (www.calfish.org/)
[3] From: USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
[4] From: CDFFP Census 2010 block data (migrated), CalFire FRAP (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)
[5] From: CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells) (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)
** Includes National Forest Lands and Military Reservations; does not include State or County Parks (from: http://old.casil.ucdavis.edu/casil/gis.ca.gov/teale/govtowna/)*
*** Total or average for Pajaro River watershed (including Uvas Creek sub-watershed), Lower Salinas Basin (including Gabilan Creek and Arroyo Seco sub-watersheds), and Upper Salinas Basin (including San Antonio River and Nacimiento River sub-watersheds)*

9.4 THREATS AND THREAT SOURCES

Information identified in the CAP Workbooks on habitat and land-use indicators for the Interior Coast Range BPG was supplemented by additional information developed since the preparation of the CAP Workbooks and incorporated into the threat assessment. Varying numbers and intensities of habitat impairments (sources of threats) were identified in the CAP Workbooks analyses for the Interior Coast Range BPG, ranging from seven sources in the Nacimiento River and San Antonio River watersheds to 16 in the Salinas River mainstem; additional information developed since the preparation of the CAP has also been incorporated into the threat assessment. The level of threat severity is generally very high in all watersheds in this BPG, but especially in Uvas Creek and along the mainstem Pajaro and Lower Salinas rivers. Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b; see also, California Department of Fish and Game 2011b, Casagrande 2011, 2003, 2001, Central Coast Salmon Enhancement 2008, Casagrande and Watson 2006, Casagrande and Hager 2003, Smith 2007a, 2007b, 1982, Upper Salinas-Las Tables Resource Conservation District 2004, Hager 2001, Hagar Environmental Science 2006, 2005a, 2005b, 2003, 2001, Monterey County Water Resources Agency 2005, San Benito County Water District 2006, Santa Clara Valley Water District 2006, Londquist 2001, Watson *et al*. 2000, Stephenson and Calcarone 1999, Sundermeyer 1999, Harvey & Stanley 1983).

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Ten anthropogenic activities ranked as the top five sources of stress to anadromous *O. mykiss* viability in this BPG (Table 9-2). These sources are not mutually exclusive and can be grouped into the following four general threat categories: 1) barriers to upstream and downstream migration (roads, dams, groundwater extraction, sand and gravel mining); 2) agricultural conversion of floodplain habitats; 3) recreational facilities and activities, and 4) water management activities (dam operations, diversions, groundwater extractions). (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b)

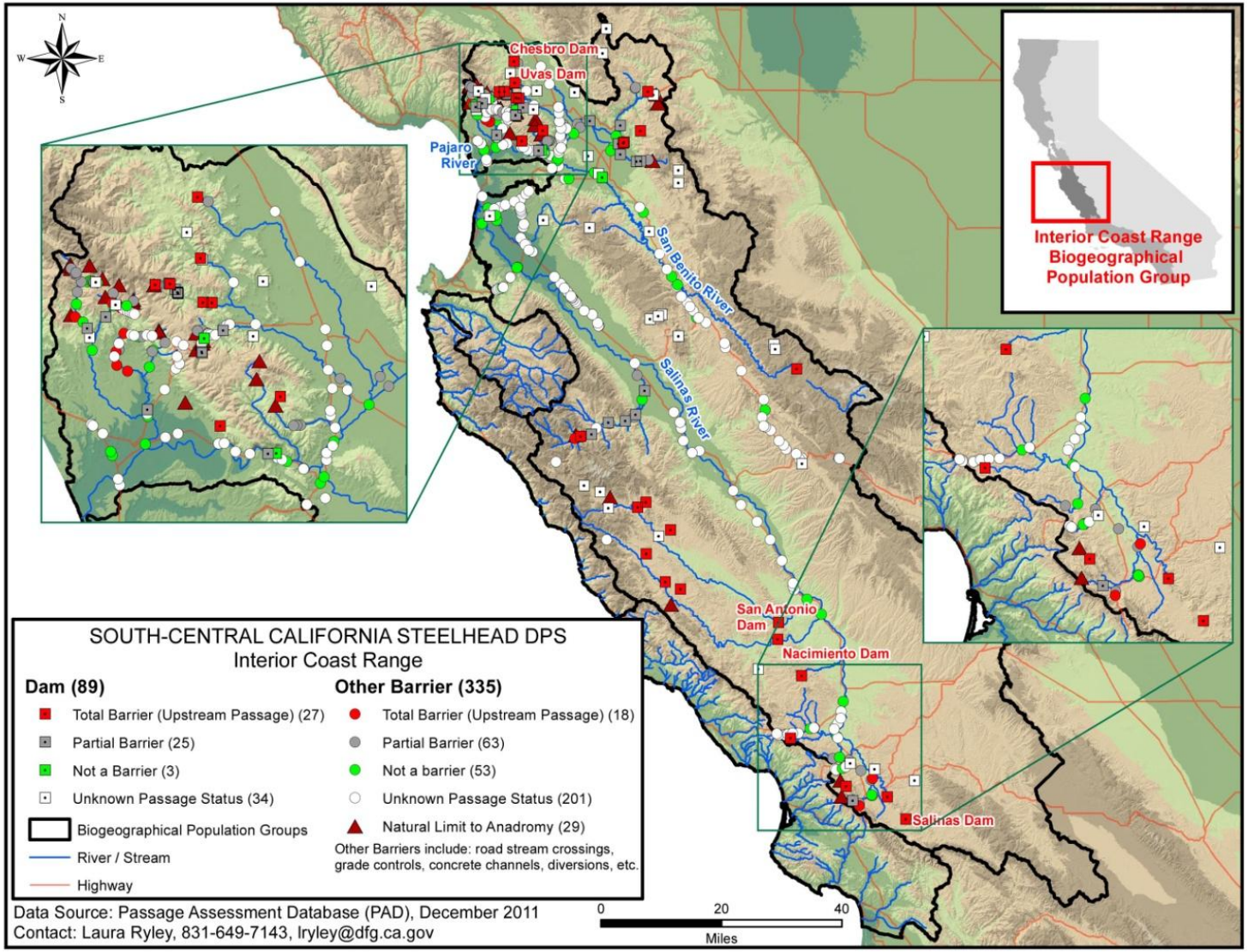

Figure 9-4. Major Fish Passage Impediments, Interior Coast Range BPG.

Table 9-2. Threat source rankings in each component watershed in the Interior Coast Range BPG (see CAP Workbooks for details).

Interior Coast Range BPG Component Watersheds (north to south)							
THREAT* SOURCES	Uvas Creek	Pajaro River Mainstem	Salinas River Mainstem	Gabilan Creek	Arroyo Seco	San Antonio River	Nacimiento River
Dams and Surface Water Diversions							
Groundwater Extraction							
Agricultural Development							
Recreational Facilities							
Levees and Channelization							
Non-Native Species							
Urban Development							
Flood Control Maintenance							
Agricultural Effluents							
Roads							
Culverts and Road Crossings (Passage Barriers)							

Key: Threat cell colors represent threat rating from CAP Workbook: Red = Very High threat; Yellow = High threat; Light green = Medium threat; Dark green = Low threat

**Wildfires were not identified during the CAP Workbook analyses as one of the top five threats in these watersheds, but wildfires within the headwaters of Gabilan Creek (Fremont Peak) in the northern Gabilan Range, as well as wildfires in the tributaries of the Salinas River could be a significant threat to these populations.*

9.5 SUMMARY

Dams and water diversions (including groundwater extractions) on the major rivers of the Interior Coast Range BPG (Salinas and Pajaro rivers) have had the most severe adverse impacts on steelhead populations, reducing and degrading mainstem habitats (including spawning and rearing habitats), cutting off access to upstream spawning and rearing habitats, and altering the magnitude, duration, and timing of flows necessary for immigration of adults and emigration of juveniles throughout the watersheds. Additionally, land-use practices in the Pajaro Valley, particularly conversion of the riparian corridor to agricultural and other land uses, and associated flood control practices including channelization and periodic clearance of the channel of native vegetation and other natural stream features have significantly impacted this important steelhead bearing watershed. Numerous small fish passage barriers have also cumulatively impacted the Pajaro River system by preventing or prohibiting the natural rates of migration of fish (both adults and juvenile) between the ocean and estuary and upstream spawning and rearing habitats. Table 9-3 summarizes the critical recovery actions needed within the Core 1 populations of this BPG. Recovery Action Tables 9-4 through 9-6 provide additional specific recovery actions for the Interior Coast Range Population Group.

Restoring conditions for steelhead passage, spawning, and/or rearing in these watersheds will require multiple, long-term measures related to water management, recreation, and barrier removal or modification to allow effective fish passage. Promoting rain water harvesting and off-channel storage of winter "surplus" flows and other innovative water use practices in tributary streams (*e.g.*, Uvas, Little Arthur, Bodfish, and Gabilan Creeks) may be effective alternative water management practices to address the impacts of existing water extractions in smaller watersheds. Impediments to fish passage stemming from the construction and operation of dams and groundwater extractions (*e.g.,* the mainstems and tributaries of the Pajaro River and the Salinas River), modification of channel morphology and adjacent riparian habitats for flood control, and other instream activities such as sand and gravel mining need to be further evaluated for this BPG. Additionally, the loss of estuarine functions caused by filling and pollution from point and non-point agricultural and other anthropogenic waste discharges need to be addressed further in this region.

The threats sources discussed in this section should be the focus of a variety of recovery actions to address specific stresses to anadromous *O. mykiss* viability. Spatial and temporal data acquired on specific indicators associated with threat sources or stresses, such as water temperature, pH, nutrients, *etc*., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigation in order to refine the primary recovery actions or to target additional recovery actions as part of any recovery strategy for the Interior Coast Range BPG. Recovery Action Tables 9-4 through 9-6 below rank and describe proposed recovery actions for each sub-watershed in the Interior Coast Range BPG including the estimated cost for implementing such actions in five year increments, and where applicable extended out to 100 years, though many of the recovery actions can and should be achieved within a shorter period (Hunt & Associates 2008a 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Table 9-3. Critical recovery actions for Core 1 populations within the Interior Coast Range BPG.

POPULATION	CRITICAL RECOVERY ACTIONS
Pajaro River	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases from Uvas Dam to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Physically modify Uvas Dam to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Manage instream mining to minimize impacts to migration, spawning, and rearing habitat. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
Salinas	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases from Salinas Dam to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Physically modify all fish passage impediments, including the Salinas Dam, to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Manage instream mining to minimize impacts to migration, spawning, and rearing habitat. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
San Antonio River	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions and dams (*e.g.,* San Antonio Dam), to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Physically modify San Antonio Dam to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean.
Nacimiento River	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions and dams (*e.g.,* Nacimiento Dam) to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Physically modify Nacimiento to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean.

South-Central California Coast Steelhead DPS Recovery Action Tables Identification Key, Interior Coast Range BPG (Tables 9-4 to 9-6).

Recovery Action Number Key: XXXX – SCCCS – 1.2	
XXXX	Watershed
SCCCS	Species Identifier – South-Central California Coast Steelhead
1	Threat Source
2	Action Identity Number
Action Rank	
A	Action addresses the first listing factor regarding the destruction or curtailment of the species' habitat
B	Action addresses one of the other four listing factors

XXXX ID Table	
Paj	Pajaro River
UC	Uvas Creek
Sal	Salinas River
GC	Gabilan Creek
AS	Arroyo Seco
SAnt	San Antonio
Nac	Nacimiento

Threat Source Legend	
1	Agricultural Development
2	Agricultural Effluents
3	Culverts and Road Crossings (Passage Barriers)
4	Dams and Surface Water Diversions
5	Flood Control Maintenance
6	Groundwater Extraction
7	Levees and Channelization
8	Mining and Quarrying
9	Non-Native Species
10	Recreational Facilities
11	Roads
12	Upslope/Upstream Activities
13	Urban Development
14	Urban Effluents
15	Wildfires

See Chapter 8, Table 8-1 for Detailed Description of Recovery Actions. See Appendix E for discussion of recovery action cost estimates.

Table 9-4. South-Central California Coast Steelhead DPS Recovery Action Table for Pajaro River Sub-Watersheds (Interior Coast Range BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Pajaro River												
Paj-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, USGS, SBC, SCC, SCRC, RCDMC, SCRC, MC, COG, COW, TWI, TU, CT, CHEER	Agricultural Development	1, 4,	1B	20	0	0	0	0	0	0
Paj-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, USGS, SBC, SCC, SCRC, MC, RCDMC, SCRC, COG, COW,TWI, TU, CT, CHEER	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
Paj-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, USGS, SBC SCC, SCRC, MC, RCDMC, SCRC, COG, COW,TWI, TU, CT, CHEER	Agricultural Development	1, 4,	1B	5	0	0	0	0	0	0
Paj-SCCCS-2.1	Develop and implement a plan to minimize runoff from agricultural activities	NRCS, BLM, USGS, SBC, SCC, SCRC, RCDMC, SCRC, MC, COG, COW,RWQCB, TU, CT, CHEER	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
Paj-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, USFS, CDFG, RCDMC, SCRC, MC, COG, COW, CDOT, TWI, CT, TU, CHEER	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
Paj-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers within the watershed	NMFS, SCRC, MC, RCDMC, COG, COW, CDFG, CDOT, TWI, CT, TU, CHEER	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Paj-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, SWRCB, SCRC, MC, RCDMC, SCVWD, TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Paj-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, CDFG, SWRCB, SCRC, MC, RCDMC,SCVWD, TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Paj-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, SWRCB,SCRC, RCDMC, SCVWD, , TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1, 3, 4	1A	5	TBD	TBD	TBD	TBD	TBD	TBD
Paj-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, MC, USGS,SCRC, RCDMC, CDFG, TWI, CT, TU, CHEER	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
Paj-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, CDFG, SCRC, RCDMC, SCVWD, TWI, TU, CT, CHEER	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
Paj-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	USGS, NMFS, CDFG, SCRC, SCVWD, TWI, TU, CT, CHEER	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125
Paj-SCCCS-7.1	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees.	FEMA, USGS, ACOE, BLM, NRCS, SCRC, RCDMC, SCVWD, NMFS, CDFG, TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
Paj-SCCCS-7.2	Develop and implement a plan to restore natural	CSCC, NMFS, CDFG,SCRC, MC, RCDMC, SCVWD,	Levees and Channelization	1, 4	1B	20	4217625	4217625	4217625	4217625	0	16870500

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	channel features	TWI, TU, CT, CHEER										
Paj-SCCCS-7.3	Develop and implement a stream bank and riparian corridor restoration plan	CSCC, NMFS, CDFG, SCRC, MC, RCDMC, TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
Paj-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, NMFS, CDFG, NRCS, RCDMC, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
Paj-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, NMFS, CDFG, NRCS, RCDM, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
Paj-SCCCS-9.3	Develop and implement a public education program on non-native species impacts	USFWS, NMFS, CDFG, NRCS, RCDMC, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
Paj-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests	USFWS, CSCC, CDFG, TU, CT, CHEER	Recreational Facilities	1, 2, 3, 4, 5	3B	20	0	0	0	0	0	0
Paj-SCCCS-	Develop and implement public	USFWS, CSCC, CDFG, TWI, TU, CT,	Recreational Facilities	1,2, 3, 4, 5	3B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
10.2	education program on watershed processes	CHEER										
Paj-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	DOT, USFWS, CSCC, CDFG, TWI, TU, CT, CHEER	Roads	1, 4	2B	20	0	0	0	0	0	0
Paj-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	DOT, USFWS, CSCC, CDFG, TWI, TU, CT, CHEER	Roads	1, 4	2B	20	32260	32260	32260	32260	0	129040
Paj-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	DOT, USFWS, CSCC, CDFG, TWI, TU, CT, CHEER	Roads	1, 4	2B	20	0	0	0	0	0	0
Paj-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFWS, EPA, NMFS, NFWF,CDFG, TU, CT, CHEER	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	8174000	0	0	0	0	8174000
Paj-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCOM, CDFG, NMFS, RCDMC, SCRC, MC, TWI, TU, CT, CHEER	Upslope/Upstream Activities	1, 2, 3, 4, 5	1B	5	62400	0	0	0	0	62400
Paj-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	NMFS, CDFG, SCRC, MC, TU, CT, CHEER	Urban Development	1, 4	2B	5	62400	0	0	0	0	62400
Paj-SCCCS-13.2	Retrofit storm drains in developed areas	RWQCB, DFG, RCDMC, NMFS, DOT, CDFG, SCRC, MC, TU, CT, CHEER	Urban Development	1, 4	2B	20	0	0	0	0	0	0
Paj-SCCCS 13.3	Develop and implement riparian restoration plan to	ACOE, NRCS, NMFS, RCDMC, SCRC, MC, CDFG,	Urban Development	1,4	2B	5	398000	0	0	0	0	398000

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	replace artificial bank stabilization structures	TU, CT, CHEER										
Paj-SCCCS-14.1	Review California Regional Water Quality Control Board Region Basin Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, NRCS, NMFS, CDFG, SCRC, MC, TU, CT, CHEER	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0
Paj-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCB, SWRCB, NMFS, SCRC, MC, CDFG, TU, CT, CHEER	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Uvas Creek												
UC-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, CDFG, USGS, SB, SCC, SCRC, RCDSC, TWI, TU, CT, CHEER	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
UC-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, CDFG, USGS, SBCC, SCRC, RSDSC, TWI, TU, CT, CHEER	Agricultural Development	1, 4,	1B	5	47520	0	0	0	0	47520
UC-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, CDFG, USGS, SCC, SCRC, RSDSC, TWI, TU, CT, CHEER	Agricultural Development	1, 4,	3B	5	0	0	0	0	0	0
UC-SCCCS-2.1	Develop and implement a plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, CDFG, USGS, SCC, SCRC, RSDSC, TWI, TU, CT, CHEER	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
UC-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, USFS, CDFG, SCRC, RSDSC, CDOT, TWI, CT, TU, CHEER	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
UC-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers within the watershed	NMFS, USFS, CDFG, SCRC, RSDSC, CDOT, TWI, CT, TU, CHEER	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
UC-SCCCS-4.1	Develop and implement water management plan	NMFS, CDFG, SWRCB, SCRC,	Dams and Surface Water	1, 3, 4	1A	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	for diversion operations	RSDSC, TWI, ACWA, CT, TU, CHEER	Diversions									
UC-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, CDFG, SWRCB, SCRC, RSDSC, TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
UC-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, SWRCB,SCRC, RSDSC, TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1, 3, 4	1A	5	TBD	TBD	TBD	TBD	TBD	TBD
UC-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, USGS,SCRC, RSDSC, CDFG, TWI, CT, TU, CHEER	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
UC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, CDFG, SCRC, RSDSC, TWI, TU, CT, CHEER	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
UC-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	USGS, NMFS, CDFG, SCRC, RSDSC, TWI, TU, CT, CHEER	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125
UC-SCCCS-7.1	Develop and implement a plan to restore natural channel features	FEMA, USGS, ACOE, BLM, NRCS, SCRC, NMFS, RSDSC, CDFG, TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	20	4217625	4217625	4217625	4217625	0	16870500
UC-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	FEMA, CSCC, NMFS, CDFG, SCRC, RSDSC, TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
UC-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	FEMA, CSCC, NMFS, CDFG, SCRC, RSDSC, TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
UC-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
UC-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
UC-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
UC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests	USFWS, CSCC, CDFG, CCRP, SCRC,WCB.TWI, TU, CT, CHEER	Recreational Facilities	1, 3, 5	3B	20	0	0	0	0	0	0
UC-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, CSCC, CDFG, CCRP, SCRC,WCB,TWI, TU, CT, CHEER	Recreational Facilities	1, 2, 4	3B	20	76140	76140	76140	76140	0	304560
UC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	DOT, CDOT,USFWS, SCRC, CDFG, TWI, TU, CT, CHEER	Roads	1, 4	2B	20	0	0	0	0	0	0
UC-SCCCS 11.2	Retrofit storm drains to filter runoff from roadways	DOT, CDOT, USFWS, SCRC, CDFG, TWI, TU, CT, CHEER	Roads	1,4	2B	20	32260	32260	32260	32260	0	129040

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
UC-SCCCS11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	DOT, CDOT, USFWS, SCRC, CDFG, TWI, TU, CT, CHEER	Roads	1,4	2B	20	0	0	0	0	0	0
UC-SCCCS-12.1	Review and modify applicable County and/or City Local Coastal Plans	CCOM, SCRC, CDFG, NMFS, TWI, TU, CT, CHEER	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
UC-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	SCRC, NMFS, CDFG,SCRC, TU, CT, CHEER	Urban Development	1, 4	2B	5	62400	0	0	0	0	62400
UC-SCCCS-13.2	Retrofit storm drains in developed areas	SCRC, ACOE, NRCS, NMFS, SCRC, CDFG, TU, CT, CHEER	Urban Development	1, 4	2B	20	0	0	0	0	0	0
UC-SCCCS-13.3	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	SCRC, ACOE, NRCS, NMFS,SCRC, CDFG, TU, CT, CHEER	Urban Development	1,4	2B	5	398000	0	0	0	0	398000
UC-SCCCS-14.1	Review California Regional Water Quality Control Boards Coast Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, NRCS, SCRC, NMFS, CDFG, TU, CT, CHEER	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
UC-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCB, SWRCB, NMFS, SCRC, CDFG, TU, CT, CHEER	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Table 9-5. South-Central California Coast Steelhead DPS Recovery Action Table for Lower Salinas River Sub-Watersheds (Interior Coast Range BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Salinas River												
Sal-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, USGS, RSDSC, MC,SLOC, NMFS, CDFG, USTRCD, USWC, TWI,TU,TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
Sal-SCCCS-1.2	Manage agricultural development and restore riparian zones	NRCS, BLM, USGS, RSDMC, MC,SLOC, NMFS, CDFG, USTRCD, USWC, TWI,TU,TCFT	Agricultural Development	1, 4,	1B	5	0	0	0	0	0	0
Sal-SCCCS-1.3	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, USGS, RSDMC, MC,SLOC, NMFS, CDFG, USTRCD, USWC,CSLRCD,TWI,TU,TCFT	Agricultural Development	1, 4,	2B	5	47520	0	0	0	0	47520
Sal-SCCCS-2.1	Develop and implement a plan to minimize runoff from agricultural activities	RWQCB, SWRCB,NRCS, BLM, USGS, NMFS, CDFG, RSDMC, MC,SLOC, USTRCD, USWC, TWI,TU,TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
Sal-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, MC, FRGP, SLOC, RSDSC, CDOT, USCW, USLTRCD,TWI, CT, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Sal-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers with in the watershed	NMFS, CDFG, CCCON, MC, FRGP, SLOC, RSDMC, CDOT, USCW, USLTRCD,TWI, CT, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
Sal-SCCCS-4.1	Develop and implement water management plan for dam operations	NMFS, CDFG, CCON, MC, MCWRA, FRGP, SLOC, RSDMC, USWC, USLTRCD,TWI, CT, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Sal-SCCCS-4.2	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCON, MC, MCWRA, FRGP, SLOC, RSDMC, USWC, USLTRCD,TWI, CT, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Sal-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, CCON, MC, MCWRA,FRGP, SLOC, RSDMC, USWC, USLTRCD,TWI, CT, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	10	TBD	TBD0	TBD	TBD	TBD	TBD
Sal-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, USGS, MC, SLOC, RSDMC, CDFG, TWI, USLTRCD, USWC,CT, TU, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
Sal-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, CDFG, MC, SLOC, RSDMC, USLTRDC, USWC,TWI, TU, CT, TCFT	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
Sal-SCCCS-6.2	Develop and implement a groundwater monitoring and	USGS, NMFS, CDFG, MC, SLOC, RSDMC, USLTRDC, USWC,TWI, TU, CT, TCFT	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	management program											
Sal-SCCCS-7.1	Develop and implement a plan to restore natural channel features	FEMA, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RSDMC, CDFG, TWI, USLTRCD, USWC,CT, TU, TCFT	Levees and Channelization	1, 4	1B	20	4217625	4217625	4217625	4217625	0	16870500
Sal-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	FEMA, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RSDMC, CDFG, TWI, USLTRCD, USWC,CT, TU, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
Sal-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	FEMA, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RSDMC, CDFG, TWI, USLTRCD, USWC,CT, TU, TCFT	Levees and Channelization	1,4	1B	5	10521940	0	0	0	0	10521940
Sal-SCCCS-8.1	Review and modify mining operations	USGS, NMFS, CDFG, CDMG, MC, SLOC, NRCS, RSDMC, USLTRCD, USWC,CT, TU, TCFT	Mining and Quarrying	1, 4, 5	1B	20	68030	0	0	0	0	68030
Sal-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, RSDMC, USLTRCD, USWC,TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Sal-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, RSDMC, USLTRCD, USWC,TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
Sal-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, RSDMC, USLTRCD, USWC,TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
Sal-SCCCS-10.1	Manage off-road recreational vehicle activity in riparian floodplain corridors	USFWS, USFS, BLM, CDFG, MC, SLOC,,WCB.TWI, USLTRCD, USWC,TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
Sal-SCCCS-10.2	Review and modify development and management plans for recreational areas and national forests	USFWS, USFS, BLM, CDFG, MC, SLOC,,WCB.TWI, USLTRCD, USWC,TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
Sal-SCCCS-10.3	Develop and implement a public educational program on watershed processes	USFWS, USFS, BLM, CDFG, MC, SLOC,,WCB.TWI, USLTRCD, USWC,TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
Sal-SCCCS-	Management roadways and	DOT, CDOT, USFWS, MC, SLOC, CDFG, USLTRCD,	Roads	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
11.1	adjacent riparian corridor and restore abandoned roadways	USWC,TWI, TU, CT, TCFT										
Sal-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	DOT, CDOT, USFWS, RWQCB, MC, SLOC, CDFG, USLTRCD, USWC,TWI, TU, CT, TCFT	Roads	1, 4	2B	20	32260	32260	32260	32260	0	129040
Sal-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	DOT, CDOT, USFWS, MC, SLOC, CDFG, USLTRCD, USWC,TWI, TU, CT, TCFT	Roads	1,4	2B	20	0	0	0	0	0	0
Sal-SCCCS-12.1	Develop and implement a restoration an estuary restoration and management plan	USFWS, EPA, NMFS, NFWF,CDFG, TU, CT, ESF	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	29949000	0	0	0	0	29949000
Sal-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCOM, SCRC, CDFG, NMFS, MC, SLOC, USLTRCD, USWC,TWI, TU, CT, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1B	5	62400	0	0	0	0	62400
Sal-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	NMFS, CDFG, MC, SLOC, USLTRCD, USWC, TU, CT, TCFT	Urban Development	1, 4	2B	5	62400	0	0	0	0	62400
Sal-SCCCS-13.2	Retrofit storm drains in developed	RWQCB, NMFS, CDFG, MC, SLOC, USLTRCD, USWC, TU, CT, TCFT	Urban Development	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	areas											
Sal-SCCCS-14.1	Review California Regional Water Quality Control Boards Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, NMFS, MC, SLOC, CDFG, USLTRCD, USWC,TU, CT, TCFT	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0
Sal-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* City of Paso Robles Wastewater Treatment Facility)	RWQCB, SWRCB, NMFS, MC, SLOC, CDFG, USLTRCD, USWC,TU, CT, TCFT	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Gabilan Creek												
GC-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, CDFG, USGS, SCC, , RSDSC, SCRC, TWI, TU, CT, CHEER	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
GC-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, CDFG, USGS, SCC, , RSDSC, SCRC, TWI, TU, CT, CHEER	Agricultural Development	1, 4,	1B	5	47520	0	0	0	0	47520
GC-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, CDFG, USGS, SCC, , RSDSC, SCRC, TWI, TU, CT, CHEER	Agricultural Development	1, 4,	2B	5	0	0	0	0	0	0
GC-SCCCS-2.1	Develop and implement a plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, RWQCB, SWRCB, CDFG, USGS, SCC, , RSDSC, SCRC, TWI, TU, CT, CHEER	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
GC-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment (or periodically up-date)	NMFS, USFS, CDFG, SCRC, RSDSC, CDOT, TWI, CT, TU, CHEER	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
GC-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers within the watershed	NMFS, USFS, CDFG, SCRC, RSDSC, CDOT, TWI, CT, TU, CHEER	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
GC-SCCCS-4.1	Develop and implement water management plan for any future diversion operations	NMFS, CDFG, SWRCB, SCRC, RSDSC, TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
GC-SCCCS-4.2	Develop and implement water management plan for any future dam operations	NMFS, CDFG, SWRCB, SCRC, RSDSC, TWI, ACWA, CT, TU, CHEER	Dam and Surface Water Diversions	1,3,4	1A	5	91850	0	0	0	0	91850
GC-SCCCS-4.3	Provide fish passage around any future dams and diversions	NMFS, CDFG, SWRCB, SCRC, RSDSC, TWI, ACWA, CT, TU, CHEER	Dams and Surface Water Diversions	1,3, 4	1A	5	0	0	0	0	0	0
GC-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, USGS,SCRC, RSDSC, CDFG, TWI, CT, TU, CHEER	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
GC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, CDFG, SCRC, RSDSC, TWI, TU, CT, CHEER	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
GC-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	USGS, NMFS, CDFG, SCRC, RSDSC, TWI, TU, CT, CHEER	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125
GC-SCCCS-7.1	Develop and implement plan to restore natural channel features	FEMA, USGS, NMFS, CDFG ACOE, BLM, NRCS, SCRC, RSDSC, TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	20	4217625	4217625	4217625	4217625	0	16870500
GC-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near	FEMA, USGS, NMFS, CDFG, ACOE, BLM,	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	levees	NRCS, SCRC, RSDSC, TWI, TU, CT, CHEER										
GC-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	FEMA, USGS, NMFS, CDFG, ACOE, BLM, NRCS, SCRC, RSDSC,TWI, TU, CT, CHEER	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
GC-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
GC-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
GC-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts (or periodically update)	USFWS, NMFS, CDFG, SCRC, RSDSC, NRCS, TWI, TU, CT, CHEER	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
GC-SCCCS-10.1	Develop and implement a public educational program on watershed processes (or periodically update)	USFWS, CSCC, CDFG, CCRP, SCRC,WCB.TWI, TU, CT, CHEER	Recreational Facilities	1, 2, 3,4, 5	3B	20	76140	76140	76140	76140	0	304560
GC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	DOT, CDOT,USFWS, SCRC, CDFG, TWI, TU, CT, CHEER	Roads	1, 4	2B	20	0	0	0	0	0	0
GC-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	DOT, CDOT,USFWS, SCRC, CDFG, TWI, TU, CT, CHEER	Roads	1,4	2B	20	32260	32260	32260	32260	0	129040

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
GC-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	DOT, CDOT,USFWS, SCRC, CDFG, TWI, TU, CT, CHEER	Roads	1,4	2B	20	0	0	0	0	0	0
GC-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	SCRC, NMFS, CDFG,SCRC, TU, CT, CHEER	Urban Development	1, 4	2B	5	62400	0	0	0	0	62400
GC-SCCCS-13.2	Retrofit storm drains in developed areas	SCRC, ACOE, NRCS, NMFS,SCRC, CDFG, TU, CT, CHEER	Urban Development	1, 4	2B	20	0	0	0	0	0	0
GC-SCCCS-14.1	Review California Regional Water Quality Control Boards Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, NRCS, SCRC, NMFS, CDFG, TU, CT, CHEER	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
GC-SCCCS-14.2	Review, assess and modify NPDES wastewater discharge permits	RWQCB, SWRCB, NMFS, SCRC, CDFG, TU, CT, CHEER	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Arroyo Seco												
AS-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, USGS, RSDMC, MC, NMFS, CDFG, USTRCD, TWI,TU, ASRA,	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
AS-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, USGS, RCDMC, MC,SLOC, NMFS, CDFG, TWI,TU, ASRA	Agricultural Development	1, 4,	1B	5	47520	0	0	0	0	47520
AS-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, USGS, RCDMC, MC,SLOC, NMFS, CDFG, TWI,TU, ASRA	Agricultural Development	1, 4,	2B	5	0	0	0	0	0	0
AS-SCCCS-2.1	Develop and implement a plan to minimize runoff from agricultural activities	NRCS, BLM, USGS, RCDMC, RWQCB, SWRCB,MC,SLOC, NMFS, CDFG, TWI,TU, ASRA	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
AS-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, USFS, USFWS, CDFG, CCCON, MC, FRGP, RCDMC, CDOT, TWI, CT, TU, ASRA	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
AS-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers within the watershed (*e.g.,* Sycamore Flats, Miller's Lodge, Clark Colony, *etc.*)	NMFS, USFW, USFS, CDFG, CCCON, MC, FRGP, RCDMC, CDOT, TWI, CT,TU, ASRA	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
AS-SCCCS-4.1	Develop and implement water management plan for any future dam operations	NMFS, USFS, USFWS, CDFG, CCON, MC,	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		MCWRA, FRGP, RSDMC, TWI, CT, TU, ASRA										
AS-SCCCS-4.2	Develop and implement water management plan for any future diversion operations	NMFS,USFS, USFWS, CDFG, CCON, MC, MCWRA, FRGP, RCDMC,TWI, CT, TU, ASRA	Dams and Surface Water Diversions	1,3, 4	1A	100	0	0	0	0	0	0
AS-SCCCS-4.1	Provide fish passage around any future dams and diversions	NMFS, CDFG, CCON, MC, MCWRA, FRGP, RCDSC, TWI, CT, TU, ASRA	Dams and Surface Water Diversions	1, 3, 4	1A	100	TBD	TBD	TBD	TBD	TBD	TBD
AS-SCCCS-5.1	Develop and implement flood control maintenance program (or periodically update)	ACOE, USFS, USFWS, NMFS, CDFG, NRCS, USGS, MC, RCDMC, CDFG, TWI, CT, TU, ASRA	Flood Control Maintenance	1, 4	3B	100	0	0	0	0	0	0
AS-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, CDFG, MC, RCDMC, TWI, TU, CT, ASRA	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
AS-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	USGS, NMFS, CDFG, MC, RCDSC, TWI, TU, CT, ASRA	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125
AS-SCCCS-7.1	Develop and implement a plan to restore natural channel features	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, RCDMC, CDFG, TWI, CT, TU, ASRA	Levees and Channelization	1, 4	2B	20	4217625	4217625	4217625	4217625	0	16870500

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AS-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, RCDMC, CDFG, TWI, CT, TU, ASRA	Levees and Channelization	1, 4	2B	100	0	0	0	0	0	0
AS-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, RCDMC, CDFG, TWI, CT, TU, ASRA	Levees and Channelization	1,4	2B	5	10521940	0	0	0	0	10521940
AS-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, RSDMC, NRCS, RCDMC, TWI, TU, CT, ASRA	Non-Native Species	1, 3,5	2B	100	0	0	0	0	0	0
AS-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, RCDMC, NRCS, RSDMC, TWI, TU, CT, ASRA	Non-Native Species	1, 3, 5	2B	100	0	0	0	0	0	0
AS-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, RCDMC, NRCS, RCDSC, TWI, TU, CT, ASRA	Non-Native Species	1, 3, 5	2B	20	76140	76140	76140	76140	0	304560
AS-SCCCS-10.1	Manage off-road recreational vehicle activity in riparian floodplain corridors	USFWS, USFS, BLM, CDFG, MC, WCB.TWI, TU, CT, ASRA	Recreational Facilities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
AS-SCCCS-10.2	Review and modify development and management plans for recreational areas and national forests	USFWS, USFS, BLM, CDFG, MC, WCB.TWI, TU, CT, ASRA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AS-SCCCS-10.3	Develop and implement a public educational program on watershed processes	USFWS, USFS, BLM, CDFG, MC, WCB.TWI, TU, CT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
AS-SCCCS-11,1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	DOT, CDOT, USFWS, MC, RCDMC,CDFG, TWI, TU, CT, ASRA	Roads	1, 4	2B	20	0	0	0	0	0	0
AS-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	DOT, CDOT, USFWS, MC, RCDMC,CDFG, TWI, TU, CT, ASRA	Roads	1,4	2B	20	32260	32260	32260	32260	0	129040
AS-SCCCS-13.1	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	USFS, USFWS, NMFS, RCDMC, DFG, MC, TU, CT	Urban Development	1, 4	3B	5	398000	0	0	0	0	398000
AS-SCCCS-14.1	Review California Regional Water Quality Control Board Central Coast Region Basin Plans and modify applicable stormwater permits	USFS, NMFS, RCDSC, RWQCB, SWRCB, DFG, MC, TU, CT, ASRA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
AS-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	USFS, NMFS, RCDMC, RWQCB, SWRCB, DFG, MC, TU, CT, ASRA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Table 9-6. South-Central California Coast Steelhead DPS Recovery Action Table for Upper Salinas River Sub-Watersheds (Interior Coast Range BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
San Antonio												
SAnt-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, USGS, RCDMC, MC, SLOC, NMFS, CDFG, TWI,TU, TCFT	Agricultural Development	1, 4	2B	20	0	0	0	0	0	0
SAnt-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, USGS, RCDMC, MC, SLOC, NMFS, CDFG, TWI,TU, TCFT	Agricultural Development	1, 4,	2B	5	47520	0	0	0	0	47520
SAnt-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, USGS, RCDMC, MC, SLOC, NMFS, CDFG, TWI,TU, TCFT	Agricultural Development	1, 4,	3B	5	0	0	0	0	0	0
SAnt-SCCCS-2.1	Develop and implement a plan to minimize runoff from agricultural activities	NRCS, BLM, USGS, RCDMC, RWQCB, SWRCB,MC,SLOC, NMFS, CDFG, TWI,TU, TCFT	Agricultural Effluents	1, 4	3B	100	0	0	0	0	0	0
SAnt-SCCCS-3.1	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, USFS, USFWS, CDFG, CCCON, MC, SLOC, FRGP, RCDMC, CDOT, TWI, CT, TU, TCFT	Culverts and Road Crossings (Passage Barriers)	1,4	1B	5	0	0	0	0	0	0
SAnt-SCCCS-3.2	Conduct watershed-wide fish passage barrier assessment	NMFS, USFS, USFWS, CDFG, CCCON, MC, SLOC, FRGP, RCDMC, CDOT, TWI, CT, TU, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1B	5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SAnt-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, USFWS, CDFG, CCON, MC, SLOC, MCWRA, FRGP, RCDMC, TWI, CT, TU, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
SAnt-SCCCS-4.2	Develop and implement water management plan for dam operations (or periodically update)	NMFS, USFS, USFWS, CDFG, CCON, MC, SLOC, MCWRA, FRGP, RCDMC, TWI, CT, TU, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
SAnt-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, USFS, USFWS, CDFG, CCON, MC, SLOC, MCWRA, FRGP, RCDMC, TWI, CT, TU, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	10	TBD	TBD	TBD	TBD	TBD	TBD
SAnt-SCCCS-5.1	Develop and implement flood control maintenance program (or periodically update)	ACOE, USFS, USFWS, NMFS, CDFG, NRCS, USGS, MC, RCDMC, CDFG, TWI, CT, TU, TCFT	Flood Control Maintenance	1, 4	2B	100	0	0	0	0	0	0
SAnt-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, DWR, CDFG, MC, RCDMC, TWI, TU, CT, TCFT	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
SAnt-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	USGS, NMFS, DWR, CDFG, MC, RCDMC, TWI, TU, CT, TCFT	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125
SAnt-SCCCS-7.1	Develop and implement plan to restore natural channel features	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RCDMC, CDFG, TWI, CT,	Levees and Channelization	1, 4	1B	20	4217625	4217625	4217625	4217625	0	16870500

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		TU, TCFT										
SAnt-SCCCS-7.2	Develop and implement stream bank and riparian corridor restoration plan	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RCDMC, CDFG, TWI, CT, TU, TCFT	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
SAnt-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, MC, SLOC, RCDMC, MCWRA, NRCS, TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	2B	100	0	0	0	0	0	0
SAnt-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, MC, SLOC, RCDMC, MCWRA, NRCS, TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	2B	100	0	0	0	0	0	0
SAnt-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, MC, SLOC, RCDMC, MCWRA, NRCS, TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	2B	20	76140	76140	76140	76140	0	304560
SAnt-SCCCS-10.1	Manage off-road recreational vehicle activity in riparian floodplain corridors	USFWS, USFS, USA, BLM, NMFS, CDFG, MC, MCWRA, WCB.TWI, TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
SAnt-SCCCS-10.2	Review and modify development and management plans for recreational areas and national forests.	USFWS, USFS, USA, BLM, NMFS, CDFG, MC, MCWRA, WCB.TWI, TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SAnt-SCCCS-10.3	Develop and implement a public educational program on watershed processes	USFWS, USFS, USA, BLM, NMFS, CDFG, MC, MCWRA, WCB.TWI, TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
SAnt-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	DOT, USA, CDOT, USFWS, MC, SLOC, MCWRA, RCDMC,CDFG, TWI, TU, CT, TCFT	Roads	1, 4	2B	20	0	0	0	0	0	0
SAnt-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	DOT, USA, CDOT, USFWS, RWQCB, SWRCB, MC, SLOC, MCWRA, RCDMC,CDFG, TWI, TU, CT, TCFT	Roads	1, 4	2B	20	32260	32260	32260	32260	0	129040
SAnt-SCCCS-11.3	Develop and Implement plan to remove or reduce approach-fill for railroad line and roads	DOT, USA, CDOT, USFWS, RWQCB, SWRCB,MC, SLOC, MCWRA, RCDMC,CDFG, TWI, TU, CT, TCFT	Roads	1, 4	2B	20	0	0	0	0	0	0
SAnt-SCCCS-12.1	Review applicable Integrated Natural Resources Management Plans	USA, USFWS, USFW, NMFS, CDFG, MC, MCWRA, RCDMC, TWI,CT, TU, TCFT	Upslope/Upstream Activities	1, 4	2B	20	0	0	0	0	0	0
SAnt-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	USFS, USA, USFWS, NMFS, CDFG, RCDMC, MCWRA,DFG, MC, SLOC, TU, CT, TCFT	Urban Development	1, 4	3B	5	62400	0	0	0	0	62400
SAnt-SCCCS-13.2	Retrofit storm drains in developed areas	USFWS, USA, NMFS, RCDMC, RWQCB, SWRCB, NMFS, DFG, MC,	Urban Development	1, 4	3B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		SLOC, TU, CT, TCFT										
SAnt-SCCCS-13.3	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	USFS, USA, USFWS, NMFS, CDFG, RSDSC, MCWRA,DFG, MC, SLOC, TU, CT, TCFT	Urban Development	1, 4	3B	5	398000	0	0	0	0	398000
SAnt-SCCCS-14.1	Review California Regional Water Quality Control Board Central Coast Region Basin Plans and modify applicable stormwater permits	USFS, USA, NMFS, RCDMC, RWQCB, SWRCB, DFG, MC, TU, CT, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
SAnt-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	USFS, USA, NMFS, RCDMC, RWQCB, SWRCB, DFG, MC, TU, CT, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Nacimiento												
Nac-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, USGS, RCDMC SLOC, NMFS, CDFG, CSLRCD, TU, TCFT	Agricultural Development	1, 4	2B	20	47520	0	0	0	0	47520
Nac-SCCCS-1.3	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, USGS, SLOC, NMFS, RCDMC, CDFG, CSLRCD, TU, TCFT	Agricultural Development	1, 4,	2B	5	0	0	0	0	0	0
Nac-SCCCS-1.4	Manage agricultural development and restore riparian zones	NRCS, BLM, USGS, RCDMC, SLOC, NMFS, CDFG, CSLRCD, TU, TCFT	Agricultural Development	1, 4,	3B	5	0	0	0	0	0	0
Nac-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, USFS, USFWS, CDFG, CCCON, RCDMC, SLOC, FRGP, CDOT,CSLRCD, CT, TU, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1B	5	0	0	0	0	0	0
Nac-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, USFS, USFWS, RCDMC CDFG, CCCON, RCDMC, SLOC, FRGP, CDOT,CSLRCD, CT, TU, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1B	5	91850	0	0	0	0	91850
Nac-SCCCS-4.1	Develop and implement water management plan for dam operations (or periodically update)	NMFS, USFS, USFWS, CDFG, CCON, MCWRA,	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		SLOC,, FRGP, CT, TU, TCFT										
Nac-SCCCS-4.2	Develop and implement water management plan for diversion operations (or periodically update)	NMFS, USFS, USFWS, CDFG, CCON, MCWRA, SLOC,, FRGP, CT, TU, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
Nac-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, USFS, USFWS, CDFG, CCON, MCWRA, SLOC,, FRGP, CT, TU, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	10	TBD	TBD	TBD	TBD	TBD	TBD
Nac-SCCCS-5.1	Develop and implement flood control maintenance program (or periodically update)	ACOE, USFS, USFWS, NMFS, CDFG, NRCS, USGS, MC, MCWRA, CSLRCD, CDFG, CT, TU, TCFT	Flood Control Maintenance	1, 4	2B	100	91850	0	0	0	0	91850
Nac-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	USGS, NMFS, CDFG, SLOC, TU, CT, TCFT	Groundwater Extraction	1, 4	1A	5	254350	39775	0	0	0	294125
Nac-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	USGS, NMFS, CDFG, SLOC, TU, CT. TCFT	Groundwater Extraction	1, 4	1A	10	4217625	4217625	4217625	4217625	0	16870500
Nac-SCCCS-7.1	Develop and implement a plan to restore natural channel features	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RSDSC, CSLRCD, CDFG, TWI, CT, TU, TCFT	Levees and Channelization	1, 4	1B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Nac-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, SLOC, RSDSC, CSLRCD, CDFG, TWI, CT, TU, TCFT	Levees and Channelization	1, 4	1B	100	10521940	0	0	0	0	10521940
Nac-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	FEMA, USFS, USFWS, USGS, ACOE, BLM, NRCS, NMFS, MC, RCDMC, SLOC, CSLRCD, CDFG, TWI, CT, TU, TCFT	Levees and Channelization	1, 4	2B	5	0	0	0	0	0	0
Nac-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, MC, SLOC, RSDSC, MCWRA, NRCS, RCDMC, TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	2B	100	0	0	0	0	0	0
Nac-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, MC, SLOC, RCDMC, MCWRA, NRCS, RSDSC, TWI, TU, CT, TCFT	Non-Native Species	1, 3, 5	2B	100	76140	76140	76140	76140	0	304560
Nac-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, MC, SLOC, RCDMC,	Non-Native Species	1, 3, 5	2B	20	62400	0	0	0	0	62400

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		MCWRA, NRCS, RCDMC, TWI, TU, CT, TCFT										
Nac-SCCCS-10.1	Manage off-road recreational vehicle activity in riparian floodplain corridors	USFWS, USFS, USA, BLM, NMFS, CDFG, MC, MCWRA, WCB.TWI, TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	5	0	0	0	0	0	0
Nac-SCCCS-10.2	Review and modify development and management plans for recreational areas and national forests	USFWS, USFS, USA, BLM, NMFS, CDFG, MC, MCWRA, WCB.TWI, TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	62400	0	0	0	0	62400
Nac-SCCCS-10.3	Develop, adopt, and implement recreational land-use planning policies	USFWS, USFS, USA, BLM, NMFS, CDFG, MC, MCWRA, WCB.TWI, TU, CT, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	5	0	0	0	0	0	0
Nac-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	DOT, CDOT, USFWS, RWQCB, SWRCB,MC, SLOC, SLOC, MCWRA, CSLRCD, CDFG, TWI, TU, CT, TCFT	Roads	1, 4	2B	20	32260	32260	32260	32260	0	129040
Nac-SCCCS-11.2	Retrofit storm drains to filter run-off from roadways	DOT, CDOT, USFWS, RWQCB, SWRCB,MC, SLOC, MCWRA, CSLRCD, CDFG, TWI, TU,	Roads	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CT, TCFT										
Nac-SCCCS-11.3	Develop and implement a plan to remove or reduce approach-fill for railroad lines and roads	DOT, CDOT, USFWS, RWQCB, SWRCB,MC, SLOC, MCWRA, CSLRCD, CDFG, TWI, TU, CT, TCFT	Roads	1, 4	2B	20	0	0	0	0	0	0
Nac-SCCCS-12.1	Review applicable Integrated Natural Resources Management Plans	USA, USFWS, USFW, NMFS, CDFG, MC, MCWRA, RCDMC, TWI,CT, TU, TCFT	Upslope/Upstream Development	1, 4	2B	20	0	0	0	0	0	0
Nac-SCCCS-13.1	Retrofit storm drains in developed areas	USFS, USA, USFWS, NMFS, CDFG, RCDMC, MCWRA,DFG, MC, SLOC, TU, CT, TCFT	Urban Development	1, 4	3B	20	62400	0	0	0	0	62400
Nac-SCCCS-13.2	Develop, adopt, and implement urban land-use planning policies and standards	USFS, USA, USFWS, NMFS, CDFG, RCDMC, MCWRA,DFG, MC, SLOC, TU, CT, TCFT	Urban Development	1, 4	3B	5	398000	0	0	0	0	398000
Nac-SCCCS-13.3	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	USFS, USA, USFWS, NMFS, CDFG, RCDMC, MCWRA,DFG, MC, SLOC, TU, CT, TCFT	Urban Development	1, 4	2B	5	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Nac-SCCCS-14.1	Review California Regional Water Quality Control Board Central Coast Region Basin Plans and modify applicable stormwater permits	USFS, USA, NMFS, RCDMC, MC, SLOC, RWQCB, SWRCB, DFG, TU, CT, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
Nac-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Heritage Ranch Wastewater Treatment Facility)	USFS, USA, NMFS, RCDMC, MC, SLOC, RWQCB, SWRCB, DFG, TU, CT, TCFT	Urban Effluents	1, 4	2B	20	47520	0	0	0	0	47520

10. Carmel River Basin Biogeographic Population Group

"Assessment at the group level indicates a priority for securing inland populations in southern Coast Ranges and Transverse Ranges, and a need to maintain not just the fluvial-anadromous life-history form, but also lagoon-anadromous and freshwater-resident forms in each population."

NOAA Fisheries Technical Recovery Team
Viability Criteria for South-Central and Southern California, 2007

10.1 LOCATION AND PHYSICAL CHARACTERISTICS

The Carmel River Basin Biogeographic Population Group BPG region is one of the smallest of the four BPG regions in the SCCS Recovery Planning Area (Figure 10-1). The main axis of the Carmel River watershed is just 28 miles long. In contrast, the main axis of the neighboring Interior Coast Range BPG region is over 180 miles long.

Upper Carmel River

The Carmel River Basin BPG region drains the eastern slopes of the northern Santa Lucia Range and the western slopes of the Sierra de Salinas in northwestern Monterey County Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service and National Marine Fisheries Service 2008a, 2008b).

Carmel River between Los Padres and San Clemente Dams

The Carmel River flows into the Pacific Ocean at Carmel Bay, just south of the

Monterey Peninsula. This BPG region shares some physical characteristics with the Interior Coast Range BPG region, such as general northwest-southeast watershed orientation, landform evolution largely controlled by tectonic activity associated with the San Andreas Fault, and a highly dissected watershed. There are seven major perennial tributaries to the Carmel River (Figure 10-1). Average annual precipitation in this region is relatively low and shows high spatial variability. In general, the coastal regions and higher elevations receive higher amounts of precipitation. The Carmel River watershed is relatively steep and most of the tributaries are naturally perennial (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Carmel River Estuary

10.2 LAND USE

Table 10-1 summarizes land use and population density in this region. Human population density is moderate to high and concentrated in the lower and middle portions of the Carmel Valley, including the towns of Carmel and Carmel Valley (March 2012, Palumbi 2011, Chiang 2008, Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Carmel River Watershed Conservancy 2004, Walton 2003, Stephenson and Calcarone 1999, Monterey Peninsula Water Management District 1987, 1983, Kondolf 1986, California Department of Water Resources 1978).

Golf Course Development

Population density averages 70 persons per square mile. Although less than four percent of the watershed is classified as urban, well over 50 percent of the watershed is privately-owned and the Carmel Valley, through which the mainstem flows, is surrounded by extensive ranches and areas of rural land use. Less than one percent of the watershed is under cultivation.

There are four dams in the Carmel River watershed: Black Rock Creek Dam, Old Carmel River Dam, San Clemente Dam, and Los Padres Dam. Black Rock Creek Dam, constructed in 1925 on a tributary to the Carmel River, is used for recreational purposes. The Old Carmel River, San Clemente and Los Padres Dams, were constructed on the mainstem Carmel River in 1880, 1921 and 1949, respectively, for municipal and agricultural water supply (California Department of Fish and Game 2011b, California Department of Water Resources1988).

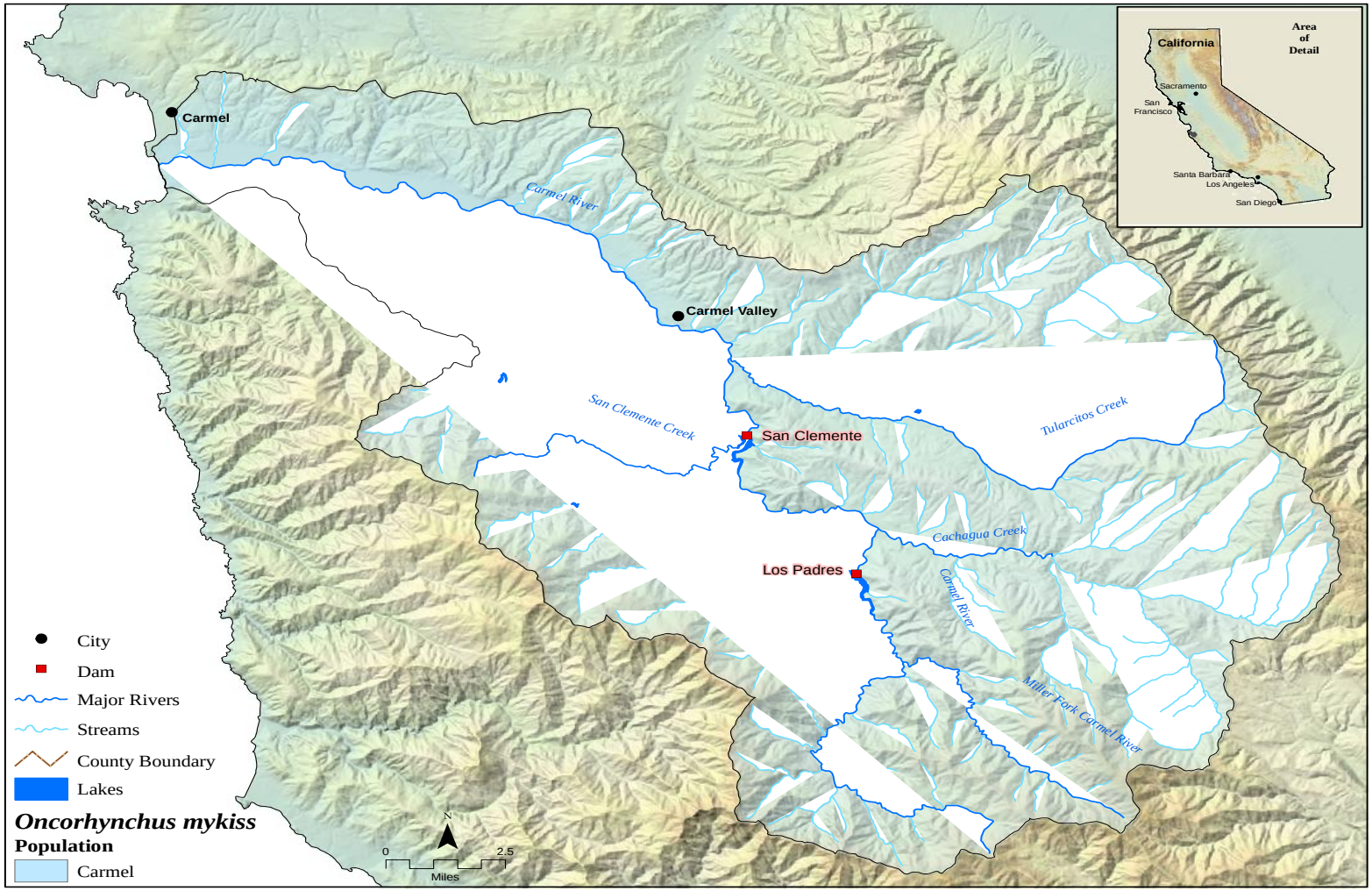

Figure 10-1. The Carmel River Basin BPG region. This BPG region is comprised of a single watershed (Carmel River).

Table 10-1. Physical and Land-Use Characteristics of Watersheds in the Carmel River Basin BPG region.

PHYSICAL CHARACTERISTICS						**LAND USE**			
WATERSHED	**Area** (acres)[1]	**Area** (sq.miles)[1]	**Stream Length**[2] (miles)	**Ave. Ann. Rainfall**[3] (inches)	**Total Human Population**[4]	**Public Ownership***	**Urban Area**[5]	**Agriculture/ Barren**[5]	**Open Space**[5]
Carmel River	162,286	254	248	19.8	17,020	31%	4%	0.6%	95%

[1] *From: CDFFP CalWater 2.2 Watershed delineation, 1999 (www.ca.nrcs.usda.gov/features/calwater/)*
[2] *From: CDFG 1:1,000,000 Routed stream network, 2003 (www.calfish.org/)*
[3] *From: USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)*
[4] *From: CDFFP CalFire FRAP (http://cdf.ca.gov/data/frapisdata/select.sap)(migrated)*
[5] *From: CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells) (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)*
** Includes National Forest Lands and Military Reservations only; does not include State or County Parks (from:*

http://old.casil.ucdavis.edu/casil/gis.ca.gov/teale/govtowna/)

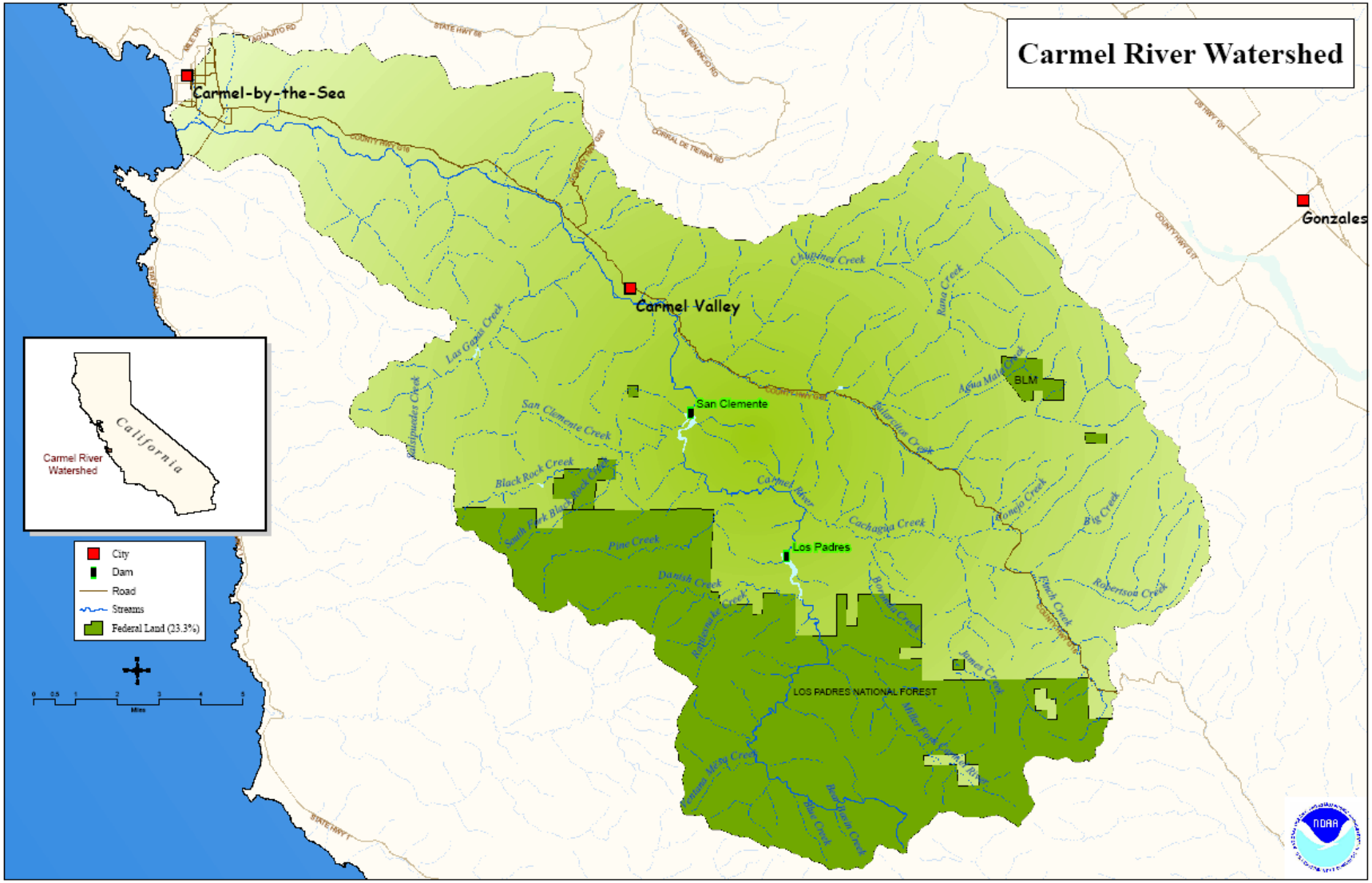

Figure 10-2. Federal and Non-Federal Land ownership within the Carmel River Watershed.

10.3 CURRENT WATERSHED CONDITIONS

Watershed conditions in this BPG region were assessed for the Carmel River watershed. A total of 30 indicators were used in the CAP Workbook analysis for this BPG. This analysis rated overall habitat conditions for anadromous *O. mykiss* in the Carmel River watershed as "Fair." Approximately 33 percent of the indicators were impaired (fair condition) or severely impaired (poor condition) and these indicators repeatedly focused on lack of surface flows in the mainstem caused by water management activities (*i.e.,* dams, surface water diversions, and excessive pumping of groundwater). (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b; see also, March 2012, Monterey Peninsula Water Management District, 2000-2011, 1983, Casagrande 2006, Casagrande and Watson 2003, California Department of Fish and Game 2005, Monterey Peninsula Water Management District and Carmel River Watershed Conservancy 2004, Carmel River Conservancy 2004, Stephenson and Calcarone 1999, Dettman 1987, 1986, Kondolf 1986, Snider 1983, California Department of Water Resources 1978.)

The mainstem contains suitable spawning habitat and functions as the conduit connecting the ocean and estuary to even more extensive spawning habitat in the upper watershed. However, San Clemente and Los Padres dams (while equipped with fish passage facilities) impede access to spawning and rearing habitat in at least 50 percent of the Carmel River watershed. Native non-anadromous *O. mykiss* populations persist in the mainstem and most of the tributaries above these dams. Additionally, a significant portion of the lower Carmel River below San Clemente Dam has been altered by bank protection for flood control purposes, thus adversely affecting steelhead habitats.

Carmel River – Residential Encroachment

Another aspect of the Carmel River watershed that received low ratings was the estuary. While the existing estuary has undergone substantial restoration and still contains valuable rearing habitat, at least 33% of the original estuary has been eliminated due to encroachment from residential development, transportation corridors (Highway 1), and recreational development (Carmel Beach State Park). (See Anderson *et al*. 2008, California Department of Fish and Game 2008, Carmel River Coalition 2007, Perry *et al.* 2007, Casagrande 2006, Casagrande and Watson 2003, Larson *et al.* 2006, Watson and Casagrande 2004, Hagar 2003, Alley Associates 1997, Kitting 1990, Dettman 1984.)

Carmel River Estuary – Artificial Breaching

10.4 THREATS AND THREAT SOURCES

Information identified in the CAP Workbooks on habitat and land-use indicators for the Carmel River Basin BPG was supplemented by additional information developed since the preparation of the CAP Workbooks and incorporated into the threat assessment. However, the underlying threat sources that determined the poor to very poor conditions of approximately one-third of those indicators repeatedly pointed to a limited number of anthropogenic causes, including: passage barriers caused by excessive surface and groundwater diversions; passage impediments caused by dams; loss or degradation of spawning substrates below San Clemente Dam due to water management practices, including substantial groundwater use for golf course irrigation; urban development, and associated levee construction that has significantly reduced estuarine habitats and constricted the lower floodplain of the river; and artificial breaching of the estuary sandbar to alleviate flooding of adjacent residential development.

San Clemente Dam

A pervasive threat to anadromous *O. mykiss* throughout the Carmel River BPG region are impediments to upstream and downstream fish passage, either in the form of dams and surface water diversions, or excessive groundwater extraction that creates dry stream reaches (Table 10-2), and connectivity with the Carmel River Estuary. Several miles of the mainstem Carmel River below San Clemente Dam that would otherwise have perennial surface flows frequently dry up or are reduced to isolated pools by late spring and early summer due to a combination of reduced runoff and surface and subsurface water withdrawals. As a result, an annual fish rescue and relocation efforts is made to deal with this situation on an interim basis (with fish reared and subsequently released from the Sleepy Hallow rearing facility located downstream of the San Clemente Dam and operated by the Monterey Peninsula Water Management District. Spawning habitat in the mainstem below San Clemente Dam has been degraded by water releases from the dam, contributing to increasing bank erosion and armoring. The Los Padres Dam has also constrained the natural movement of steelhead, both upstream migrating adults and downstream emigrating juveniles (Capelli 2007, Entrix 2006, Raines and Carella 2002, Monterey Peninsula Water Management District 2000, R2 Resource Consultants 2000, Stephenson and Calcarone 1999, Alley Associates 1998, 1996, 1992, Dettman 1993, 1989).

Los Padres Dam

Surface and groundwater extractions artificially modify the pattern of sandbar formation and natural breaching at the estuary. The sandbar is also breached artificially for flood control, which causes premature draining of the estuary; these artificial breachings can result in the loss of important juvenile steelhead rearing habitat, as

well as the flushing of rearing juveniles to the ocean (California Department of Parks and Recreation 2008, Watson and Casagrande 2004, National Marine Fisheries Service 2002, Dettman 1984, U.S. Fish and Wildlife Service 1980).

Carmel River Estuary.

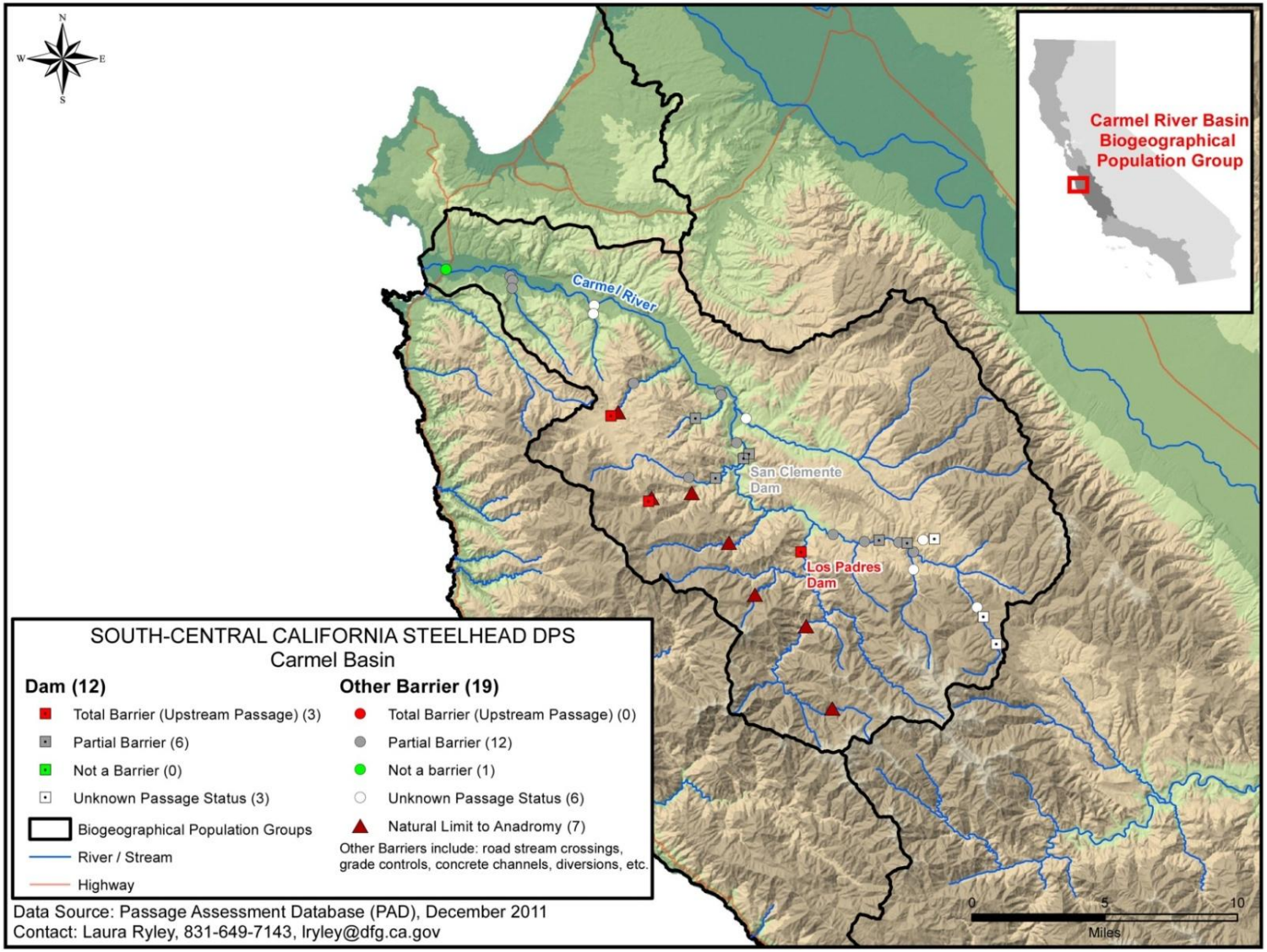

Figure 10-4. Major Fish Passage Barriers, Carmel River Basin BPG.

Table 10-2. Threat source rankings in the Carmel River Basin BPG region (see CAP Workbooks for details).

THREAT SOURCES*	WATERSHED
	Carmel River
Dams and Surface Water Diversions	
Groundwater Extraction	
Urban Development	
Levees and Channelization	
Culverts and Road Crossings (Other Passage Barriers)	
Recreational Facilities	

Key: Threat cell colors represent threat rating from CAP Workbook: Red = Very High threat; Yellow = high threat; Light green = Medium threat; Dark green = Low threat

**Note Agricultural development was not identified during the CAP Workbook analyses as one of the top five threats in this watershed, but agricultural development in the middle reaches of the Carmel River, and with some tributaries could be a significant threat to these population.*

10.5 SUMMARY

Dams and diversions (including groundwater extractions) on the Carmel River have had the most severe adverse impacts on steelhead populations in this BPG by reducing access to upstream spawning and rearing habitats and altering the magnitude, and timing of flows necessary for immigration of adults and emigration of juveniles. Urban and agricultural developments within the Carmel River watershed are also significant threats. For example, residential development around the estuary and along some reaches of the lower mainstem has encroached on and degraded estuarine and riparian habitats. Generally, road density, population density, and fire frequency are relatively low; however these factors can be expected to increase in the future.

Because the mainstem of the Carmel River is the conduit that connects upstream spawning and rearing habitat with the ocean, recovery actions in this watershed should focus on reducing the severity of anthropogenic impacts stemming from the construction and operation of dams (*e.g.,* San Clemente and Los Padres Dams) and groundwater extractions along the mainstem in order to promote connectivity between the ocean and estuarine habitats, as well as to maintain spawning and rearing habitat in the mainstem itself. Additionally, degraded estuarine conditions stemming from filling, artificial sandbar manipulation, and both point and non-point waste discharges, should be further evaluated and addressed. Table 10-3 summarizes the critical recovery actions needed within the Core 1 populations of this BPG.

The threat sources discussed in this chapter are the focus of a variety of recovery actions to address specific stresses associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, *etc.,* are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions as part of any recovery strategy for the Carmel River Basin BPG. Recovery Action Table 10-4 below ranks and describes proposed recovery actions in the Carmel River Basin BPG including the estimated cost for implementing such actions in five year increments, and where applicable extended out to 100 years, though many of the recovery actions can and should be achieved within a shorter period (Hunt & Associates 2008a 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Table 10-3. Critical recovery actions for Core 1 populations within the Carmel River Basin BPG.

POPULATION	CRITICAL RECOVERY ACTIONS
Carmel River	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, from San Clemente and Los Padres Dams to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove San Clemente, Los Padres, and Old Carmel River Dams to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.

South-Central California Coast Steelhead DPS Recovery Action Tables Identification Key, Carmel River Basin BPG (Table 10-4).

Recovery Action Number Key: XXXX – SCCCS – 1.2	
XXXX	Watershed
SCCCS	Species Identifier – South-Central California Steelhead
1	Threat Source
2	Action Identity Number
Action Rank	
A	Action addresses the first listing factor regarding the destruction or curtailment of the species' habitat
B	Action addresses one of the other four listing factors

XXXX ID Table	
Car	Carmel River

Threat Source Legend	
1	Agricultural Development
2	Agricultural Effluents
3	Culverts and Road Crossings (Passage Barriers)
4	Dams and Surface Water Diversions
5	Flood Control Maintenance
6	Groundwater Extraction
7	Levees and Channelization
8	Mining and Quarrying
9	Non-Native Species
10	Recreational Facilities
11	Roads
12	Upslope/Upstream Activities
13	Urban Development
14	Urban Effluents
15	Wildfires

See Chapter 8, Table 8-1 for Detailed Description of Recovery Actions. See Appendix E for discussion of recovery action cost estimates.

Table 10-4. South-Central California Steelhead DPS Recovery Action Table for the Carmel River Watershed (Carmel River Basin BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Carmel River												
Car-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, MC, MPWMD, CRWC	Agricultural Development	1, 4, 5	2B	20	0	0	0	0	0	0
Car-SCCCS-1.2	Manage agricultural development and restore riparian zone	NRCS, BLM,NMFS, MC, MPWMD, CRWC, CCON, CDFG, CRA, CRSA, CRWC, CVPOA	Agricultural Development	1, 4, 5	2B	5	0	0	0	0	0	0
Car-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM,NMFS, MC, MPWMD, CRWC, CCON, CDFG, CRA, CRSA, CRWC, CVPOA	Agricultural Effluents	1, 4, 5	2B	100	0	0	0	0	0	0
Car-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCON, MPWMD, CAWC, CRLC, CRSA, CRWC, CRWCO	Culverts and Road Crossings (Passage Barriers)	1, 4, 5	1B	5	96690	0	0	0	0	96690
Car-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCON, MPWMD, CAWC, CRLC, CRSA, CRWC, CRWCO	Culverts and Road Crossings (Passage Barriers)	1, 4, 5	1B	20	TBD	TBD	TBD	TBD	TBD	TBD
Car-SCCCS-4.1	Develop and implement water management plan for dam operations	NMFS, CDFG, MPWMD, CAWC, CRA, CRWC	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Car-SCCCS-4.2	Develop and implement water management	NMFS, CDFG, MPWMD, CAWC, CRA, CRWC	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	plan for diversion operations											
Car-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, MPWMD, CAWC, CRA, CRWC	Dams and Surface* Water Diversions *Reflects only the cost of the removal of San Clemente Dam; the removal of Los Padres and Old Carmel River Dams have not been estimated.	1, 3, 4	1A	5	84000000	0	0	0	0	84000000
Car-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, FEMA, NMFS, CDFG, MC, COC, MCPWP, MPWMD, CRLC, CRSA, CRWC, CRWCO, CVPOA	Flood Control Maintenance	1, 3, 4	2A	100	0	0	0	0	0	0
Car-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	MC, MCWRA, MPWMD, NMFS, CDFG, CAWC, CRA, COC, PBCSD, CRLC, CRSA, CRWC, CRWCO	Groundwater Extraction	1, 4	1A	5	91850	0	0	0	0	91850
Car-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	MC, MCWRA, MPWMD, NMFS, CDFG, CAWC, CRA, COC, PBCSD, CRLC, CRSA, CRWC, CRWCO	Groundwater Extraction	1, 4	1A	10	254350	39775	0	0	0	294125
Car-SCCCS-7.1	Develop and implement a plan to restore natural channel features	NRCS, FEMA, NMFS, CDFG, CRA, COC, CRSA, CRWC, CRWCO, CVPOAMCPA, MCWRA,MPWMD, MCUSA	Levees and Channelization	1, 4	1B	20	4217625	4217625	4217625	4217625	0	16870500
Car-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or	NRSC, FEMA, NMFS, CDFG, CRA, CRSA, CRWC, CRWCO, CVPOAMCPA,	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	minimize herbicide use near levees	MCWRA,MPWMD, MCUSA										
Car-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	NRSC, FEMA, NMFS, CDFG, CRA, COC, CRSA, CRWC, CRWCO, CVPOAMCPA, MCWRA,MPWMD, MCUSA	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
Car-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CRA, CRSA, CRWC, CRWCO	Non-Native Species	1, 3, 5	1B	100	0	0	0	0	0	0
Car-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CRA, CRSA, CRWC, CRWCO	Non-Native Species	1, 3, 5	1B	100	0	0	0	0	0	0
Car-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CRA, CRSA, CRWC, CRWCO	Non-Native Species	1, 3, 5	1B	20	76140	76140	76140	76140	0	304560
Car-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests	CDPR, CDFG, USFS, NMFS, MC, CRA, COC, CRLC, CRSA, CRWC, CRWCO, MBNMS, MRPD	Recreational Facilities	1, 2, 3, 4, 5	1B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	(*e.g.,* the Carmel State Beach Management Plan)											
Car-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, USFS, NMFS, MC, CRA, COC, CRLC, CRSA, CRWC, CRWCO, MBNMS, MRPD	Recreational Facilities	1, 2, 3, 4, 5	1B	20	76140	76140	76140	76140	0	304560
Car-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, CDOT, MC, MCPWD, NMFS, CDPR, CDFG, AMBAG, CRA, COC, CRSA, CRWC, CRWCO, CWPOA	Roads	1, 4	2B	20	0	0	0	0	0	0
Car-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, CDOT, MC,MCPWD, NMFS, CDPR, CDFG, AMBAG, CRA, COC, CRSA, CRWC, CRWCO, CWPOA	Roads	1, 4	2B	20	32260	32260	32260	32260	0	129040
Car-SCCCS-11.3	Develop and implement plan to remove or reduce approach fill f or railroad line and roads	USDOT, CDOT, MC,MCPWD, NMFS, CDPR, CDFG, AMBAG, CRA, COC, CRSA, CRWC, CRWCO, CWPOA	Roads	1, 4	2B	20	0	0	0	0	0	0
Car-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USDOT, CDOT, MC, MCPWD, NMFS, CDPR, CDFG, AMBAG TWI	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	1876000	0	0	0	0	1876000

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Car-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, COC, NMFS, CDFG, MCPWD, CRA, CRSA, CRWC, CVPOA	Upslope/Upstream Activities	1, 2, 3, 4, 5	1B	5	62400	0	0	0	0	62400
Car-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, MC, NMFS, CDFG, AMBAG, MCPWD, COC, CRA, CRSA, CRWC, CVPOA	Urban Development	1, 4, 5	1B	5	62400	0	0	0	0	62400
Car-SCCCS-13.2	Retrofit storm drains in developed areas	RWQCB, MC, NMFS, CDFG, AMBAG, MCPWD, COC, CRA, CRSA, CRWC, CVPOA	Urban Development	1, 4, 5	1B	20	0	0	0	0	0	0
Car-SCCCS-14.1	Review California Regional Water Quality Control Board s Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, MCPWD, CRA, COC, CRLC, CRSA, CRWCO, CVPOA, PBCSD, MC, MCWRA, MPWMD	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0
Car-SCCCS-14.2	Review, assess and modify NPDES wastewater discharge permits (*e.g.,* Carmel Area Wastewater Treatment Facility)	RWQCD, SWRCB, NMFS, CDFG, CAWD, CRA, COC,CRLC, CRSA, CRWCO, CVPOA, PBCSD, MC, MCWRA, MPWMD	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0
Car-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management	USFS, USFWS, CDF&FP, MC, NMFS, CDFG, MPWMD, MRPD, CRA, CRSA, CRWC, CRWCO	Wildfires	1,4,5	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	plan											

11. Big Sur Coast Biogeographic Population Group

"Assessment at the group level indicates a priority for securing inland populations in southern Coast Ranges and Transverse Ranges, and a need to maintain not just the fluvial-anadromous life-history form, but also lagoon-anadromous and freshwater-resident forms in each population."

NOAA Fisheries Technical Recovery Team
Viability Criteria for South-Central and Southern California Steelhead, 2007

11.1 LOCATION AND PHYSICAL CHARACTERISTICS

The Big Sur Coast BPG consists of seven small watersheds that drain the steep coastal slopes of the northern Santa Lucia Range. This region extends approximately 60 miles along a sparsely populated section of coastal Monterey County from the Monterey Peninsula southward almost to the San Luis Obispo County line. From north to south, these watersheds are: San Jose Creek, Garrapata Creek, Bixby Creek, Little Sur River, Big Sur River, Willow Creek, and Salmon Creek (Figure 11-1).

The Big Sur Coast BPG resembles the Conception Coast BPG in Santa Barbara County and the Santa Monica Mountains BPG in Ventura and Los Angeles counties in that its component watersheds are, with one or two exceptions, small, steep, and have small total stream lengths. Although average annual precipitation shows little spatial variation across the component watersheds, total seasonal rainfall in this region is highly variable from year to year, depending on the intensity and duration of Pacific storms.

Big Sur Coast

In general, the higher elevations receive greater amounts of precipitation, and persistent spring and summer fog is characteristic of this region. All of the watercourses in this BPG are perennial (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

11.2 LAND USE

Table 11-1 summarizes land use and population density in the Big Sur Coast BPG region. This BPG region supports, by far, the lowest total human population of any other BPG region and is highly buffered from urban areas by extensive undeveloped open space and rural lands. Average human population density averages about 4 persons per square mile (Table 11-1).

The closest population centers are the small towns of Carmel near the north end and Cambria near the south end of the BPG region.

Big Sur River

There are no major cities or towns within this BPG. There is a strong gradient of increasing public ownership of watershed lands, from less than 1 percent in the San Jose Creek watershed in the north to over 98% in the Salmon Creek watershed in the south. Most of the federal lands are in the Los Padres National Forest. Small parcels of National Recreation Area lands occur along the immediate coast. The Los Padres National Forest encompasses several federally designated wilderness areas, such as Ventana and Silver Peak Wilderness Areas. Additionally, the Big Sur River, including the North and South Forks, is a federally designated Wild River. There are several State and County parks along the coast in this region, but some of the larger state parks, such as Andrew Molera and Pfeiffer-Big Sur in the Big Sur River watershed, extend well inland.

Little Sur River

Urban and agricultural conversion of land in these watersheds lands is correspondingly low, with the overwhelming majority of watershed lands being open space (Table 11-1). There are no major dams in this region, though there are seasonal dams in some drainages that may affect anadromous *O. mykiss*, particularly the instream movement of juveniles (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Stephenson and Calcarone 1999, California Department of Water Resources 1978).

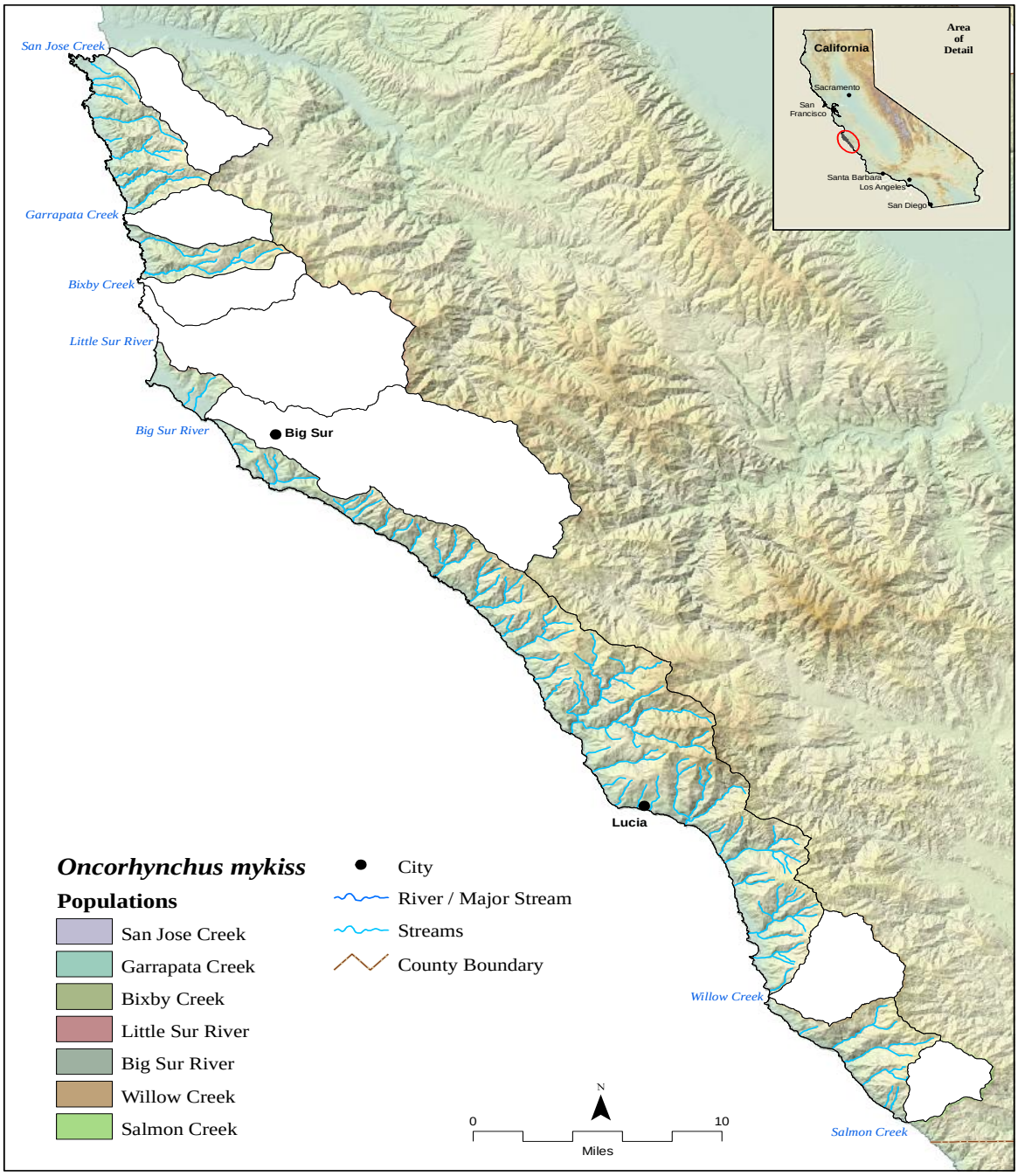

Figure 11-1. The Big Sur Coast BPG region. Seven populations/watersheds were analyzed in this region.

Table 11-1. Physical and Land-Use Characteristics of Watersheds in the Big Sur Coast BPG region.

PHYSICAL CHARACTERISTICS						**LAND USE**			
WATERSHEDS (north to south)	**Area** (acres)[1]	**Area** (sq.miles)[1]	**Stream Length**[2] (miles)	**Ave. Ann. Rainfall**[3] (inches)	**Total Human Population**[4]	**Public Ownership***	**Urban Area**[5]	**Agriculture/ Barren**[5]	**Open Space**[5]
San Jose Creek	8,826	14	23	20.3	41	0.1%	0.2%	0.1%	> 99%
Garrapata Creek	6,925	11	16	20.5	122	12%**	0%	0%	100%
Bixby Creek	7,218	11	15	20.8	27	27%	0%	0%	100%
Little Sur River	26,541	41	64	20.8	60	63%	0.2%	< 0.1%	> 99%
Big Sur River	37,374	58	92	20.8	341	86%	0.7%	< 0.1%	> 99%
Willow Creek	10,412	16	26	18.5	27	95%	0%	0%	100%
Salmon Creek	5,406	8	12	19.5	2	98%	0%	0%	100%
TOTAL or AVERAGE	**102,702**	**159**	**248**	**20.2**	**618**	**54%**	**< 0.2%**	**< 0.1%**	**> 99%**

[1] From: CDFFP CalWater 2.2 Watershed delineation, 1999 (www.ca.nrcs.usda.gov/features/calwater/)
[2] From: CDFG 1:1,000,000 Routed stream network, 2003 (www.calfish.org/)
[3] From: USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
[4] From: CDFFP Census 2010 block data (migrated), CalFire FRAP (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)
[5] From: CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells) (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)
** Includes National Forest lands and State Recreation Areas, does not include State and County Parks (from: http://old.casil.ucdavis.edu/casil/gis.ca.gov/teale/govtowna/)*
*** 68% of the watershed is owned by the State, Land Trust, or has conservation easement restrictions on land use.*

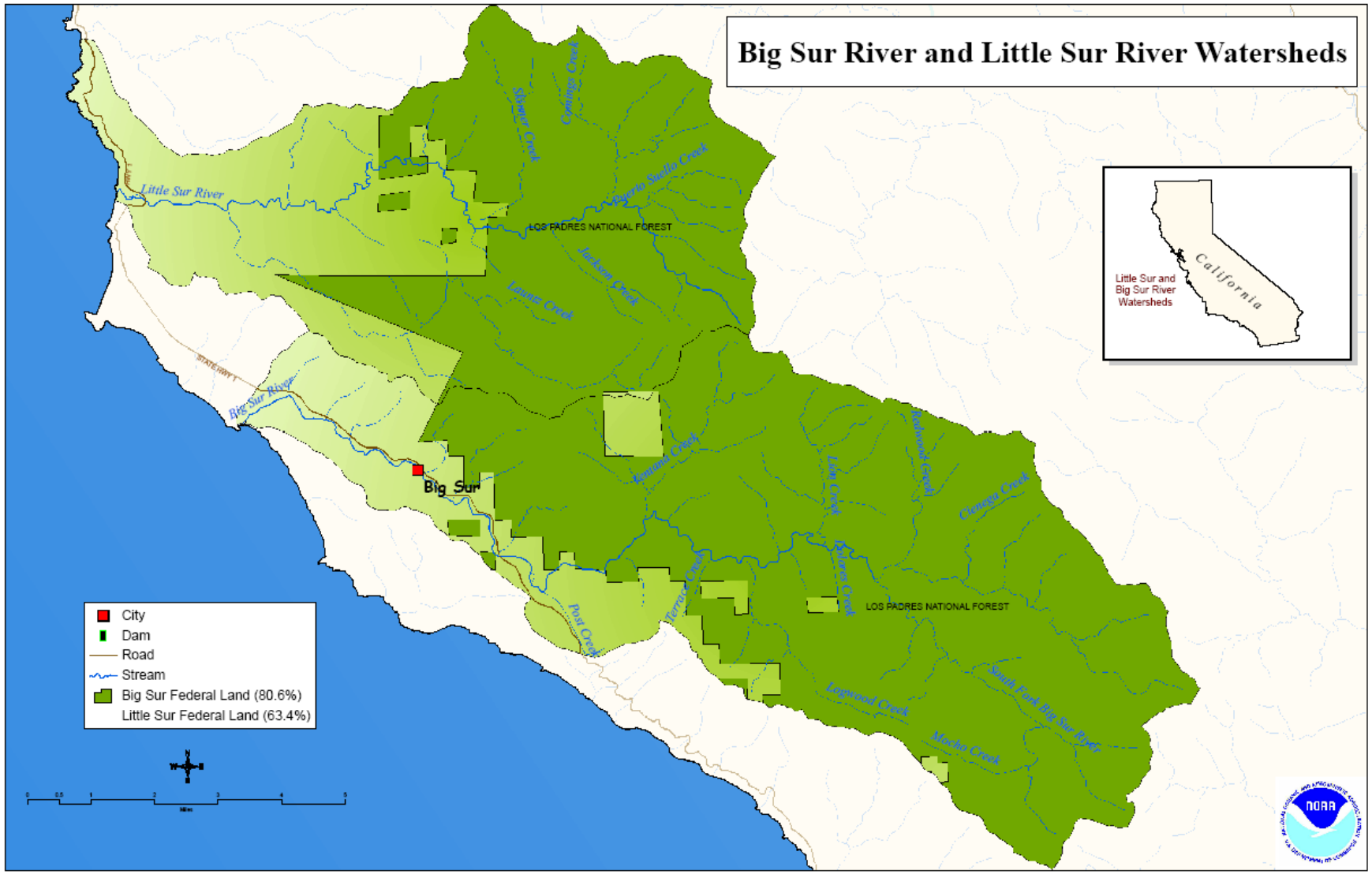

Figure 11-2. Federal and Non-Federal Land Ownership within the Big and Little Sur Watersheds.

11.3 CURRENT WATERSHED CONDITIONS

Watershed conditions were assessed for the seven major drainages in the Big Sur Coast BPG region. Instream, riparian, and upland habitat conditions in the watersheds in this region are collectively rated the highest of any of the BPG regions by the CAP Workbook analyses. The CAP Workbooks rated overall habitat conditions for steelhead as "Fair" in the San Jose Creek watershed, "Good" in the Garrapata Creek, Big Sur River, and Salmon Creek watersheds, and "Very Good" in the Bixby Creek, Little Sur River, and Willow Creek watersheds. However, Garrapata is impacted by logjams which impede fish passage, and elevated levels of fine sediments resulting from roads. The Little Sur River Estuary is the most intact estuary within the SCCCS Recovery Planning Area – the result of the Highway 1 alignment upstream of the estuary (Garrapata Creek Watershed Community Council 2006, Smith *et al.* 2006, 2005, Casagrande and Smith 2005, Nedeff 2005, 2004, Pacific Watershed Associates 2003, Kittleson Environmental Consultants 2002, Rathbun et al. 1991).

Little Sur River Estuary

Land-use activities that negatively affect these ratings are most pronounced in watersheds that are mostly under private ownership. For example, the San Jose Creek, Garrapata Creek, and Bixby Creek watersheds are degraded by groundwater and surface water diversions, increased sedimentation from old logging roads, and fish-passage barriers created by log or debris jams associated with past logging activities, and in the case of San Jose Creek, the loss and degradation of estuarine habitat as the result of the design and alignment of U.S. Highway 1 (Nelson *et al.* 2006a, 2006b, Nelson 2005, Hagar Environmental Science 2002.

San Jose Creek Estuary

The Big Sur River and Salmon Creek have natural barriers that block anadromous *O. mykiss* passage to the middle and upper portions of these watersheds. While this limits the amount of accessible spawning and rearing habitat, particularly in Salmon Creek, the most significant adverse impacts are to the Big Sur River stemming from water withdrawals in the lower reaches, and both public and private recreational development within the vicinity of U.S. Highway 1

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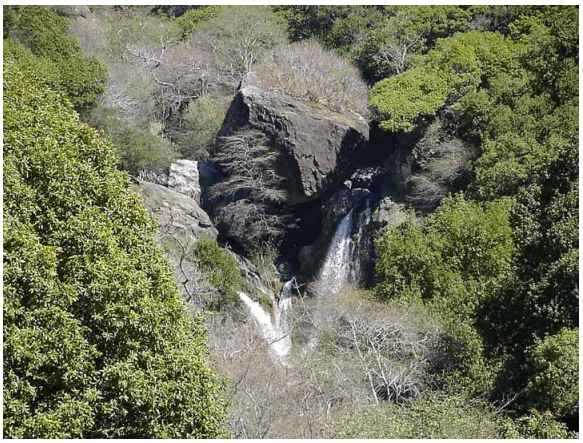

Salmon Creek

Increased fire frequency in these watersheds was rated as a severe threat because of potential sedimentation and various other fire-related impacts to instream and riparian habitats. In general, however, the six watersheds south of San Jose Creek provide excellent spawning and rearing habitat (Watson *et al*. 2008, Denise Duffy and Associates 2003, Kittleson Environmental Consultants, Denise Duffy and Associates and Fall Creek Engineering 2002, Collin 1998, Rischbieter 1990a).

Willow Creek

11.4 THREATS AND THREAT SOURCES

Information identified in the CAP Workbooks on habitat and land-use indicators for the Big Sur Coast BPG was supplemented by additional information developed since the preparation of the CAP Workbooks and incorporated into the threat assessment. The number of threats identified in the CAP Workbook analysis in the Big Sur Coast BPG region is very low compared to other BPG regions, ranging from three in the Bixby Creek watershed to eleven in the San Jose Creek watershed; however, additional information developed since the preparation of the CAP has also been incorporated into the threat assessment. These relatively low numbers of threats reflect the low human population density and fewer associated land-use impacts in this portion of the SCCCS Recovery Planning Area. Aside from San Jose Creek watershed, the most pervasive threats stem from roads (as a source of sedimentation and barriers to fish passage), wildfires, and other fish passage barriers (e.g., periodic landslides), and groundwater extractions (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Little Sur River – Road Cut

On-going restoration and re-vegetation of eroded slopes and decommissioned logging roads in the Garrapata Creek watershed should

eventually reduce or eliminate this threat source and improve habitat conditions for steelhead. Land-use activities in the mostly privately-owned San Jose Creek watershed pose a number of problems. Surface water diversions and groundwater extraction in the mainstem of San Jose Creek severely impair instream habitat quality and quantity for anadromous *O. mykiss*. Such diversions create passage barriers (*i.e.*, dry stream reaches), and can exacerbate poor water quality under extremely low-flow conditions. Higher road density in this watershed serves to further degrade water quality through input of sediment and other sources of pollution arising from road surfaces (Watson *et al*. 2008, Garrapata Creek Watershed Council 2006, Nelson *et al*. 2006a, 2006b,, Nedeff 2004, 2005, Ford 2004).

The persistence of anadromous *O. mykiss* in the Salmon Creek watershed is potentially threatened by a large waterfall that sets the natural limit of anadromy is less than a mile above the mouth of the creek. Mainstem Salmon Creek between the ocean and the Highway 1 culvert provides excellent spawning and rearing habitat for anadromous *O. mykiss* (although that culvert is also barrier to upstream fish passage under low-flow conditions).

Salmon Creek

The three principal sources of threats to individual steelhead populations in the Big Sur Coast BPG are passage barriers created by culverts, road crossings, and periodic landslides; impediments to migration and degradation of spawning and rearing habitats as a result of groundwater extraction, and surface water diversions; and non-point pollution, including sedimentation resulting road cuts, including abandoned logging roads. Wildfires and non-native species, particularly plants, are also continuing or potential pervasive threats within the Big Sur Coast BPG. However, CAP Workbook Analysis of the Bixby Creek watershed produced only three threats (Table 11-2). The severity of these threats compared to similar threat levels in other BPGs in the SCCCS Recovery Planning Area is generally low (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

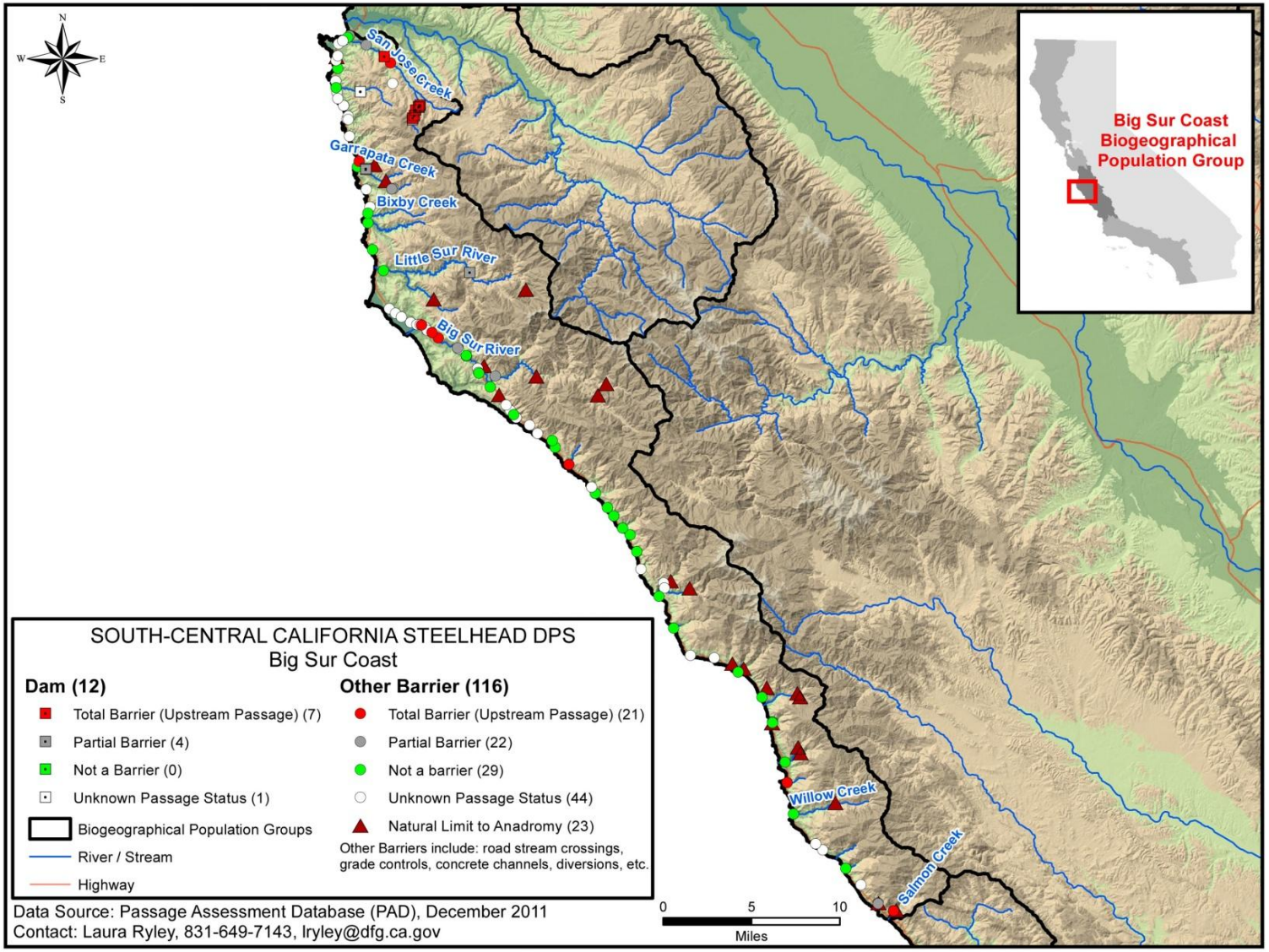

Figure 11-4. Major Fish Passage Barrier, Big Sur Coast BPG.

Table 11-2. Threat source rankings in the component watersheds of the Big Sur Coast BPG region (see CAP Workbook for details).

Big Sur Coast BPG Component Watershed (north to south)							
THREAT SOURCES	San Jose Creek	Garrapata Creek	Bixby Creek	Little Sur River*	Big Sur River	Willow Creek	Salmon Creek
Culverts and Road Crossings (Other Passage Barriers							
Roads							
Non-Point Pollution							
Groundwater Extraction							
Recreational Facilities							
Wildfires							
Dams and Surface Water Diversions							
Non-Native Species							

Key: Threat cell colors represent threat rating from CAP Workbook: Red = Very High threat; Yellow = High threat; Light green = Medium threat; Dark green = Low threat

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11.5 SUMMARY

The Big Sur Coast BPG contains some of the least altered watersheds within any of the four BPG regions in the SCCCS Recovery Planning Area. In particular, the Bixby Creek, Little Sur River, Big Sur River, Willow Creek, and Salmon Creek watersheds are some of the best preserved, though there are significant developments along the middle portions of the Little Sur and lower reaches of the Big Sur Rivers. With the exception of San Jose Creek and Garrapata Creek, the majority of threats in the watersheds in the Big Sur Coast BPG are rated as low. Only three medium-severity threat sources were identified for the relatively undeveloped Bixby Creek watersheds. However, these conditions could change in the future because some of these watersheds are largely under private ownership, are all traversed by Highway 1, and all support low to moderately intense livestock ranching operations. Additionally, natural wildfires remain a persist threat throughout the Big Sur Coast BPG.

Increased residential and recreational development within several of these watersheds, including higher road densities, could significantly alter natural fire regimes in the Big Sur Coast BPG by allowing greater human access to portions of these watersheds. Increased fire frequency can increase slope erosion and sediment input to streams, resulting in long-term changes to substrate composition, embeddedness, water quality (*e.g.,* turbidity), and water temperature (loss of riparian canopy cover).

Improving one or more of the moderate threats that adversely affect anadromous *O. mykiss* habitat in the Bixby Creek, Little Sur River, Big Sur River, Willow Creek, and Salmon Creek watershed (*e.g.,* road crossings and erosion control) could reduce or eliminate threats to anadromous *O. mykiss* habitats in these watersheds. Recovery actions to address the severe to very severe sedimentation impacts from existing and abandoned roads and fish-passage impediments in the San Jose Creek and Garrapata Creek watersheds will require multiple, long-term, measures related to water management and land-use practices, including agricultural and residential development and related road development. Additionally, the restoration of the San Jose estuary, which has largely been eliminated as a result of the construction of Highway 1, will require removal of fill and replacement of the existing culvert with a free-spanning road crossing. Table 11-3 summarizes the critical recovery actions needed within the Core 1 populations of this BPG.

The threat sources discussed in this chapter should be the focus of a variety of recovery actions to address specific stresses associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, *etc*., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions as part of any recovery strategy for the Big Sur Coast BPG. Tables 11-4 through 11-10 below rank and describe proposed recovery actions for each sub-watershed in the Big Sur Coast BPG including the estimated cost for implementing such actions in five year increments, and where applicable extended out to 100 years, though many of the recovery actions can and should be achieved within a shorter period (Hunt & Associates 2008a 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Table 11-3. Critical recovery actions for Core 1 populations within the Big Sur Coast BPG.

POPULATION	CRITICAL RECOVERY ACTIONS
San Jose Creek	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify sources of sediment and develop a comprehensive, watershed-wide sediment management plan. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
Little Sur River	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Manage roads to minimize sedimentation of spawning and rearing habitat.
Big Sur River	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, to provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean.

South-Central California Coast Steelhead DPS Recovery Action Tables Identification Key, Big Sur Coast BPG (Tables 11-4 to 11-10).

Recovery Action Number Key: XXXX – SCCCS – 1.2	
XXXX	Watershed
SCCCS	Species Identifier – South Central California Steelhead
1	Threat Source
2	Action Identity Number
Action Rank	
A	Action addresses the first listing factor regarding the destruction or curtailment of the species' habitat
B	Action addresses one of the other four listing factors

XXXX ID Table	
SJC	San Jose Creek
Gar	Garrapata Creek
Bix	Bixby Creek
LS	Little Sur River
BS	Big Sur River
WC	Willow Creek
SC	Salmon Creek

Threat Source Legend	
1	Agricultural Development
2	Agricultural Effluents
3	Culverts and Road Crossings (Passage Barriers)
4	Dams and Surface Water Diversions
5	Flood Control Maintenance
6	Groundwater Extraction
7	Levees and Channelization
8	Mining and Quarrying
9	Non-Native Species
10	Recreational Facilities
11	Roads
12	Upslope/Upstream Activities
13	Urban Development
14	Urban Effluents
15	Wildfires

See Chapter 8, Table 8-1 for Detailed Description of Recovery Actions. See Appendix E for discussion of recovery action cost estimates.

Table 11-4. South-Central California Steelhead DPS Recovery Action Table for the San Jose Creek Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
San Jose Creek												
SJC-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, CCON, MC, RCDMC, MPWMD, TWI, TBSLT, VWA	Agricultural Development	1,3, 4	2B	20	0	0	0	0	0	0
SJC-SCCCS-1.2	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM,NMFS, MC, RCDMC, MPWMD, CCCON, CDFG, TWI, TBSLT, VWA	Agricultural Effluents	1,3, 4	2B	100	0	0	0	0	0	0
SJC-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, MPWMD, TWI, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2B	5	96690	0	0	0	0	96690
SJC-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, MPWMD, TWI, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	0	0	0	0	0	0
SJC-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCCON, MPWMD, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
SJC-SCCCS-4.2	Provide fish passage around dams and diversions	NMFS, CDFG, CCCON, MPWMD, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
SJC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	MC, MCWRA, MPWMD, NMFS, USGS, CDFG, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SJC-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	MC, MCWRA, MPWMD, NMFS, USGS, CDFG, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
SJC-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, TWI, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
SJC-SCCCS-9.2	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, TWI, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
SJC-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, TWI, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
SJC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forest (*e.g.*, Santa Lucia Preserve Management Plan)	CDPR, CDFG,, NMFS, MC, CRA, MBNMS, MRPD, TWI, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
SJC-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG,, NMFS, MC, CRA, MBNMS, MRPD, TWI	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
SJC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, CD, TBSLT, VWA OT, MC, MCPWD, NMFS, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	1A	20	0	0	0	0	0	0
SJC-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, CDOT, MC, MCPWD, NMFS, CDPR, CDFG, AMBAG	Roads	1,4	1A	20	32260	32260	32260	32260	0	129040

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		TWI, TBSLT, VWA										
SJC-SCCCS-11.3	Develop and implement a plan to remove or reduce approach-fill for railroad lines and roads	USDOT, CDOT, MC, MCPWD, NMFS, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	1B	20	0	0	0	0	0	0
SJC-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USDOT, CDOT, MC, MCPWD, NMFS, CDPR, CDFG, AMBAG TW, TBSLT, VWA I	Upslope/Upstream Activities	1, 4, 5	1A	5	670000	0	0	0	0	670000
SJC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, COC, NMFS, CDFG, MCPWD,TWI, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
SJC-SCCCS-13.1	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	CCCOM, MC, NMFS, CDFG, AMBAG, MCPWD, TWI, TBSLT, VWA	Urban Development	1, 4, 5	2B	5	398000	0	0	0	0	398000
SJC-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, MCPWD, TWI, TBSLT, VWA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
SJC-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, MCPWD, TWI, TBSLT, VWA	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
SJC-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, MC, NMFS, CDFG,	Wildfires	1, 4, 5	2B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		MPWMD, MRPD, TBSLT, VWA										

Table 11-5. South-Central California Steelhead DPS Recovery Action Table for the Garrapata Creek Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Garrapata Creek												
Gar-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment (or periodically update)	NMFS, CDFG, CCCON, MC, TWI, GCWC, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	96690	0	0	0	0	96690
Gar-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed (*e.g.,* Garrapata Creek Watershed Barrier Assessment, 2005)	NMFS, CDFG, CCCON, MC, TWI, GCWC, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	0	0	0	0	0	0
Gar-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG, CCON. MC, GCWC, TBSLT, VWA	Dams and Surface Water Diversions	1, 3 4	1A	5	0	0	0	0	0	0
Gar-SCCCS-4.2	Provide fish passage around any future dams and diversions	NMFS, USFS, CDFG, CCON. MC, GCWC, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
Gar-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USGS, CDFG, CCON, MC, GCWC, TBSLT, VWA	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
Gar-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USGS, CDFG, CCON. MC, GCWC	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
Gar-SCCCS-9.1	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, GCWC, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
Gar-SCCCS-9.2	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, GCWC, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Gar-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, GCWC, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
Gar-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan)	CDPR, CDFG, WCB, NMFS, USFS,USFWS, MC, GCWC, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
Gar-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, WCB, NMFS, USFS, USFWS, MC, GCWC, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
Gar-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDOT, MC, CDPR, CDFG, AMBAG TWI, GCWC, TBSLT, VWA	Roads	1,4	2B	20	0	0	0	0	0	0
Gar-SCCCS-12.1	Develop and implement an estuary restoration and management plan (or periodically update; *e.g.,* Garrapata Creek Lagoon, Central Coast, California: A Preliminary Assessment, 2006)	USDOT, CDOT, MC, NMFS, CDPR, CDFG, AMBAG TWI, GCWC	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	100		0	0	0	0	0
Gar-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, NMFS, CDFG,TWI, GCWC, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
Gar-SCCCS-14.1	Review California Regional Water Quality Control Boards Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, GCWC, TBSLT, VWA	Urban Effluents	1, 4, 5	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Gar-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, MC, NMFS, CDFG, GCWC, TBSLT, VWA	Wildfires	1, 4, 5	1B	100	0	0	0	0	0	0

Table 11-6. South-Central California Steelhead DPS Recovery Action Table for the Bixby Creek Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Bixby Creek												
Bix-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON , MC, TWI, CCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2A	5	96690	0	0	0	0	96690
Bix-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers within the watershed	NMFS, USF,CDFG, CCCON, MC,TWI, CCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2A	5	0	0	0	0	0	0
Bix-SCCCS-4.2	Provide fish passage around dams and diversions	NMFS, USF,CDFG, CCCON, MC, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1.3. 4	1A	5	0	0	0	0	0	0
Bix-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USGS, CDFG, CCON, MC, TWI,	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
Bix-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USGS, CDFG, CCON CCORP, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
Bix-SCCCS-9.1	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
Bix-SCCCS-9.2	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
Bix-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
Bix-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land	CDPR, CDFG, WCB, NMFS, USFS, USFWS, MC, TWI, CCORP, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	Management Plan)											
Bix-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, WCB, NMFS, USFS, USFWS, MC, TWI, CCORP	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
Bix-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDOT, MC, CDPR, CDFG, AMBAG TWI, CCORP, TBSLT, VWA	Roads	1,4	2A	20	0	0	0	0	0	0
Bix-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, NMFS, CDFG CCORP,TWI	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
Bix-SCCCS-14.2	Review California Regional Water Quality Control Boards Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, TBSLT, VWA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
Bix-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, MC, NMFS, CDFG, TBSLT, VWA	Wildfires	1, 4, 5	1B	100	0	0	0	0	0	0

Table 11-7. South-Central California Steelhead DPS Recovery Action Table for the Little Sur River Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-26	FY 1-100
Little Sur River												
LS-SCCCS-1.1	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, CCON, MC, RCDMC, TWI, TBSLT, VWA	Agricultural Development	1, 4	2B	5	47520	0	0	0	0	47520
LS-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, MC, TWI, CCCORP , TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	96690	0	0	0	0	96690
LS-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, MC, TWI, CCCORP , TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	0	0	0	0	0	0
LS-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS,CDFG, CCCON, MC, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	2A	5	91850	0	0	0	0	91850
LS-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, USFS,CDFG, CCCON, MC, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
LS-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, USFS,CDFG, CCCORP, TBSLT, VWA CCCON, MC, TWI	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
LS-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USGS, CDFG, CCCON, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-26	FY 1-100
LS-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USGS, CDFG, CCCON, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
LS-SCCCS-9.1	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
LS-SCCCS-9.2	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
LS-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
LS-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan)	CDPR, CDFG, WCB, NMFS, USFW, MC, TW CCCORP, TWI, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
LS-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, WCB, NMFS, USFS,USFWS, USFWS, MC, TWI, CCCORP,	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-26	FY 1-100
		TBSLT, VWA										
LS-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	3B	20	0	0	0	0	0	0
LA-SCCCS 11.2	Retrofit storm drains to filter runoff from roadways (*e.g.,* Old Coast Highway)	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1, 4	1B	20	0	00	0	0	0	0
LS-SCCCS-12.1	Develop and implement an estuary restoration and management plan (or periodically update)	USDOT, CDOT, MC, NMFS, USFS, CDFG, AMBAG TWI, CCCORP, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	0	0	0	0	0	0
LS-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, NMFS, CDFG CCCORP, TWI, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	62400	0	0	0	0	62400
LS-SCCCS-13.1	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	CCCON, MC, NMFS, CDFG, AMBAG, TWI. CCCORP	Urban Development	1, 4, 5	2B	5	398000	0	0	0	0	398000
LS-SCCCS-14.1	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, TBSLT, VWA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
LS-SCCCS-14.2	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, TBSLT, VWA	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
LS-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, MC, NMFS, CDFG,	Wildfires	1, 4, 5	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-26	FY 1-100
		TBSLT, VWA										

Table 11-8. South-Central California Steelhead DPS Recovery Action Table for the Big Sur River Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Big Sur River												
BS-SCCCS-1.1	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, CCON, MC, RCDMC, TWI, TBSLT, VWA	Agricultural Development	1,3, 4	3B	5	47520	0	0	0	0	47520
BS-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	CDOT, NMFS, CDFG, CCCON, MC, TWI, CCCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2A	5	96690	0	0	0	0	96690
BS-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	CDOT, NMFS, CDFG, CCCON, MC, TWI, CCCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2A	5	0	0	0	0	0	0
BS-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS,CDFG, CCCON, MC, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
BS-SCCCS-4.2	Provide fish passage around dams and diversions	NMFS, USFS,CDFG, CCCON, MC, TWI, TBSLT, VWA	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
BS-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USGS, CDFG, CCCON, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
BS-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USGS, CDFG, CCCON, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
BS-SCCCS-9.1	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
BS-SCCCS-9.2	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
BS-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
BS-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* Pfeiffer Big Sur and Andrew Molera State Park General Plan, U.S. Forest Service Los Padres National Forest Land Management Plan)	CDPR, CDFG, CCCON, WCB, NMFS, USFS, USFWS, MC, TWI, CCCORP, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
BS-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, CCCON, WCB, NMFS, USFS, USFWS, MC, TWI, CCCORP	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
BS-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	2B	20	0	0	0	0	0	0
BS-SCCCS-11.2	Develop and implement plan to remove or reduce approach-fill road and roads	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	3B	20	0	0	0	0	0	0
BS-SCCCS-12.1	Develop and implement an estuary restoration and management plan	CDOT, MC, NMFS, USFS, CDFG, AMBAG TWI, CCCORP, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	1340000	0	0	0	0	1340000
BS-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, NMFS, USFS, CDFG, CCCORP, TWI, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
BS-SCCCS-14.1	Review, assess and modify residential and commercial wastewater septic treatment facilities	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TW, TBSLT, VWA I	Urban Effluents	1, 4, 5	2B	100	0	0	0	0	0	0
BS-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, TBSLT, VWA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
BS-SCCCS-14.3	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, TBSLT, VWA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
BS-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, MC, NMFS, CDFG, TBSLT, VWA	Wildfires	1, 4, 5	1B	100	0	0	0	0	0	0

Table 11-9. South-Central California Steelhead DPS Recovery Action Table for the Willow Creek Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Willow Creek												
WC-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	CDOT, NMFS, CDFG, CCCON, MC, TWI, CCCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2A	5	96690	0	0	0	0	96690
WC-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	CDOT, NMFS, CDFG, CCCON, MC, TWI, CCCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	2A	5	0	0	0	0	0	0
WC-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS,CDFG, CCCON, MC, TWI, TBSLT, VWA	Dams and Surface Water Diversions			5	91850	0	0	0	0	91850
WC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USGS, CDFG, CCCON, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
WC-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USGS, CDFG, CCCON, MC, TWI, TBSLT, VWA	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
WC-SCCCS-9.1	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, M, TBSLT, VWA C, TWI, CCCORP	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
WC-SCCCS-9.2	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI, CCCORP, TBSLT, VWA	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
WC-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CNPS, CDPR, MC, TWI,	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CCCORP, TBSLT, VWA										
WC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan)	CDPR, CDFG, CCCON, WCB, NMFS, USFS, USFWS, MC, TWI, CCCORP, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
WC-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, CCCON, WCB, NMFS, USFW, MC, TWI, CCCORP, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
WC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	2B	20	0	0	0	0	0	0
WC-SCCCS-11.2	Develop and implement a plan to remove or reduce approach-fill for railroad lines and roads	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	3B	20	0	0	0	0	0	0
WC-SCCCS-12.1	Develop and implement an estuary restoration and management plan	CDOT, MC, CDPR, CDFG, AMBAG TWI	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	335000	0	0	0	0	335000
WC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, NMFS, USFS, CDFG, CCCORP, TWI, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
WC-SCCCS-14.2	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
WC-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, MC, NMFS, CDFG, TBSLT, VWA	Wildfires	1, 4, 5	1B	100	0	0	0	0	0	0

Table 11-10. South-Central California Steelhead DPS Recovery Action Table for the Salmon Creek Watershed (Big Sur Coast BPG).

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Salmon Creek												
SC-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	CDOT, NMFS, CDFG, CCCON, MC, TWI, CCCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	96690	0	0	0	0	96690
SC-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	CDOT, NMFS, CDFG, CCCON, MC, TWI, CCCORP, TBSLT, VWA	Culverts and Road Crossings (Passage Barriers)	1, 3, 4	1A	5	0	0	0	0	0	0
SC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan)	CDPR, CDFG, CCCON, WCB, NMFS, USFS,USFWS, MC, TWI, CCCORP, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
SC-SCCCS-10.2	Develop and implement a public educational program on watershed processes	CDPR, CDFG, CCCON, WCB, NMFS, UFS, USFWS, MC, TWI, CCCORP, TBSLT, VWA	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
SC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1,4	2B	20	0	0	0	0	0	0
SC-SCCCS-11.2	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	CDOT, MC, CDPR, CDFG, AMBAG TWI, TBSLT, VWA	Roads	1, 4	2B	20	0	0	0	0	0	0
SC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, MC, NMFS, USFS, CDFG, CCCORP, TWI, TBSLT, VWA	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
SC-SCCCS-14.2	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCD, SWRCB, MC, NMFS, CDFG, AMBAG, TWI, TBSLT, VWA	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Potential Collaborators	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SC-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP, USFS, USFWS, MC, NMFS, CDFG, TBSLT, VWA	Wildfires	1, 4, 5	1B	100	0	0	0	0	0	0

12. San Luis Obispo Terrace Biogeographic Population Group

"Assessment at the group level indicates a priority for securing inland populations in southern Coast Ranges and Transverse Ranges, and a need to maintain not just the fluvial-anadromous life-history form, but also lagoon-anadromous and freshwater-resident forms in each population."

NOAA Fisheries Technical Recovery Team
Viability Criteria for South-Central and Southern California Steelhead, 2007

12.1 LOCATION AND PHYSICAL CHARACTERISTICS

The San Luis Obispo Terrace BPG region extends north-to-south about 75 miles to include the extreme southwest corner of Monterey County and almost the entire length of coastal San Luis Obispo County. It consists of eleven small to moderate-sized watersheds that drain the steep coastal slopes of the southern Santa Lucia Range. This BPG region is similar to the Big Sur Coast BPG region in terms of its upper watersheds, but because the spine of the Santa Lucia Range veers inland to the south, the lower portions of the watersheds in the San Luis Obispo Terrace BPG region are relatively flat and cut across coastal terraces before entering the Pacific Ocean.

From north to south, 12 watersheds are included in this BPG: San Carpoforo Creek, Arroyo de la Cruz, Little Pico Creek, Big Pico Creek, San Simeon Creek, Santa Rosa Creek, Morro Creek, Chorro Creek (Morro Bay), Los Osos Creek (Morro Bay), San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek. (Figure 12-1). The Morro Bay region includes the separate watersheds of Morro Creek, which empties into the Pacific Ocean north of Morro Bay, and Chorro and Los Osos creeks, which (along with several smaller drainages) flow into Morro Bay forming an extensive estuarine wetland. Separate CAP Workbooks were prepared for Morro, Chorro, and Los Osos creeks (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

San Carpoforo Creek Estuary

Watersheds in the San Luis Obispo BPG vary in size by over an order of magnitude, from less than 5,300 acres in the Little Pico Creek watershed to almost 100,000 acres in the Arroyo Grande Creek watershed. Average annual precipitation shows some spatial variation across the component watersheds and total seasonal rainfall in this region is highly variable from year to year, depending on the intensity and duration of Pacific storms.

In general, the higher elevations receive greater amounts of precipitation, and persistent spring and summer coastal fog is characteristic of this region. All of the watercourses in this BPG are perennial (though some reaches may be seasonally reduced to isolated pools, particularly during low rainfall years).

Arroyo Grande Creek

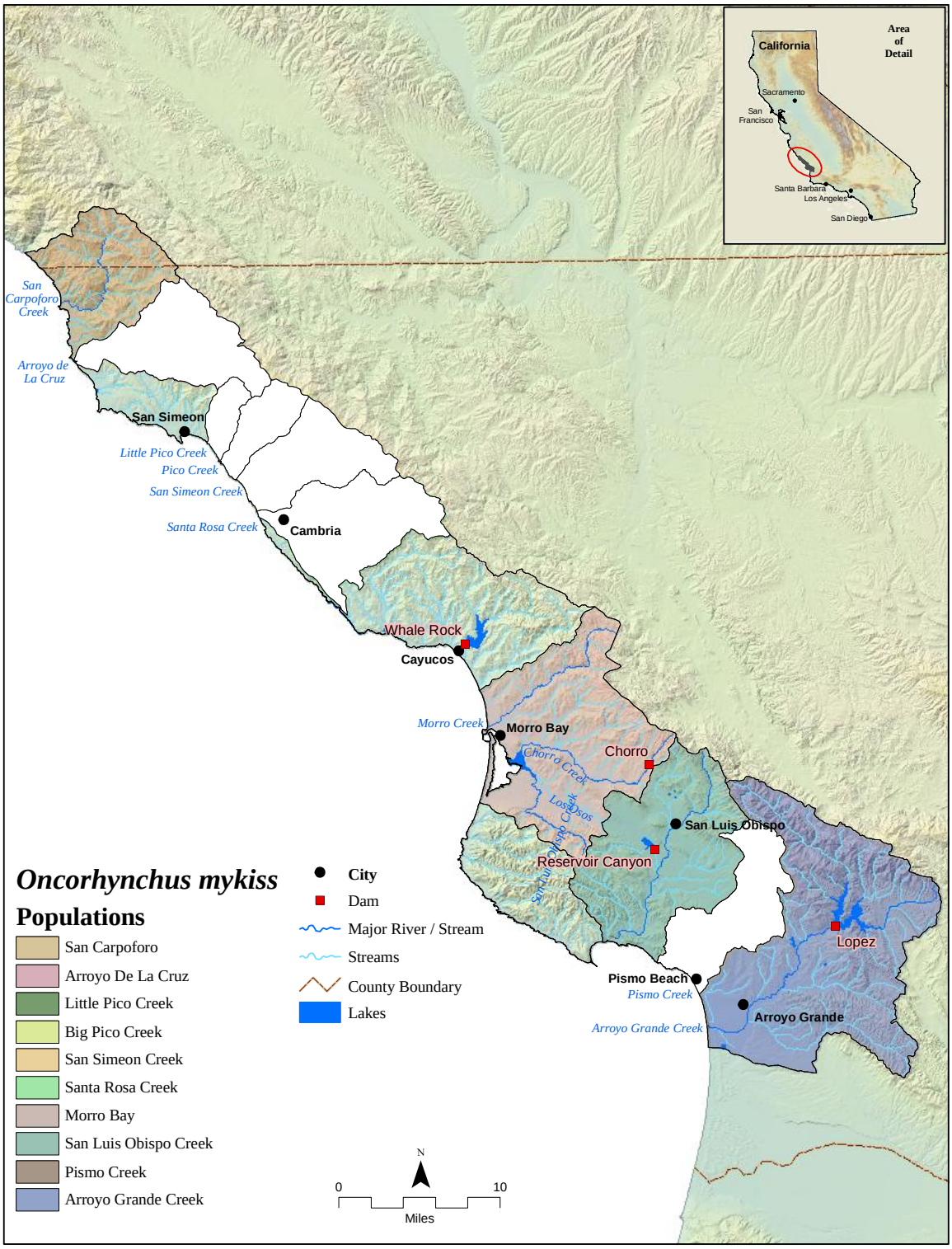
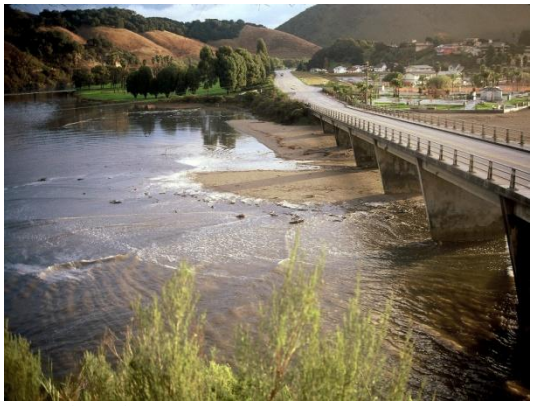


Figure 12-1. The San Luis Obispo Terrace BPG region. Twelve steelhead populations/watersheds were analyzed in this region, including three in the Morro Bay region.

12.2 LAND USE

Table 12-1 summarizes land use and population density in this BPG region. Despite a relatively low total human population density, the San Luis Obispo Terrace BPG region has over 2.5 times the population density of any BPG region in the SCCCS Recovery Planning Area, averaging about 248 persons per square mile.



San Luis Obispo Creek Estuary

Population density increases dramatically south of the San Simeon Creek watershed such that over 99 percent of the total population in the San Luis Obispo Terrace BPG is concentrated in the seven southern watersheds: Santa Rosa Creek, Morro Creek, Chorro Creek (Morro Bay), Los Osos Creek (Morro Bay), San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek. The San Carpoforo Creek, Arroyo de la Cruz, Little Pico Creek, Big Pico Creek, and San Simeon Creek watersheds are largely undeveloped (although there are ranching and agricultural activities in several of these watersheds), or have very low population densities. The Los Padres National Forest encompasses a federally designated wilderness area: the Santa Lucia Wilderness Area within the San Luis Obispo Creek and Arroyo Grande Creek watersheds (Hunt & Associates 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Stephenson and Calcarone 1999, California Department of Water Resources 1978).

The strong increasing gradient in population density towards the southern portions of this BPG region is reflected in land-use changes, such as increasing agricultural conversion of watershed lands, increasing urbanization (including small cities, such as Morro Bay, San Luis Obispo, Grover Beach, Pismo Beach, Shell Beach, and Arroyo Grande), increasing private ownership of land, and correspondingly lower amounts of open space (Table 12-1). The coastal terraces of the southern watersheds receive high recreational and urban use. There are a number of dams in this region: Whale Rock Dam on Old Creek, Chorro Dam on Chorro Creek a privately-owned dam on West Corral de Piedra, tributary of Pismo Creek, Lopez Dam on Arroyo Creek, and Terminal Dam on a tributary of Arroyo Grande Creek. The reservoirs created by these dams are used for municipal water supply, agricultural irrigation, and recreation (California Department of Fish and Game 2011b, California Department of Water Resources 1988).

Lopez Dam – Arroyo Grande Creek

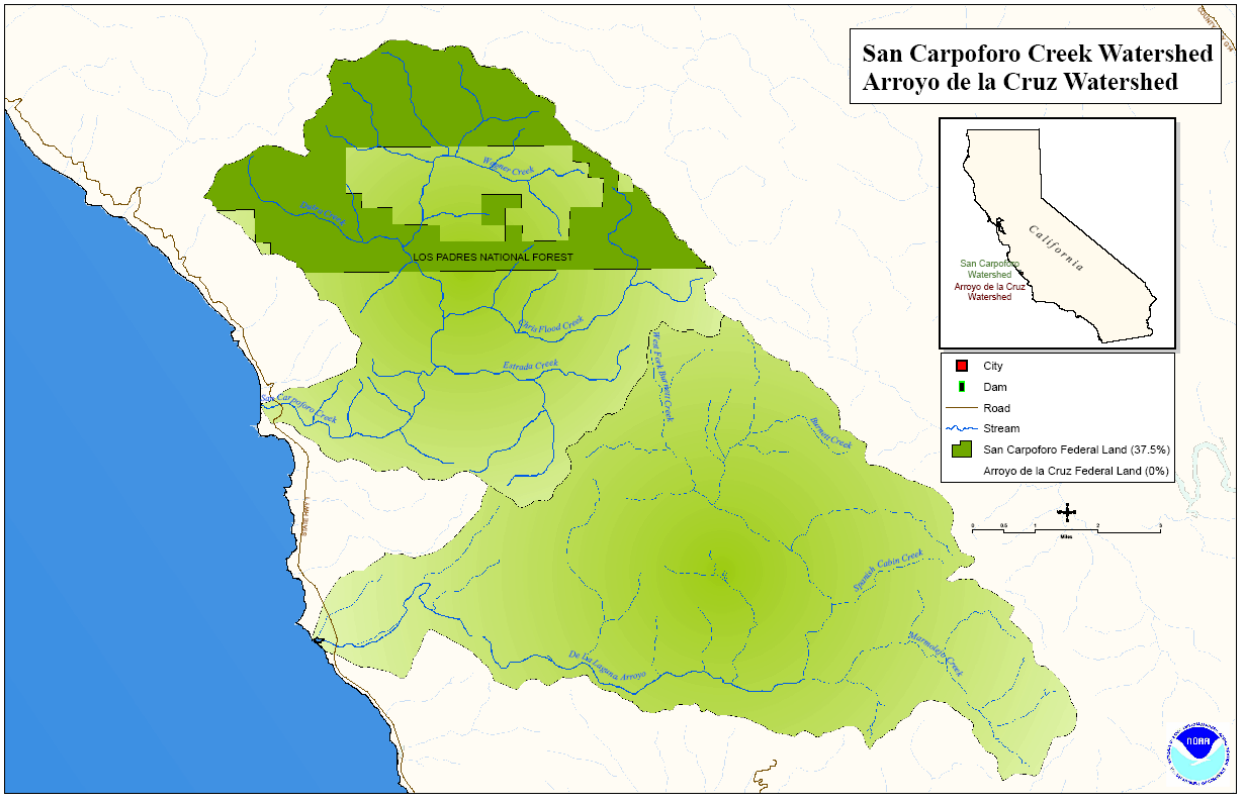


Figure 12-2. Federal and Non-Federal Land Ownership within the San Carpoforo Creek and Arroyo de la Cruz Watersheds.

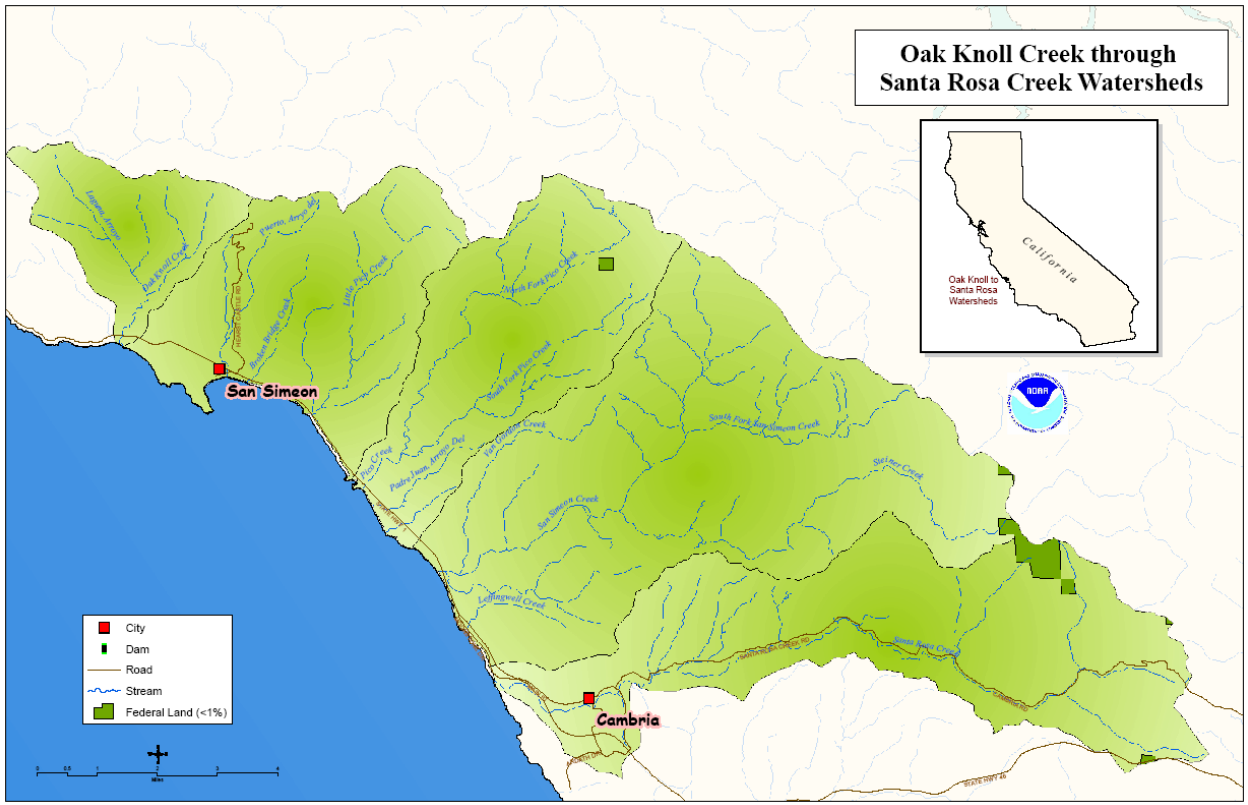


Figure 12-3. Federal and Non-Federal Land Ownership within the Oak Knoll Creek through the Santa Rosa Creek Watersheds.

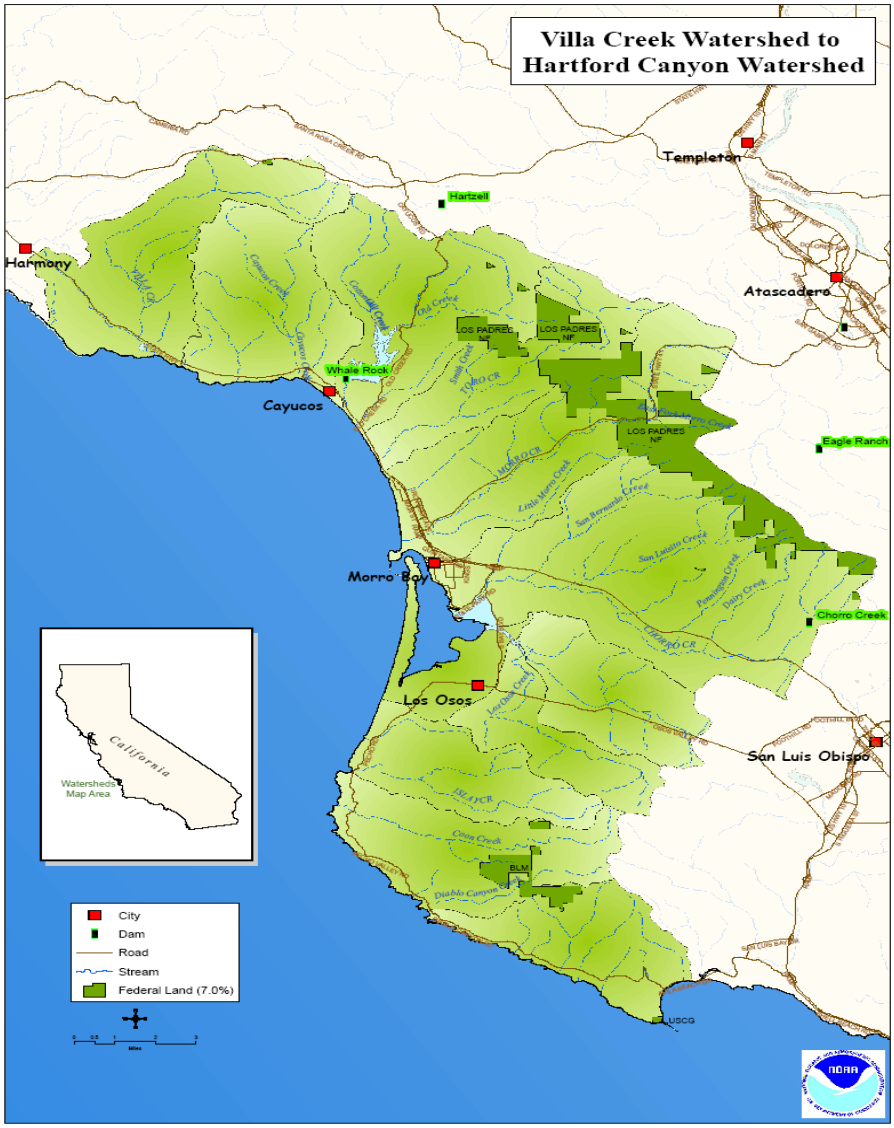


Figure 12-4. Federal and Non-Federal Land Ownership within the Villa Creek through the Hartford Canyon Watersheds.

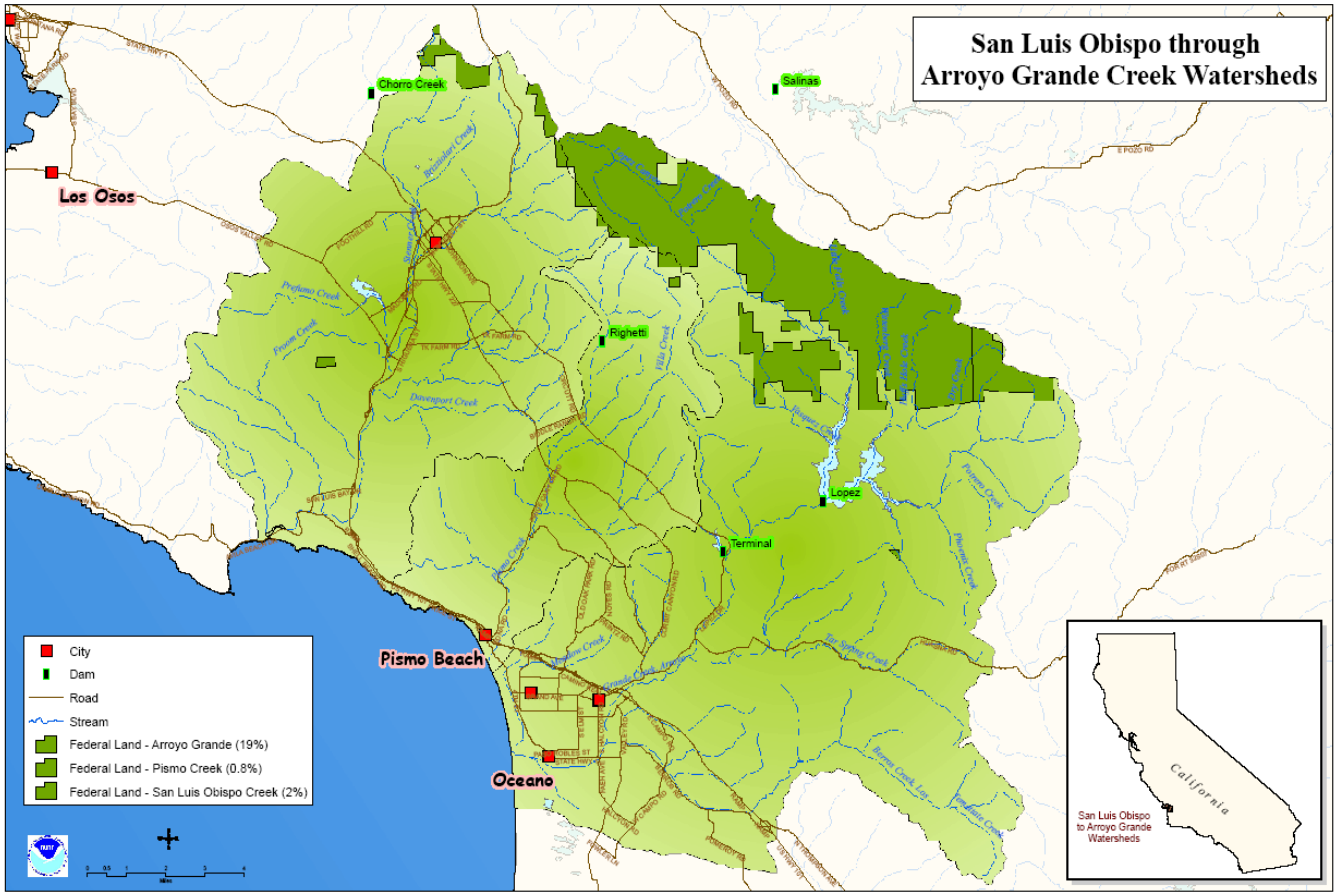


Figure 12-5. Federal and Non-Federal Land Ownership within the San Luis Obispo through the Arroyo Grande Creek Watersheds

12.3 CURRENT WATERSHED CONDITIONS

Watershed conditions were assessed for 12 watersheds and sub-watersheds in the San Luis Obispo Terrace BPG region. The CAP Workbook analyses rated overall habitat conditions for steelhead as "Very Good" or "Good" in the northernmost watersheds, and "Fair" in the watersheds in the central and southern portions of this BPG region.

Arroyo de la Cruz Creek

There is a dramatic shift in the habitat quality in watersheds south of Pico Creek, reflecting increasing land-use changes associated with higher human population densities.

Arroyo de la Cruz Estuary

Although mostly or entirely privately owned, the northernmost watersheds in this BPG: San Carpoforo Creek, Arroyo de la Cruz, Little Pico Creek, and Pico Creek are relatively unaltered (Watson *et al.* 2008, California Conservation Corps 2005, Wurster *et al.* 2002, Stephenson and Calcarone 1999, Nelson 1994, California Department of Water Resources 1978, Knable 1978).

Table 12-1. Physical and Land Use Characteristics of Watersheds in the San Luis Obispo Terrace BPG region.

PHYSICAL CHARACTERISTICS						**LAND USE**			
WATERSHEDS (north to south)	**Area** (acres)[1]	**Area** (sq.miles)[1]	**Stream Length**[2] (miles)	**Ave. Ann. Rainfall**[3] (inches)	**Total Human Population**	**Public Ownership***	**Urban Area**[5]	**Agriculture/ Barren**[5]	**Open Space**[5]
San Carpoforo Creek	29,316	46	64	19.7	74	30%	0.1%	0.1%	> 99%
Arroyo de la Cruz	27,774	43	65	19.4	3	0.1%	0.2%	0.2%	> 99%
Little Pico Creek	5,229	8	13	18.1	1	0%	0%	0.2%	> 99%
Big Pico Creek	9,687	15	29	18.1	477	0.3%	1%	< 0.1%	99%
San Simeon Creek	22,247	35	57	17.8	450	0.1%	1%	1%	98%
Santa Rosa Creek	31,484	49	81	17.2	4,459	1%	5%	3%	92%
Morro Bay (*)	65,993	103	127	18.8	32,843	17%	10%	6%	84%
San Luis Obispo Creek	55,554	87	98	18.9	57,762	2%	16%	6%	78%
Pismo Creek	25,355	40	49	18.4	5,408	0.1%	6%	9%	85%
Arroyo Grande Creek	97,873	153	175	18.0	48,421	20%	7%	9%	84%
TOTAL or AVERAGE	**370,512**	**579**	**758**	**18.4**	**149,906**	**7%**	**5%**	**3%**	**92%**

[1] From: CDFFP CalWater 2.2 Watershed delineation, 1999 (www.ca.nrcs.usda.gov/features/calwater/)
[2] From: CDFG 1:1,000,000 Routed stream network, 2003 (www.calfish.org/)
[3] From: USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
[4] From: CDFFP Census 2010 block data (migrated), CalFire FRAP (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)
[5] From: CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells) (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)
** National Forest Lands only; Military Reservations or State and County Parks not included.*

12.4 THREATS AND THREAT SOURCES

Information identified in the CAP Workbooks on 30 habitat and land-use indicators for the San Luis Obispo Terrace BPG was supplemented by additional information developed since the preparation of the CAP Workbooks and incorporated into the threat assessment. All or most of the "threats" identified in the four northern watersheds (San Carpoforo, Arroyo de la Cruz, Little Pico, and Pico creeks) are rated as low severity. In fact, near-natural conditions identified in these northern watersheds reflect prevailing low-intensity land use. Pico Creek has a single threat rated as "high" – extensive reaches of the mainstem and North Fork frequently go dry in summer posing fish-passage impediments to juveniles and smolts. This condition is natural, but can be exacerbated by groundwater extraction and surface water diversions (Hunt & Associates 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b; see also, Nelson 1994).

Pico Creek Estuary

Although the San Simeon Creek watershed has a relatively low human population density (about 19 persons/square mile) and less than two percent of the watershed has been converted to row crop agriculture, most of this agricultural conversion has occurred within the narrow floodplain of San Simeon Creek, thereby concentrating land-use impacts in this area. The stream and riparian corridor are subject to a number of severe to very severe threats related to land use: groundwater extraction, severe stream incision (caused by confinement of the active channel due to encroachment of agriculture on the floodplain), cattle grazing within the active channel, and the presence of ranch houses and the main road through the watershed. Wastewater treatment facilities near the San Simeon Creek estuary and a proposed desalination plant have the potential to adversely affect the lower stream reaches and estuary through direct or indirect discharges of effluents. Development of recreational facilities (San Simeon State Park) at the mouth of the creek and the placement of the Highway 1 bridge abutments has eliminated 50 percent of the estuary. A recent potential threat to estuarine habitat is the development of desalinization facilities that withdraw water from groundwater sources that contribute to and maintain estuarine water levels, particularly during the summer when the sandbar closes the estuary off to the ocean D.W. Alley & Associates 2008, 2007, 2006a, 2006b, 2001, Nelson *et al*. 2005b).

San Simeon Creek

Fourteen anthropogenic activities ranked as the top five sources of threats to anadromous *O. mykiss* viability in this BPG region (Table 12-2). These sources are not mutually exclusive and can be grouped into a few general threat categories related to the land use. Although open space is by far the dominant land use within all of the watersheds in this BPG region, with less than 10 percent of any watershed converted to agricultural production, watersheds south of San Simeon Creek share a common pattern of urban and agricultural development that largely determines the degree habitat degradation in these drainages. These watersheds are primarily under private ownership, with land-use activities concentrated along the narrow, coastal terrace floodplains, which magnifies impacts to instream and riparian habitats in these locations. Recurring sources of threats to instream and riparian habitats here include: agricultural conversion of the floodplain, increased road density and placement of roads in or near the riparian corridor, and the development of towns and cities on the floodplains, frequently at or near the estuary. Other important sources of threats to anadromous *O. mykiss* in this BPG region include: sedimentation, substrate embeddedness, excessive groundwater extraction, numerous culverts and road crossings that serve as passage barriers, recreational facilities, non-point pollution as well as nutrient and coliform bacteria loading from agricultural and wastewater treatment effluents, and channelization).

Santa Rosa Creek

Dams and surface water diversions on Morro Creek, Chorro Creek, San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek that serve agricultural, urban, and recreational purposes have significantly altered natural sediment and hydrological processes in these watersheds. Dams have also isolated native non-anadromous *O. mykiss* in the upper watersheds of these drainages; some of which may have the potential to exhibit an anadromous life-history (Boughton 2006). The reservoirs behind these dams create favorable habitat conditions for several species of non-native fishes and bullfrogs that may affect one or more life-history stages of *O. mykiss* either directly (*e.g.,* predation) or indirectly (*e.g.,* competition for food). Non-native fishes, crayfish, and/or amphibians also occur in the mainstems of the many watersheds in this BPG region (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b; see also, Stillwater Sciences 2012, Central Coast Salmon Enhancement 2009, 2005, D. W. Alley & Associates 2008, 2007, 2006b, 2006a, 2001, 1996, 1997, Rischbieter 2008, 2007, 2006, 2004, The Land Conservancy of San Luis Obispo County 2008, Swanson Hydrology & Geomorphology 2006a, 2006b, 2004, Tri-County Fish Team 2006, California Conservation Corps 2005, Nelson *et al*. 2005a, 2005b, Close and Smith 2004, Thomas

R. Payne and Associates 2004, 2001, 2000, Dvorsky 2003, Ross Taylor and Associates 2003, Spina 2003, Stark and Wilkison 2002, Otte and McEwan 2001, Cleveland 1995).

Little Pico Creek

The Pico Creek, San Simeon Creek, Santa Rosa Creek, Morro Creek, San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek estuaries have lost between 50 percent and 80 percent of their former size as a result of development of recreational facilities (*e.g.*, State and County parks), Highway 1 bridge construction, and/or agricultural or urban development.

Pismo Creek Estuary

Fires have been relatively minor source of disturbance in the northern watersheds of this BPG region where less than 4 percent of watershed lands have burned in the past 25 years; however, between 18 percent and 44 percent of the Morro Creek, Chorro Creek, Los Osos Creek, San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek watersheds to the south have burned over this period. Sedimentation and increased substrate embeddedness resulting from overgrazing and agricultural developments are significant habitat stressors in these watersheds. Increased road density and human population density in these fire-prone watersheds has served to increase fire frequency.

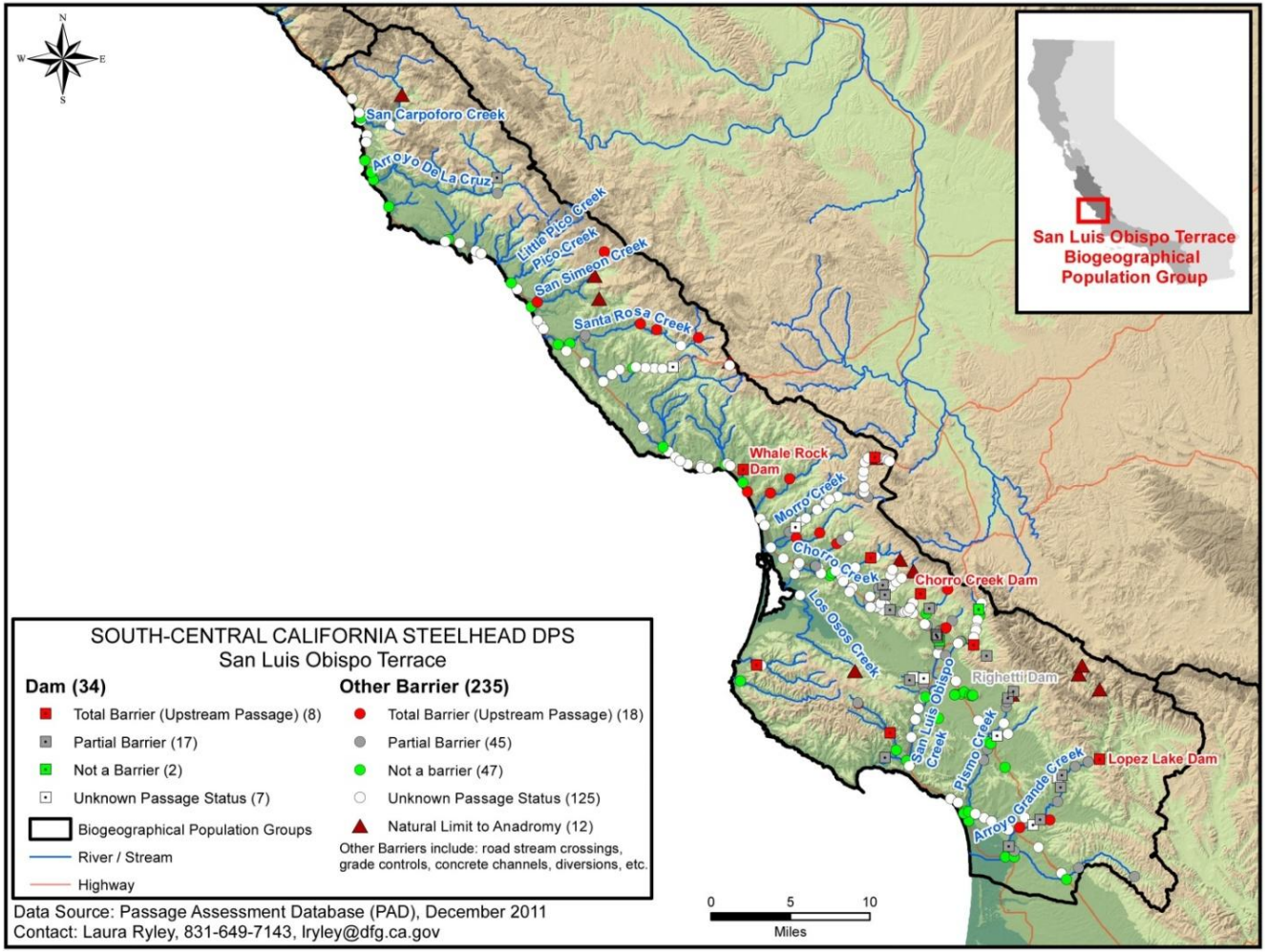


Figure 12-7. Major Fish Passage Barriers, San Luis Obispo Terrace BPG.

Table 12-2. Threat source rankings in the San Luis Obispo Terrace BPG (see CAP Workbooks for individual watersheds for details).

THREAT SOURCES	**San Luis Obispo BPG Component Watersheds** (north to south)											
	San Carpoforo Creek*	Arroyo de la Cruz*	Little Pico Creek*	Pico Creek	San Simeon Creek	Santa Rosa Creek	Morro Creek	Chorro Creek	Los Osos Creek	San Luis Obispo Creek	Pismo Creek	Arroyo Grande Creek
Agricultural Development												
Groundwater Extraction												
Dams and Surface Water Diversions												
Levees and Channelization												
Culverts and Road Crossings (Other Passage Barriers)												
Urban Development												
Roads												
Recreational Facilities												
Urban Effluents												
Agricultural Effluents												

Key: Threat cell colors represent threat rating from CAP Workbook: Red = Very High threat; Light green = Medium threat; Yellow = High threat; Dark green = Low threat.

12.5 SUMMARY

The watersheds in the San Luis Obispo Terrace BPG exhibit the widest range of habitats conditions for steelhead in the SCCCS Recovery Planning Area. The San Carpoforo Creek, Arroyo de la Cruz Creek, Little Pico Creek, and Pico Creek watersheds contain the best preserved and protected streams in the region. Although threats to these streams are currently low relative to other watersheds within the SCCCS Recovery Planning Area, though there are significant issues regarding water extractions from these watersheds to support existing recreational development and agricultural operations. Additionally, conditions could change in the future because much land in this BPG region is under private ownership and subject to additional development that could further increase water extraction from these watersheds; all watersheds are traversed by Highway 1, and all support low to moderately intense livestock ranching operations. San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek exhibit the highest number and severity of threat sources within this BPG region.

As a result of the substantial increase in human population density and related development pressures in the southern portion of this BPG region, recovery actions should be focused on the watersheds south of the community of San Simeon (although efforts to ensure continued protection of the more northern watersheds are also important). Recovery actions in these watersheds should concentrate on: reducing the severity of anthropogenic impacts from water diversions, groundwater extractions, and related agricultural and urban development that adversely impact rearing habitat; minimizing erosion and sedimentation caused by upslope development and land uses (including roads, overgrazing, and agricultural and urban development); removing impediments to fish passage along the mainstems and tributaries of affected drainages to facilitate connectivity between the ocean, estuaries and the upstream spawning and rearing habitats; and restoring channel morphology and riparian habitats affected by urban and agricultural floodplain encroachment and related flood control activities. Additionally, degraded estuarine conditions stemming from filling, artificial sandbar manipulation, and both point and non-point waste discharges should be further evaluated and addressed for the San Luis Obispo Terrace BPG. Table 12-3 summarizes the critical recovery actions needed within the Core 1 populations of this BPG. The threat sources discussed in this chapter should be the focus of a variety of recovery actions to address specific stresses associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, *etc*., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions as part of any recovery strategy for the San Luis Obispo Terrace BPG. Tables 12-4 through 12-10 below rank and describe proposed recovery actions for each sub-watershed in the San Luis Obispo Terrace BPG including the estimated cost for implementing such actions in five year increments, and where applicable extended out to 100 years, though many of the recovery actions can and should be achieved within a shorter period (Hunt & Associates 2008a 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Table 12-3. Critical recovery actions for Core 1 populations within the Big Sur Coast BPG.

POPULATION	CRITICAL RECOVERY ACTIONS
San Simeon Creek	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Manage instream mining to minimize impacts to migration, spawning and rearing habitat. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
Santa Rosa Creek	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
San Luis Obispo Creek	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
Pismo Creek	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.
Arroyo Grande Creek	Implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage barriers to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.

South Central California Steelhead DPS Recovery Action Tables Identification Key, San Luis Obispo Terrace BPG (Tables 12-4 to 12-14).

Recovery Action Number Key: XXXX – SCCCS – 1.2	
XXXX	Watershed
SCCCS	Species Identifier – South Central California Steelhead
1	Threat Source
2	Action Identity Number
Action Rank	
A	Action addresses the first listing factor regarding the destruction or curtailment of the species' habitat
B	Action addresses one of the other four listing factors

XXXX ID Table	
SCp	San Carpoforo
AC	Arroyo de la Cruz
LP	Little Pico Creek
PC	Pico Creek
SS	San Simeon Creek
SR	Santa Rosa Creek
MC	Morro Creek
CC	Chorro Creek
LO	Los Osos Creek
SLO	San Luis Obispo Creek
Pis	Pismo Creek
AG	Arroyo Grande Creek

Threat Source Legend	
1	Agricultural Development
2	Agricultural Effluents
3	Culverts and Road Crossings (Passage Barriers)
4	Dams and Surface Water Diversions
5	Flood Control Maintenance
6	Groundwater Extraction
7	Levees and Channelization
8	Mining and Quarrying
9	Non-Native Species
10	Recreational Facilities
11	Roads
12	Upslope/Upstream Activities
13	Urban Development
14	Urban Effluents
15	Wildfires

See Chapter 8, Table 8-1 for Detailed Description of Recovery Actions. See Appendix E for discussion of recovery action cost estimates.

Table 12-4. South-Central California Steelhead DPS Recovery Action Table for the San Carpoforo Creek Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
San Carpoforo Creek												
ScP-SCCCS-1.1	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	2B	5	47520	0	0	0	0	47520
ScP-SCCCS-1.2	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	2B	5	0	0	0	0	0	0
ScP-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Effluents	1, 4	3B	100	0	0	0	0	0	0
ScP-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Dams and Surface Water Diversions	1, 3, 4	3A	5	91850	0	0	0	0	91850
ScP-SCCCS-4.2	Provide fish passage around dams and diversions	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Dams and Surface Water Diversions	1,3, 4	3A	5	0	0	0	0	0	0
ScP-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TCFT TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
ScP-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
ScP-SCCCS-9.2	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
ScP-SCCCS-9.3	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
ScP-SCCCS-9.1	Develop and implement public education program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
ScP-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan U.S. Forest Service Plan for the Silver Peak Wilderness Area)	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
ScP-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
ScP-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT,	Roads	1, 4	3B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		VWA, TCFT										
ScP-SCCCS-11.2	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, TCFT	Roads	1, 4	3B	20	0	0	0	0	0	0
ScP-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFS, USFWS, NMFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	4154000	0	0	0	0	4154000
ScP-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
ScP-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
ScP-SCCCS-14.1	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
ScP-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Wildfires	1, 4, 5	2B	100	0	0	0	0	0	0

Table 12-5. South-Central California Steelhead DPS Recovery Action Table for the Arroyo de la Cruz Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Arroyo de la Cruz												
AC-SCCCS-1.1	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	2B	5	47520	0	0	0	0	47520
AC-SCCCS-1.2	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	2B	5	0	0	0	0	0	0
AC-SCCCS-1.3	Develop, adopt and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	2B	20	0	0	0	0	0	0
AC-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT	Agricultural Effluents	1, 4	3B	100	0	0	0	0	0	0
AC-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	3A	5	91850	0	0	0	0	91850
AC-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA,	Dams and Surface Water Diversions	1,3, 4	3A	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CCSE, TCFT										
AC-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Dams and Surface Water Diversions	1,3, 4	3A	5	0	0	0	0	0	0
AC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
AC-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
AC-SCCCS-9.1	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
AC-SCCCS-9.2	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
AC-SCCCS-9.3	Develop and implement public education program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan)	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
AC-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
AC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, TCFT	Roads	1, 4	3B	20	0	0	0	0	0	0
AC-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFS, USFWS, NMFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	1742000	0	0	0	0	174200
AC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	CCCOM, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
AC-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
AC-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AC-SCCCS-15.1	Develop and implement an integrated wildlands fire and hazardous fuels plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Wildfires	1, 4, 5	2B	100	0	0	0	0	0	0

Table 12-6. South-Central California Steelhead DPS Recovery Action Table for the Little Pico Creek Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Little Pico Creek												
LP-SCCCS-1.1	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	3B	5	47520	0	0	0	0	47520
LP-SCCCS-1.2	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	3B	5	0	0	0	0	0	0
LP-SCCCS-1.3	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	3B	20	0	0	0	0	0	0
LP-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT	Agricultural Effluents	1, 4	3B	100	0	0	0	0	0	0
LP-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	3A	5	91850	0	0	0	0	91850
LP-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA,	Dams and Surface Water Diversions	1, 3, 4	2B	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CCSE, TCFT										
LP-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 3, 5	2A	5	96690	0	0	0	0	96690
LP-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 3, 5	2A	5	0	0	0	0	0	0
LP-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
LP-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
LP-SCCCS-9.1	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
LP-SCCCS-9.2	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
LP-SCCCS-9.3	Develop and implement public education program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
LP-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* U.S. Forest Service Los Padres National Forest Land Management Plan)	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
LP-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
LP-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, TCFT	Roads	1, 4	3B	20	0	0	0	0	0	0
LP-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFS, USFWS, NMFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	1474000	0	0	0	0	1474000
LP-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
LP-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
LP-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* San Simeon Community Service District Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
LP-SCCCS-15.1	Develop and implement an integrated wildlands fire and hazardous fuels plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Wildfires	1, 4, 5	2B	100	0	0	0	0	0	0

Table 12-7. South-Central California Steelhead DPS Recovery Action Table for the Pico Creek Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Pico Creek												
PC-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	3B	20	0	0	0	0	0	0
PC-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	3B	5	47520	0	0	0	0	47520
PC-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	3B	5	0	0	0	0	0	0
PC-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT	Agricultural Effluents	1, 4	3B	100	0	0	0	0	0	0
PC-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE,TCFT	Culverts and Road Crossings (Passage Barriers)	1, 3, 5	2A	5	96690	0	0	0	0	96690
PC-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE,TCFT	Culverts and Road Crossings (Passage Barriers)	1, 3, 5	2A	5	0	0	0	0	0	0
PC-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT,	Dams and Surface Water Diversions	1, 3, 4	3B	5	91850	0	0	0	0	91850

		TBSLT, VWA, TCFT										
PC-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Dams and Surface Water Diversions	1, 3, 5	2A	5	91850	0	0	0	0	91850
PC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	5	91850	0	0	0	0	91850
PC-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, TCFT	Groundwater Extraction	1, 4	3B	10	254350	39775	0	0	0	294125
PC-SCCCS-9.1	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1,3, 5	3B	100	0	0	0	0	0	0
PC-SCCCS-9.2	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
PC-SCCCS-9.3	Develop and implement public education program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
PC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, TCFT	Recreational Facilities	1, 2 , 3, 4, 5	3B	20	0	0	0	0	0	0
PC-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA,	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560

		TCFT										
PC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, TCFT	Roads	1, 4	3B	20	0	0	0	0	0	0
PC-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFS, USFWS, NMFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	2345000	0	0	0	0	2345000
PC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
PC-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
PC-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* San Simeon Community Service District Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
PC-SCCCS-15.1	Develop and implement an integrated wildlands fire and hazardous fuels plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Wildfires	1, 4, 5	2B	100	0	0	0	0	0	0

Table 12-8. South-Central California Steelhead DPS Recovery Action Table for the San Simeon Creek Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
San Simeon Creek												
SS-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
SS-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
SS-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
SS-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT	Agricultural Effluents	1, 4	2B	100	0	0	0	0	0	0
SS-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessments	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
SS-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
SS-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	3B	5	91850	0	0	0	0	91850
SS-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA,	Dams and Surface Water Diversions		3B	5	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		TCFT										
SS-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCES,TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
SS-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
SS-SCCCS-7.1	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	NRCS, FEMA, NMFS, CDFG SLOC, CCRCDC, CSLRCD, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
SS-SCCCS-7.2	Develop and implement a stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC, CCRCDC, CSLRCD, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
SS-SCCCS-8.1	Review and modify mining operations	USGS, NMFS, CDFG, CDMG, SLOC, CCRCDC, CSLRCD, NRCS, CCSE, TCFT	Mining and Quarrying	1, 3, 5	1B	20	68030	0	0	0	0	68030
SS-SCCCS-9.1	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, CCSE, TBSLT, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
SS-SCCCS-9.2	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, CCSE, VWA, CCSE, TCFT	Non-Native Species	1, 3, 5	3B	100	0	0	0	0	0	0
SS-SCCCS-9.3	Develop and implement public education program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, CCSE, VWA, CSSE, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SS-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.*, U.S. Forest Service Los Padres National Forest Land Management Plan, San Simeon State Beach Management Plan)	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
SS-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
SS-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
SS-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040
SS-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
SS-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFS, USFWS, NMFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	1675000	0	0	0	0	1675000
SS-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
SS-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE,TCFT	Urban Development	1,4	2B	5	62400	0	0	0	0	62400

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SS-SCCCS-13.2	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Urban Development	1,4	2B	20	0	0	0	0	0	0
SS-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable stormwater permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
SS-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Cambria Community Service District Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Urban Effluents	1, 4	3B	20	0	0	0	0	0	0
SS-SCCCS-15.1	Develop and implement an integrated wildlands fire and hazardous fuels plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Wildfires	1,4, 5	2B	100	0	0	0	0	0	0

Table 12-9. South-Central California Steelhead DPS Recovery Action Table for the Santa Rosa Creek Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Santa Rosa Creek												
SR-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
SR-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
SR-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC,LPFW, TCLT, TBSLT, VWA, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
SR-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
SR-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SR-SCCCS-3.2	Develop and implement plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, SLOC, TBSLT, VWA, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)			5	0	0	0	0	0	0
SR-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 5	1A	5	91850	0	0	0	0	91850
SR-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, USFS, CDFG,SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Dams and Surface Water Diversions		2A	5	0	0	0	0	0	0
SR-SCCCS-5.1	Develop and implement a plan to minimize disturbance of instream habitats and riparian vegetation	ACOE, NMFS, NRCS, SLOC, USGS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	5	68030	0	0	0	0	68030
SR-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG, SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
SR-SCCCS-6.2	Develop and implement groundwater monitoring and management plan	NMFS, USFS, USGS, CDFG, SLOC, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
SR-SCCCS-7.1	Develop and implement plan to restore natural channel features	NRCS, FEMA, NMFS, CDFG SLOC, CCRCDC, CSLRCD, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SR-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	NRCS, FEMA, NMFS, CDFG SLOC, CCRCDC, CSLRCD, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
SR-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC, CCRCDC, CSLRCD, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Levees and Channelization			100	0	0	0	0	0	0
SR-SCCCS-9.1	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, CCSE, VWA, TCFT	Non-Native Species	1,3, 5	3B	100	0	0	0	0	0	0
SR-SCCCS-9.2	Develop and implement non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, CCSE, VWA, TCFT	Non-Native Species	1, 3, 5	3B	20	76140	76140	76140	76140	0	304560
SR-SCCCS-9.3	Develop and implement public education program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, CCSE, VWA,TCFT	Non-Native Species	1, 3, 5	3B	20	0	0	0	0	0	0
SR-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* Shamel County Park)	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SR-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, USFS, NMFS, CDFG, CDPR, CNPS, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
SR-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040
SR-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
SR-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Roads	1,4	1B	5	4355000	0	0	0	0	4355000
SR-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFS, USFWS, NMFS, CDOT, SLOC, CDPR, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	62400	0	0	0	0	62400
SR-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
SR-SCCC	Develop, adopt, and implement urban land-use planning policies and	CCCOM, SLOC, NMFS, CDFG,	Urban Development	1,4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
S-13.1	standards	TCLT, TBSLT, VWA, CCSE,TCFT										
SR-SCCCS-13.2	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE,TCFT	Urban Development	1, 4	2B	20	0	0	0	0	0	0
SR-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
SR-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Cambria Community Service District Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, NMFS, CDFG, TCLT, TBSLT, VWA, CCSE, TCFT	Urban Effluents	1, 4	2B	100	0	0	0	0	0	0
SR-SCC-	Develop and implement an integrated wildland fire and hazardous fuel management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, TCLT, TBSLT, VWA, CCSE, TCFT	Wildfires	1, 4,	2B	20	0	0	0	0	0	0

Table 12-10. South-Central California Steelhead DPS Recovery Action Table for the Morro Creek Watershed (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Morro Creek												
MC-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards		Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
MC-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
MC-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
MC-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CSLRDC, CCSE,TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
MC-SCCCS-3.1	Conduct a watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
MC-SCCCS-3.2	Develop and implement a plan to remove or modify all identified fish passage barriers in the watershed	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A		0	0	0	0	0	0
MC-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
MC-SCCCS-4.2	Provide fish passage around dams and diversions	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
MC-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, SLOC, MB, USGS, CDFG, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
MC-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG, SLOC, MB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
MC-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG, SLOC, MB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
MC-SCCCS-7.1	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	NRCS, FEMA, NMFS, CDFG SLOC,MB, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	2B	100	0	0	0	0	0	0
MC-SCCCS-7.2	Develop and implement stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC,MB, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	2B	5	10521940	0	0	0	0	10521940
MC-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
MC-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
MC-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	76140	76140	76140	76140	0	304560
MC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* Morro Bay State Park)	USFWS, NMFS, MB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
MC-SCCCS-10.2	Develop and implement public education program on watershed processes	USFWS, NMFS, MB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 5	2B	20	76140	76140	76140	76140	0	304560
MC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
MC-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040
MC-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1,4	1B	20	0	0	0	0	0	0
MC-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFWS, NMFS, CDOT, SLOC, MB, CDPR, CDFGCCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5,	1A	5	2144000	0	0	0	0	2144000
MC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, MB, NMFS,	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CDFG, CCSE, TCFT										
MC-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCFT	Urban Development	1,4	2B	5	62400	0	0	0	0	62400
MC-SCCCS-13.2	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCFT	Urban Development	1,4	2B	20	0	0	0	0	0	0
MC-SCCCS-14.1	Review California Regional Water Quality Control Board Watersheds Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
MC-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Morro bay/Cayucos Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1,4	2B	20	0	0	0	0	0	0
MC-SCCCS-14.3	Review, assess and modify residential and commercial wastewater septic treatment facilities	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	100	0	0	0	0	0	0
MC-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuel management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, CCSE, TCFT	Wildfires	1, 4	2B	100	0	0	0	0	0	0

Table 12-11. South-Central California Steelhead DPS Recovery Action Table for the Morro Bay Estuary (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Chorro Creek												
CC-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
CC-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
CC-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
CC-SCCCS-2.2	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CSLRDC, CCSE,TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
CC-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
CC-SCCCS-3.1	Develop and implement a plan to remove or modify fish passage barriers within the watershed	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
CC-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
CC-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
CC-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
CC-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, SLOC, MB, USGS, CDFG, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
CC-SCCCS-6.1	Conduct groundwater extraction analysis assessment	NMFS, USFS, USGS, CDFG, SLOC, MB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
CC-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG, SLOC, MB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
CC-SCCCS-7.1	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	NRCS, FEMA, NMFS, CDFG SLOC,MB, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	2B	100	0	0	0	0	0	0
CC-SCCCS-7.2	Develop and implement stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC,MB, CCRCDC,	Levees and Channelization	1, 4	2B	5	10521940	0	0	0	0	10521940

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CSLRCD, CCSE, TCFT										
CC-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
CC-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
CC-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	76140	76140	76140	76140	0	304560
CC-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* Morro Bay State Park)	USFWS, NMFS, MB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
CC-SCCCS-10.2	Develop and implement public education program on watershed processes	USFWS, NMFS, MB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
CC-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
CC-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
CC-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill or railroad lines and roads	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCF	Roads	1, 4	1B	20	0	0	0	0	0	0
CC-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFWS, NMFS, CDOT, SLOC, MB, CDPR, CDFGCCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	67000000	0	0	0	0	67000000
CC-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
CC-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCFT	Urban Development	1, 4	2B	5	62400	0	0	0	0	62400
CC-SCCCS-13.2	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCFT	Urban Development	1, 4	2B	20	0	0	0	0	0	0
CC-SCCCS-13.3	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCF	Urban Development	1, 4	2B	5	398000	0	0	0	0	398000
CC-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable stormwater permits	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
CC-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Los Osos Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
CC-SCCCS-14.3	Review, assess and modify residential and commercial wastewater septic treatment facilities	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	100	0	0	0	0	0	0
CC-SCSS-15.1	Develop and implement an integrated wildland fie and hazardous fuels management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, CCSE, TCFT	Wildfires	1, 4	2B	100	0	0	0	0	0	0
Los Osos Creek												
LO-SCCCS-1.1	Development, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
LO-SCCCS-1.2	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CCSE. CSLRDC, TCLT, CCSE, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
LO-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, MB, CCRCDC, CSLRDC, CCSE, TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
LO-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
LO-SCCCS-3.1	Develop and implement a plan to remove or modify passage barriers in the watershed	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
LO-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
LO-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
LO-SCCCS-4.3	Provided fish passage around dams and diversions	NMFS, CDFG, CCCON, SLOC, MB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	0	0	0	0	0	0
LO-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, SLOC, MB, USGS, CDFG, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
LO-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG, SLOC, MB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
LO-SCCCS-6.2	Develop and implement groundwater monitoring and management program	NMFS, USFS, USGS, CDFG, SLOC, MB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
LO-SCCCS-7.1	Develop and implement plan to restore natural channel features	NRCS, FEMA, NMFS, CDFG SLOC,MB, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	2B	100	0	0	0	0	0	0
LO-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or	NRCS, FEMA, NMFS, CDFG SLOC,MB, CCRCDC,	Levees and Channelization	1, 4	2B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
	minimize herbicide use near levees	CSLRCD, CCSE, TCFT										
LO-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
LO-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	76140	76140	76140	76140	0	304560
LO-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, MB, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	0	0	0	0	0	0
LO-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests	USFWS, NMFS, MB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
LO-SCCCS-10.2	Develop and implement public education program on watershed processes	USFWS, NMFS, MB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
LO-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1, 4	2B	20	32260	32260	32260	32260	0	129040
LO-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1,4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
LO-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, MB, CDFG, CCSE, TCFT	Roads	1,4	2B	5	6700000	0	0	0	0	6700000
LO-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFWS, NMFS, CDOT, SLOC, MB, CDPR, CDFGCCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	62400	0	0	0	0	62400
LO-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5		5	62400	0	0	0	0	62400
LO-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCFT	Urban Development	1, 4	2B	20	0	0	0	0	0	0
LO-SCCCS-13.2	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, MB, CCSE,TCFT	Urban Development	1, 4	2B	20	0	0	0	0	0	0
LO-SCCCS-14.1	Review California Regional Water Quality Control Board Central Coast Region Basin Plans and modify applicable stormwater permits	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
LO-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Los Osos Wastewater *Treatment* Facilities)	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0
LO-SCCCS-15.1	Development and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW,	Wildfires	1.4	2B	5	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CCSE, TCFT										

Table 12-12. South-Central California Steelhead DPS Recovery Action Table for the San Luis Obispo Creek (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
San Luis Obispo Creek												
SLO-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, CCLO, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
SLO-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NMFS, USFS, SLOC, CCLO, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
SLO-SCCCS-1.3	Manage agricultural development and restore riparian zones	NMFS, USFS, SLOC, CCLO, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
SLO-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, CSLO, CCRCDC, CSLRDC, CCSE,TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
SLO-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, CSLO, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690
SLO-SCCCS-3.1	Develop and implement a plan to remove or modify passage barriers in the watershed (*e.g.,* San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation, 2005;and San Luis Obispo Creek Watershed Enhancement Plan, 2002)	NMFS, CDFG, CCCON, SLOC, CSLO, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SLO-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCCON, SLOC, CSLO, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
SLO-SCCCS-4.2	Develop and implement water management plan for dam operations	NMFS, CDFG, CCCON, SLOC, CSLO, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
SLO-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, CCCON, SLOC, CSLO, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	TBD	TBD	TBD	TBD	TBD	TBD
SLO-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, SLOC, CSLO, USGS, CDFG, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
SLO-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG, SLOC, CSLO, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
SLO-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USFS, USGS, CDFG, SLOC, CSLO, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
SLO-SCCCS-7.1	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	NRCS, FEMA, NMFS, CDFG SLOC,CSLO, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
SLO-SCCCS-7.2	Develop and implement stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC,CSLO, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
SLO-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CSLO, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
SLO-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CSLO, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
SLO-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CSLO, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	76140	76140	76140	76140	0	304560
SLO-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests	USFWS, NMFS, CSLO, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 3, 4, 5	2B	20	0	0	0	0	0	0
SLO-SCCCS-10.2	Develop and implement public education program on watershed processes	USFWS, NMFS, CSLO, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
SLO-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CSLO, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
SLO-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CSLO, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040
SLO-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, CDFG, USFS, CDOT, SLOC, CDPR, CSLO, CDFG, CCSE,	Roads	1, 4	1B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		TCFT										
SLO-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFWS, NMFS, CDOT, SLOC, CSLO, CDPR, CDFGCCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	4020000	0	0	0	0	4020000
SLO-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, MB, NMFS, CDFG, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	62400	0	0	0	0	62400
SLO-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, CSLO, CCSE,TCF	Urban Development	1, 4	2B	5	62400	0	0	0	0	62400
SLO-SCCCS-13.1	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, CSLO, CCSE,TCF	Urban Development	1, 4	2B	20	0	0	0	0	0	0
SLO-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, CSLO, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0
SLO-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* City of San Luis Obispo and Avila Wastewater Treatment Facilities)	RWQCB, SWRCB, SLOC, CSLO, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0
SLO-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, CCSE, TCFT	Wildfires	1. 4	2B	100	0	0	0	0	0	0

Table 12-13. South-Central California Steelhead DPS Recovery Action Table for the Pismo Creek (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Pismo Creek												
Pis-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, COPB, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
Pis-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat features	NRCS, BLM, NMFS, USFS, SLOC, COPB, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
Pis-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, COPB, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
Pis-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, COPB, CCRCDC, CSLRDC, CCSE,TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
Pis-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, COPB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Pis-SCCCS-3.	Develop and implement plan to remove or modify fish passage barriers in the watershed (*e.g.,* San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation, 2005)	NMFS, CDFG, CCCON, SLOC, COPB, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
Pis-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS, CDFG, CCCON, SLOC, COPB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Pis-SCCCS-4.2	Develop and implement water management plan for dam operations (*e.g.,* Righetti Dam on West Corral de Piedra Creek)	NMFS, CDFG, CCCON, SLOC, COPB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
Pis-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, CDFG, CCCON, SLOC, COPB, CCSE, TCFT	Dams and Surface Water Diversions	1, 3, 4	1A	5	TBD	TBD	TBD	TBD	TBD	TBD
Pis-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, SLOC, CPPB, USGS, CDFG, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
Pis-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG, SLOC, COPB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
Pis-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USFS, USGS, CDFG, SLOC, COPB, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
Pis-SCCCS-7.1	Develop and implement plan to restore natural channel features	NRCS, FEMA, NMFS, CDFG SLOC,COPB, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
Pis-SCCCS-	Develop and implement plan to vegetate levees and eliminate or minimize	NRCS, FEMA, NMFS, CDFG	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
7.2	herbicide use near levees	SLOC,COPB, CCRCDC, CSLRCD, CCSE, TCFT										
Pis-SCCCS-7.3	Develop and implement stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC,COPB, CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
Pis-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, CSLO, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
Pis-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, CSLO, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	76140	76140	76140	76140	0	304560
Pis-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, CSLO, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	0	0	0	0	0	0
Pis-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (e.g., Pismo State Beach)	USFWS, NMFS, COPB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
Pis-SCCCS-10.2	Develop and implement public education program on watershed processes	USFWS, NMFS, COPB, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
Pis-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, CDOT, SLOC, CDPR, COPB, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Pis-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, CDOT, SLOC, CDPR, COPB, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
Pis-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and road	USDOT, NMFS, CDFG, CDOT, SLOC, CDPR, COPB, CDFG, CCSE, TCFT	Roads	1, 4	1B	5	3082000	0	0	0	0	3082000
Pis-SCCCS-12.1	Develop and implement an estuary restoration and management	USFWS, NMFS, CDOT, SLOC, COPB, CDPR, CDFGCCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
Pis-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, COPB, NMFS, CDFG, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	62400	0	0	0	0	62400
Pis-SCCCS-13,1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, COPB, CCSE,TCF	Urban Development	1, 4	1B	20	0	0	0	0	0	0
Pis-SCCCS-13,2	Retrofit storm drains in developed areas	CCCOM, SLOC, NMFS, CDFG, COPB, CCSE,TCF	Urban Development	1, 4	1B	5	398000	0	0	0	0	398000
Pis-SCCCS-13.3	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	CCCOM, SLOC, NMFS, CDFG, COPB, CCSE,TCF	Urban Development	1, 4	1B	20	0	0	0	0	0	0
Pis-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable stormwater permits	RWQCB, SWRCB, SLOC, COPB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	1B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Pis-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* Pismo Beach Wastewater Treatment Facility and Cypress Ridge Wastewater Treatment Facility)	RWQCB, SWRCB, SLOC, COPB, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	1B	100	0	0	0	0	0	0
Pis-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuel management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, CCSE, TCFT	Wildfires	1, 4	2B	20	0	0	0	0	0	0

Table 12-14. South-Central California Steelhead DPS Recovery Action Table for the Arroyo Grande Creek (San Luis Obispo Terrace BPG).

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
Arroyo Grande Creek												
AG-SCCCS-1.1	Develop, adopt, and implement agricultural land-use planning policies and standards	NRCS, BLM, NMFS, USFS, SLOC, AG, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	20	0	0	0	0	0	0
AG-SCCCS-1.2	Manage livestock grazing to maintain or restore aquatic habitat functions	NRCS, BLM, NMFS, USFS, SLOC, AG, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	5	47520	0	0	0	0	47520
AG-SCCCS-1.3	Manage agricultural development and restore riparian zones	NRCS, BLM, NMFS, USFS, SLOC, AG, CCRCDC, CCSE. CSLRDC, CCSE, TCFT	Agricultural Development	1, 4	1B	5	0	0	0	0	0	0
AG-SCCCS-2.1	Develop and implement plan to minimize runoff from agricultural activities	NRCS, BLM, NMFS, USFS, SLOC, AG, CCRCDC, CSLRDC, CCSE,TCFT	Agricultural Effluents	1, 4	1B	100	0	0	0	0	0	0
AG-SCCCS-3.1	Conduct watershed-wide fish passage barrier assessment	NMFS, CDFG, CCCON, SLOC, AG, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)			5	96690	0	0	0	0	96690

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AG-SCCCS-3.2	Develop and implement a plan to remove or modify fish passage barriers in the watershed (*e.g.,* San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation, 2005)	NMFS, CDFG, CCCON, SLOC, AG, CCSE, TCFT	Culverts and Road Crossings (Passage Barriers)	1, 4	1A	5	0	0	0	0	0	0
AG-SCCCS-4.1	Develop and implement water management plan for diversion operations	NMFS**, CDFG, CCCON, SLOC,** AG**, CCSE, TCFT**	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
AG-SCCCS-4.2	Develop and implement water management plan for dam operations (e.g., Lopez Dam)	NMF**S, CDFG,** CCCON**, SLOC,** AG**, CCSE, TCFT**	Dams and Surface Water Diversions	1, 3, 4	1A	5	91850	0	0	0	0	91850
AG-SCCCS-4.3	Provide fish passage around dams and diversions	NMFS, **CDFG,** CCCON**, SLOC,** AG**, CCSE, TCFT**	Dams and Surface Water Diversions	1, 3, 4	1A	10	TBD	TBD	TBD	TBD	TBD	TBD
AG-SCCCS-5.1	Develop and implement flood control maintenance program	ACOE, NMFS, NRCS, SLOC, AG, USGS, CDFG, CCSE, TCFT	Flood Control Maintenance	1, 4	1B	100	0	0	0	0	0	0
AG-SCCCS-6.1	Conduct groundwater extraction analysis and assessment	NMFS, USFS, USGS, CDFG, SLOC, AG, CCSE, TCFT	Groundwater Extraction	1, 4	1B	5	91850	0	0	0	0	91850
AG-SCCCS-6.2	Develop and implement a groundwater monitoring and management program	NMFS, USFS, USGS, CDFG, SLOC, Ag, CCSE, TCFT	Groundwater Extraction	1, 4	1B	10	254350	39775	0	0	0	294125
AG-SCCCS-7.1	Develop and implement plan to restore natural channel features	NRCS, FEMA, NMFS, CDFG SLOC, AG , CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AG-SCCCS-7.2	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	NRCS, FEMA, NMFS, CDFG SLOC, AG , CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	5	10521940	0	0	0	0	10521940
AG-SC3S-7.2	Develop and implement stream bank and riparian corridor restoration plan	NRCS, FEMA, NMFS, CDFG SLOC, AG , CCRCDC, CSLRCD, CCSE, TCFT	Levees and Channelization	1, 4	1B	100	0	0	0	0	0	0
AG-SCCCS-9.1	Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures	USFWS, USFS, NMFS, CDFG, CDPR, AG, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	100	0	0	0	0	0	0
AG-SCCCS-9.2	Develop and implement a non-native species monitoring program	USFWS, USFS, NMFS, CDFG, CDPR, AG, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	76140	76140	76140	76140	0	304560
AG-SCCCS-9.3	Develop and implement a public educational program on non-native species impacts	USFWS, USFS, NMFS, CDFG, CDPR, AG, CNPS, CCSE,TCFT	Non-Native Species	1, 3, 4	2B	20	0	0	0	0	0	0
AG-SCCCS-10.1	Review and modify development and management plans for recreational areas and national forests (*e.g.,* Pismo Dunes Natural Preserve Management Plan)	USFWS, NMFS, AG, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	76140	76140	76140	76140	0	304560
AG-SCCCS-10.2	Develop and implement a public educational program on watershed processes	USFWS, NMFS, AG, CDFG, CDPR, CNPS, CCSE, TCFT	Recreational Facilities	1, 2, 3, 4, 5	2B	20	0	0	0	0	0	0
AG-SCCCS-11.1	Manage roadways and adjacent riparian corridor and restore abandoned roadways	USDOT, NMFS, CDFG, CDOT, SLOC, CDPR, AG, CDFG,	Roads	1, 4	1B	20	32260	32260	32260	32260	0	129040

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
		CCSE, TCFT										
AG-SCCCS-11.2	Retrofit storm drains to filter runoff from roadways	USDOT, NMFS, CDFG, CDOT, SLOC, CDPR, AG, CDFG, CCSE, TCFT	Roads	1, 4	1B	20	0	0	0	0	0	0
AG-SCCCS-11.3	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	USDOT, NMFS, CDFG, CDOT, SLOC, CDPR, AG, CDFG, CCSE, TCFT	Roads	1,4	1B	5	6097000	0	0	0	0	6097000
AG-SCCCS-12.1	Develop and implement an estuary restoration and management plan	USFWS, NMFS, CDOT, SLOC, AG, CDPR, CDFGCCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	1A	5	62400	0	0	0	0	62400
AG-SCCCS-12.2	Review and modify applicable County and/or City Local Coastal Plans	RWQCB, SWRCB, SLOC, AG, NMFS, CDFG, CCSE, TCFT	Upslope/Upstream Activities	1, 2, 3, 4, 5	2B	5	62400	0	0	0	0	62400
AG-SCCCS-13.1	Develop, adopt, and implement urban land-use planning policies and standards	CCCOM, SLOC, NMFS, CDFG, AG, CCSE,TCF	Urban Development	1, 4	2B	20	0	0	0	0	0	0
AG-SCCCS-13.2	Retrofit storm drains in developed areas Add an additional recovery action:	CCCOM, SLOC, NMFS, CDFG, AG, CCSE,TCF	Urban Development	1, 4	2B	5	398000	0	0	0	0	398000
AG-SCCCS-13.2	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	CCCOM, SLOC, NMFS, CDFG, AG, CCSE,TCF	Urban Development	1, 4	2B	20	0	0	0	0	0	0
AG-SCCCS-14.1	Review California Regional Water Quality Control Board Watershed Plans and modify applicable Stormwater Permits	RWQCB, SWRCB, SLOC, AG, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	20	0	0	0	0	0	0

Action #	Recovery Action Description	Responsible Parties	Threat Source	Listing Factors (1 - 5)	Action Rank (1A, 1B, 2A, 2B, 3A, 3B)	Task Duration	Fiscal Year Costs ($K)					
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	FY 1-100
AG-SCCCS-14.2	Review, assess and modify if necessary all NPDES wastewater discharge permits (*e.g.,* South San Luis Obispo Sanitation District Wastewater Treatment Facility and Cypress Ridge Wastewater Treatment Facility)	RWQCB, SWRCB, SLOC, AG, NMFS, CDFG, CCSE, TCFT	Urban Effluents	1, 4	2B	100	0	0	0	0	0	0
AG-SCCCS-15.1	Develop and implement an integrated wildland fire and hazardous fuels management plan	CDF&FP. USFS, USFWS, SLOC, NMFS, CDFG, LPFW, CCSE, TCFT	Wildfires	1, 4	2B	20	0	0	0	0	0	0

13. South-Central California Coast Steelhead Research, Monitoring, and Adaptive Management

"The analytic tools to evaluate species health have been greatly developed in recent years. The emergence of extinction theory from population genetics and ecology, the combination of demography and genetics in population viability analysis and the extension of risk analyses into the realm of biological conservation promises to lead us to wiser allocations of effort in the future."

Science and the Endangered Species Act, National Research Council, 1995

13.1 INTRODUCTION

Recovery of South-Central California steelhead will require a more thorough understanding of the distinctive biology of steelhead within the SCCCS Recovery Planning Area. Additionally, it is crucially important to identify a program for monitoring the status of individual populations and the DPS as a whole, and a plan for tracking and adjusting the recovery actions and recovery strategy over an extended period to optimize the effectiveness of the recovery effort. The following sections outline the basic elements of a research, monitoring, and adaptive management program, and identify high priority research and monitoring actions.

13.1.1 South-Central California Steelhead Research

In 2002 NMFS convened a team of scientific specialists, the Technical Review Team (TRT), whose mission was to survey existing scientific information on steelhead ecology, and formulate a biological framework for a recovery plan for South-Central California steelhead (Boughton *et al.* 2007b, 2006, Boughton and Goslin 2006, Boughton *et al.* 2005, Boughton and Fish 2003).

The current state of knowledge of steelhead ecology is largely descriptive and qualitative. This has led to uncertainties in the viability framework, including developing quantitative goals for distribution and abundance of steelhead trout and general strategies for how to achieve these goals. In general, the TRT approached uncertainty about recovery goals with a risk-averse, or precautionary, stance, consistent with accepted practice in conservation biology (McElhany *et al.* 2000). The

TRT also recognized that key uncertainties involved in recovery planning arose from the qualitative nature of the current understanding, and could be improved by a carefully conceived and planned program of scientific research and monitoring. The benefits of pursuing such a program would be a more effective, and more-cost efficient, recovery effort for steelhead.

Recovery of South-Central California steelhead will depend upon a quantitative framework that addresses their annual run size, along with year-to-year variability over the long term; and the quantitative response of steelhead runs to specific recovery actions. These are related to the two overarching questions of steelhead recovery in this region:

- How do we improve the distribution, abundance, and resilience of steelhead trout populations; and
- How much do we need to improve these biological characteristics for steelhead to be considered viable and eligible for down-listing and/or delisting?

The following sub-sections focus on the viability criteria developed by the TRT, and a series of related research questions grouped into three areas: enhancing anadromy, clarifying the population structure of *O. mykiss*, and planning for climate change.

13.2 VIABILITY CRITERIA

The viability criteria address two levels of biological organization, populations within the Distinct Population Segment (*i.e.*, only the anadromous form), and the more encompassing Evolutionarily Significant Unit (ESU), which includes all life history forms. The *O. mykiss* ESUs in this Recovery Planning Area are composed of both anadromous and non-anadromous fish, but only the non-anadromous form is on the threatened species list, under the DPS provision of the Federal Endangered Species Act. One of the principal uncertainties is the complicated relationship between the anadromous and non-anadromous (or freshwater-resident) forms of the species. Following convention, the term "steelhead trout" is used for the anadromous fish, "rainbow trout" for non-anadromous fish, and "*O. mykiss*" when referring to both or either. The goal of the Recovery Plan is to ensure the continued persistence of steelhead trout in the region over the long term (Boughton *et al.* 2007b), but it is likely that rainbow trout have some role in securing this future, and thus the viability criteria have provisions for both forms of the species.

13.2.1 Population-Level Criteria

The TRT considered *O. mykiss* in the region to be grouped into demographically - independent populations. Generally, each discrete coastal watershed in the region was assumed to have historically supported one demographically independent population of *O. mykiss.* If migratory steelhead frequently move from one watershed to another, the one-watershed-one-population assumption may have some important exceptions with implications for recovery planning.

The TRT proposed population-level viability criteria for determining whether a demographically- independent population of *O. mykiss* should be considered viable for the purpose of steelhead recovery. The TRT identified two choices for meeting the viability criteria. The first was to meet a set of criteria: a population must exhibit a mean annual run size of at least 4,150 steelhead trout, including during periods of poor ocean conditions (such as occurred from the late 1970s through early 1990s). Additionally, the spawner densities in the river systems needed to meet a minimum density threshold (fish per kilometer of stream channel at some scale), a quantitative criterion yet to be determined. The second choice was to meet a performance-based criterion, demonstrating that the extinction risk for steelhead trout is less than 5% over 100 years,

using commonly accepted quantitative methods from conservation biology, demographic data from the population in question, and passing an independent scientific review.

Extinction risk is very sensitive to both annual run size and year-to-year variability. As a result, the performance-based criteria cannot be applied in a meaningful way until run sizes have been monitored for a decade or more, allowing this key quantity to be estimated with reasonable accuracy. In the interim, the prescriptive criteria ensures that the year-to-year variability in run size, whatever its probable magnitude, is unlikely to pose a significant risk to the species. If year-to-year variability turns out to be relatively modest, a mean run size smaller than 4,150 steelhead would perhaps be sufficient to ensure a low extinction risk. Including the option for performance-based viability criteria, provides a mechanism for refining the viability criteria as more is learned over time.

Extinction risk for individual steelhead runs may also be sensitive to the influence of rainbow trout, if the trout tend to stabilize or augment those runs as a result of rainbow trout regularly producing anadromous progeny. This phenomenon is referred to as "life history crossovers," but it is not yet known whether such crossovers occur frequently enough to stabilize steelhead runs. This is another key uncertainty that, if resolved, might allow the run-size criterion of 4,150 spawners per year to be adjusted. In this case, the adjustment would be that some fraction of the 4,150 spawners within a watershed or metapopulation would need to exhibit the anadromous life history, rather than 100%. Additionally, data on the magnitude of natural fluctuations in anadromous run sizes in individual watersheds may identify a smaller mean run size is sufficient for viability in some basins (Williams *et al.* 2011). Until such research is undertaken and revisions made to the viability criteria, the population-level viability criteria for determining whether a demographically-independent population of *O. mykiss* should be considered viable for the purpose of steelhead recovery would remain 4,150. This criteria will be reviewed during NMFSs 5-year review of the Recovery Plan, and potentially during the Southwest Fisheries Science Center's 5-year status review update for Pacific salmon and steelhead listed under the ESA..

In the absence of specific information about the role of life history crossovers, the TRT took a precautionary approach (*i.e.,* it was assumed there was not any beneficial effect of crossovers). This meant that the 4,150 spawners per year required for viability must be composed entirely of steelhead trout, rather than a mixture of rainbow and steelhead to ensure viability. However, the TRT also believed that the criteria should cover the possibility that the beneficial effect of crossovers not only exists, but is necessary for viability of the listed species. This led to additional criteria that the anadromous and freshwater resident life history types should both be expressed in populations for them to be considered viable.

It would be useful to learn whether rainbow trout significantly enhance or stabilize steelhead runs. If rainbow trout progeny crossover does in fact have a beneficial effect on steelhead runs - and its magnitude can be quantified - such knowledge could be used to revise the criteria for anadromous fraction criteria, or it could be incorporated into a performance-based assessment of risk, possibly resulting in different run size and anadromous fraction criteria. Research into these topics is essential to resolve these issues in a way which maintains acceptably low extinction risk to the species.

13.2.2 ESU/DPS-Level Criteria

The TRT outlined a set of ESU/DPS-level criteria, which, if met, would indicate that a steelhead Distinct Population Segment has been successfully recovered. Satisfying the ESU/DPS-level criteria requires a set of *O. mykiss* populations in which:

- Each population satisfies the population-level criteria described above, and
- The set of populations as a whole satisfies requirements for ecological representation and redundancy, and
- The set of populations as a whole exhibit all three life history types (fluvial-anadromous, lagoon-anadromous, freshwater resident)

The criteria for representation and redundancy have two purposes. First, to protect the genetic and ecological diversity that ensures the long-term viability of the species under changing conditions, the set of populations should represent the entire range of ecological and genetic conditions originally present in the ESU/DPS. Second, to protect against catastrophic loss of entire populations due to disease, forest fires, drought, *etc.*, the set of populations should exhibit redundancy with respect to the range of ecological and genetic conditions originally present in the ESU. This ensures that if, for example, entire populations are lost from a particular ecotype, there will be at least one other population in that ecotype that survives, and can serve as a reservoir of individuals retaining the genetic and phenotypic adaptations necessary for inhabiting that ecotype. Ultimately, such individuals would be necessary for recolonizing the watersheds.

The TRT developed criteria for representation and redundancy by grouping the region's populations of *O. mykiss* into biogeographic groups, and specifying a minimum level of redundancy (number of viable populations) within each group. In addition, the TRT recommended that the core populations should inhabit watersheds with drought refugia, should be separated from one another by at least 42 miles if possible, and should exhibit three life history types—the rainbow trout form described previously, and two forms of steelhead trout, the lagoon-anadromous form and the fluvial-anadromous form.

The biogeographic groups were delineated on the basis of geographic proximity, broadly similar climate, and aspects of physiography that are relevant to the fish (see Table 5 and Figure 5 in Boughton *et al.* 2007b). Summer air temperatures, which strongly influence whether summer stream temperatures are cool enough for the fish, were a key consideration. The most important split was between coastal groups of populations, in which cool mesoclimates are maintained by proximity to the ocean, and interior groups of populations, where cool mesoclimates are primarily confined to mountain ranges, and are maintained by the temperature lapse rate (i.e. the reduction in temperature with increased elevation).

The criteria for redundancy within each biogeographic group were based on an assessment of catastrophic risks posed by wildfires and debris flows. However, the assessment was based on historical pattern and did not include considerations of climate change, which could have a large impact on the region. See Chapter 5, South-Central California Steelhead and Climate Change.

The TRT also considered the catastrophic risk posed by drought, but could not incorporate it into the criteria due to insufficient information. The broad spatial extent of the typical drought in the region indicated that simple redundancy was not a suitable strategy for protecting the species from its effects. Watersheds having potential as drought refugia—stream systems that maintain suitable summer baseflows and water temperatures during severe multi-year droughts – should be identified and protected.

The broad-scale climatic factors that control the distribution of *O. mykiss* in the region appear to be summer air temperatures, annual precipitation, and the severity of winter storms, the last having its effect by determining the power of high flow events that organize the

distribution and extent of in-stream steelhead habitat. All of these factors are likely to undergo a long-term shift as part of CO_2-induced climate change. In addition, the region's frequent wildfires strongly influence the sediment budgets of streams, and thus the distribution of steelhead habitat. The overall wildfire regime is also likely to undergo a permanent shift in response to climate change. The magnitudes of these shifts, and the magnitude of their direct and interaction effects on stream habitat, are not yet clear. Thus a key uncertainty is how to plan for climate change both at the level of the ESU and individual stream watersheds.

13.3 RESEARCH FOCUS: ANADROMY, POPULATION STRUCTURE, AND MONITORING STEELHEAD RECOVERY

The natural dynamics of watersheds and stream systems maintain steelhead habitat in the recovery planning area in a stochastic, dynamic equilibrium. This equilibrium can involve dramatic processes such as floods and forest fires that disrupt habitat in the short term but ensure its continued existence over the long term. Other processes that circumscribe the productivity of freshwater steelhead habitat, such as the severity of the dry season or the pattern of high-flow events during the wet season, may affect reproductive success. These ecological constraints are generally understood at a qualitative level, but this level of knowledge is, in some cases, too vague to provide specific guidance for setting goals and choosing specific recovery actions. The research program supporting steelhead recovery in this region should focus on quantitative studies that: 1) identify ecological factors that promote anadromy; 2) clarify key aspects of population structure; and 3) monitor progress toward recovery. Many of these research activities could be carried out within the context of the California Coastal Salmonid Population Monitoring Program (Adams *et al.* 2011).

13.3.1 Identify Ecological Factors that Promote Anadromy

The primary focus of this Recovery Plan - to recover and secure the anadromous form of *O. mykiss* - involves restoring ecological conditions that specifically promote the population growth and abundance of the anadromous form.

While it is necessary to have migration corridors for steelhead to reach a spawning area, this does not necessarily imply that anadromous forms will out-compete the freshwater residents that spawn in the same area. At present it is not clear what ecological conditions specifically promote the sea-going form over the resident form though there are some important clues. These clues present a prime opportunity for research that would lead to more effective recovery actions.

Anadromous females exhibit a large fecundity advantage over their resident counterparts. As shown in Figure 14-1, an adult female's egg production increases exponentially with body length, and adult *O. mykiss* are generally able to attain much larger sizes in the ocean than in freshwater.

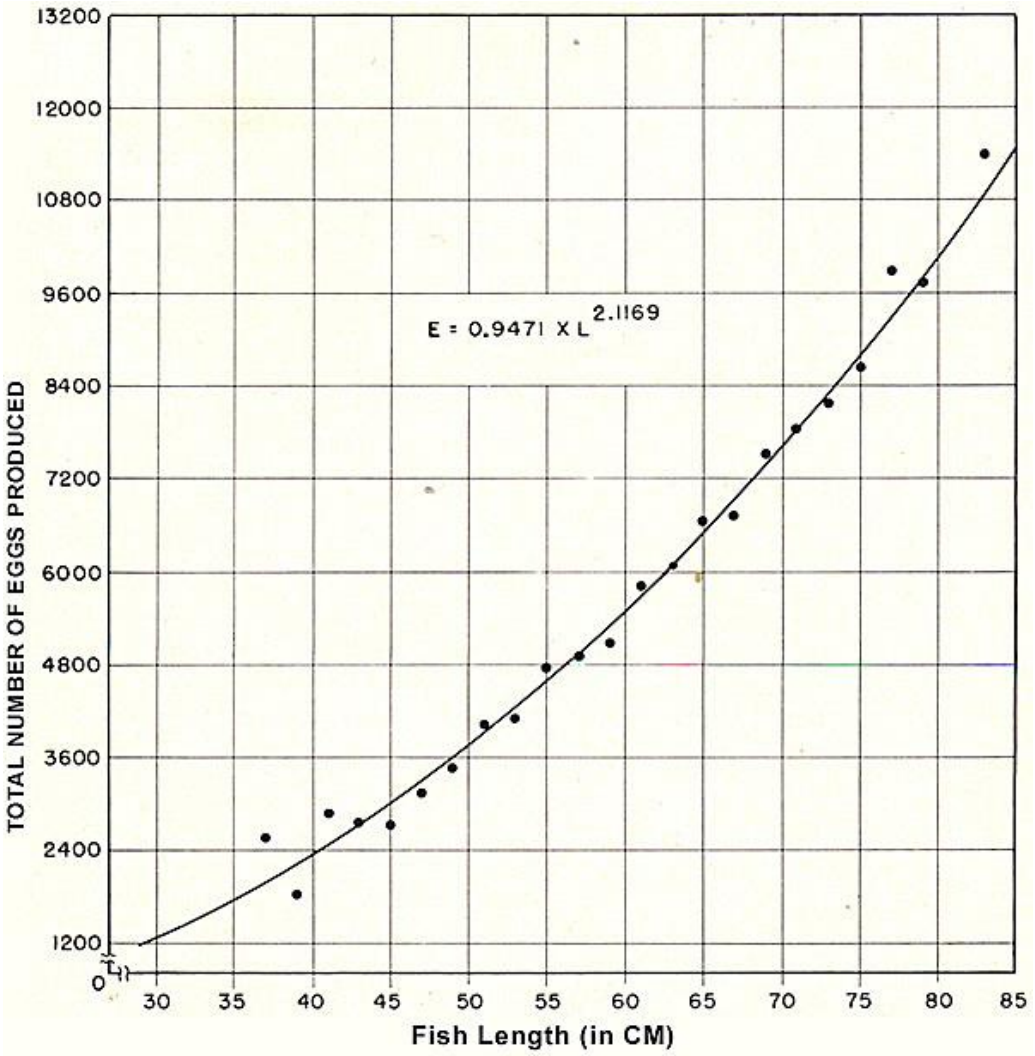


Figure 13-1. Fecundity as a function of body size for female steelhead sampled from Scott Creek in Santa Cruz County. Reproduced from Shapovalov and Taft (1954).

Thus, a typical female rainbow trout might attain a length of 35 cm, enabling her to produce 1800 eggs annually, whereas a medium sized steelhead female at 60 cm could produce over 3.5 times that number. This factor alone gives the sea-going form a distinct advantage and, all else being equal (and assuming the two forms breed true), over time the sea-going form should come to dominate any stream system with migration connectivity to the ocean. The resident forms would become confined to streams that lack migration connectivity. This pattern has been observed, for example, in the Deschutes River in Oregon (Zimmerman and Reeves 2000).

In South-Central California, three ecological factors could potentially counteract this size advantage so that the resident form is sometimes favored in anadromous waters. First, the migration corridor between the ocean and freshwater habitat could be unreliable. Second, mortality may sometimes be much higher in the ocean than in freshwater, counteracting the potential size advantage of sea-going fish. Third, juveniles of the freshwater form may survive better or compete better in freshwater than

juveniles of the sea-going form, which could also counteract the natural size/fecundity advantage of the sea-going form. Of these three possibilities, the first two are supported by various lines of evidence, and the third has some suggestive evidence. The need is to move beyond existing evidence to a quantitative understanding of ecological mechanism, so that specific recovery strategies can be linked to desired outcomes.

13.3.2 Reliability of Migration Corridors

Question: What is the relationship between reliability of migration corridors, and anadromous fraction?

Discussion: Migration corridors in this arid region are clearly unreliable, but it is not clear precisely how reliable they must be for the anadromous form to persist over the long term, nor how to best characterize reliability.

Recommendation: The relationship between flow patterns in managed rivers, the reliability of migration opportunities, and the long term persistence of steelhead runs is likely to be watershed specific, but could be characterized through the establishment of a long-term monitoring effort that tracks abundance and timing of steelhead runs, and the timing of smolt runs, in specific watersheds of interest. This would provide a framework by which management actions, in the form of managed flow regimes, could be related to outcomes, in the form of migrant abundance and timing. However, answers would probably emerge only over the long term, and numerous confounding factors would also need to be taken into account by the monitoring framework.

13.3.3 Steelhead-Promoting Nursery Habitats

Question: What nursery habitats promote rapid growth rates of juveniles (and therefore larger size) at the time smolts emigrate to the ocean?

Discussion: Marine survival varies among salmonids, ranging from 25% to below 1% (Welch *et al.* 2009, Logerwell *et al*. 2003, Peterson and Schwing, 2003, Ward 2000, Ward *et al*. 1989). Improving the marine survival rate of steelhead would be beyond the scope of most management strategies, since steelhead are rarely fished and other sources of ocean mortality are largely uncontrollable. However, mortality rates of many marine fishes are strongly size-dependent. Consistent with this general pattern, young steelhead migrating to the sea tend to survive much better if they have a larger size at ocean entry (Hayes, *et al.* 2008, Bond, 2006, Ward *et al*. 1989). Thus, their growth opportunities in freshwater may influence their subsequent marine survival.

Figure 13-2, indicates that an outgoing smolt that has a fork length of 14 cm has about a 3% chance of surviving to spawn, but a 16.5 cm smolt's chances are at least 3.5 times better (*c.* 10%), and a 22 cm smolt's chances are an order of magnitude better (37%). Thus, the mortality effects of size at ocean entry can be of the same order as the fecundity advantages of migrating to the ocean in the first place.

A similar relationship between survival and size at ocean entry was observed by Bond (2006) and Hayes *et al*. (2008) in Scott Creek in Santa Cruz County, which is much closer geographically to South-Central California. Size at ocean entry appears to be at least as important as final spawning size in modulating the relative abundances of the freshwater and ocean-going forms of *O. mykiss.* [1]

[1] Its importance can vary over time, however. Ward (2000) observed that after 1989, marine survival drastically declined in the Keogh River population, and the relationship disappeared between marine survival and size at ocean entry. This was attributed to a change in ocean conditions, and indicates that the survival advantage of being a large smolt varies over time.

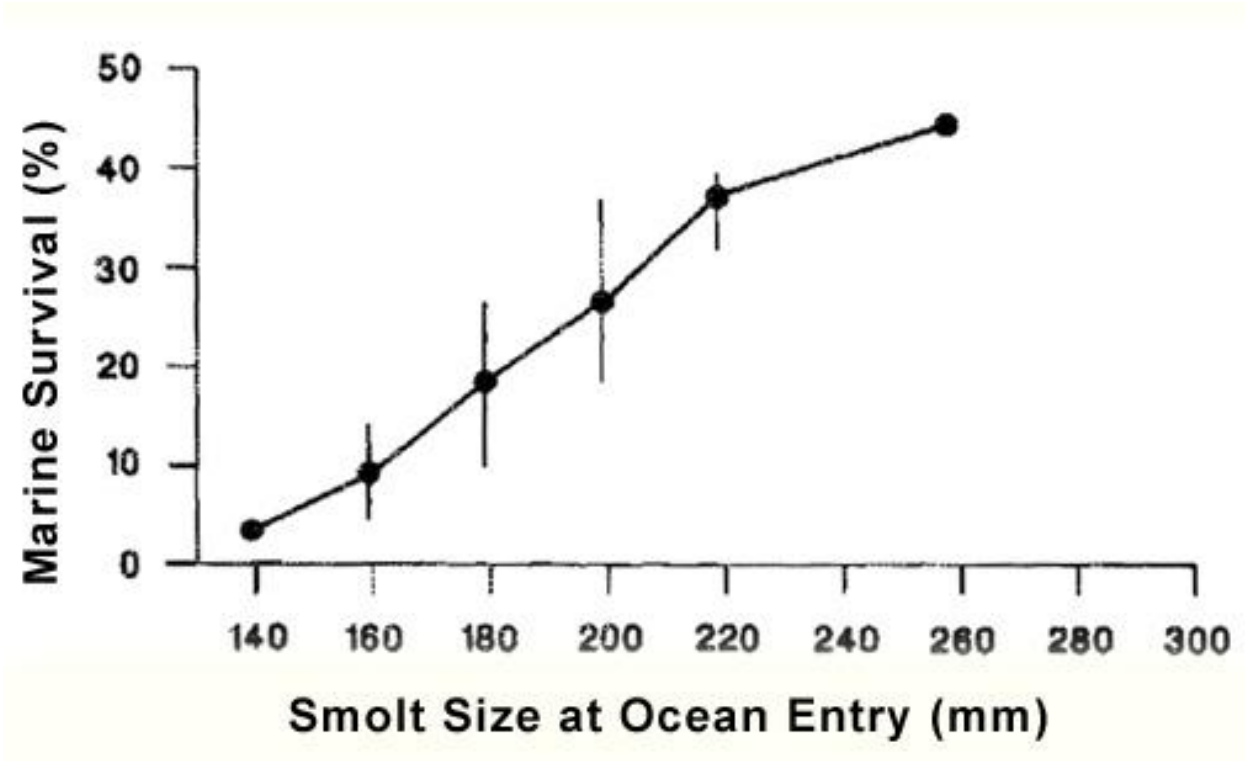


Figure 13-2. Marine survival of steelhead as a function of body size at ocean entry, in the Keogh River steelhead population described by Ward *et al*. (1989). Figure depicts the average survival to spawning of smolts emigrating in years 1977 - 1982.

High quality steelhead nursery habitats might develop where cool-water habitats receive large terrestrial inputs of food items. Terrestrial insects often fall in the water (Harvey *et al.* 2002, Douglas *et al.* 1994), and can provide a significant component of the diet of young steelhead (Rundio 2009, Rundio and Lindley, 2008). The study by Rundio and Lindley (2008) in the Big Sur area found terrestrial insects were sporadic in the diet of *O. mykiss*, but each item had large mass and thus was highly nutritious for the fish. Habitats with more frequent inputs of terrestrial insects would afford larger growth opportunities.

Finally, some habitats might produce rapid growth if there is a mechanism to keep juvenile densities low, so that individuals have expanded feeding opportunities. For example, it might be the case that intermittent streams provide expanded feeding opportunities during their wet season, because their dry season prevents the establishment of a large permanent population of resident rainbow trout. Overall, this suggests that the recovery prospects for steelhead runs would be significantly improved by identifying, restoring, and protecting those freshwater habitats that tend to produce large smolts, as part of the overall recovery strategy. These areas would qualify as steelhead "nursery habitats," defined as juvenile habitats that produce adult recruits out of proportion to their spatial extent relative to other habitats (Beck *et al*. 2001).

Recommendation: The identification and restoration of steelhead nursery habitats is a prime research opportunity with large potential

for enhancing steelhead recovery efforts. Nursery habitats would likely be estuarine or freshwater habitats that support rapid growth of young fish during the first or possibly second year of life, since large body size of migrants at ocean entry substantially improves their subsequent survival in the ocean. The simplest type of study to identify such habitats would be to use mark-recapture techniques to track growth and survival of juveniles as a function of habitat use. A more complete study would also track the consequences for marine survival.

13.3.4 Comparative Evaluation of Seasonal Lagoons

Question: What role do seasonal lagoons play in the life history of steelhead, and in particular, to what extent are seasonal lagoons used as nursery areas and promote the growth of juveniles prior to emigration to the ocean as smolts? What specific ecological factors contribute to lagoon suitability steelhead rearing (survival, growth)? What ecological factors contribute to the persistence of those lagoon features?

Discussion: One type of steelhead nursery habitat is the freshwater lagoons that form in the estuaries of many stream systems during the dry season. In some of these seasonal lagoons, juvenile steelhead can grow very quickly and enter the ocean at larger sizes, where they survive relatively well and thus contribute disproportionately to returning runs of spawners (Bond, 2006). Smith (1990), however, has observed that some lagoons can be quite vulnerable to rapid degradation in quality, and others may never be suitable, due to local environmental factors that can produce anoxic conditions or poor feeding opportunities. The existing information on the role of lagoons mostly comes from Santa Cruz County, and is focused only on a few systems. As described above, this work suggests that lagoons can comprise steelhead nursery habitat, but can also be vulnerable to various natural and anthropogenic disturbances (Smith, 1990). There is a need to determine which lagoons have the potential to play a positive role in anadromy-targeted recovery efforts.

Seasonal lagoons are a specific kind of estuary and in general, estuaries are highly dynamic interfaces between two other much larger ecosystems: freshwater stream networks on the terrestrial side, and the ocean ecosystem on the marine side. This accounts for estuaries' dynamism, complexity, and sensitivity to external influences, but also for much of their productivity (Hofmann, 2000; Jay *et al.* 2000). Although there appears to be a general unity in function of many of the small estuaries in our region (due to the general similarity of climate, terrestrial watershed conditions, and the raised coast), there is also much variation and one would expect that small differences in, say, watershed condition or coastal wind and current patterns, would sometimes translate into large differences in the suitability of lagoons as steelhead nursery habitat (Rich and Keller 2011).

Recommendation: Comparative studies on the environmental controls for productivity and reliability of lagoon habitat (including how to restore it if necessary) would aid in identifying those estuaries capable of serving as reliable steelhead nursery habitat. Such studies should focus on factors enabling rapid growth of juvenile steelhead, and factors conferring resiliency against catastrophic failure of habitat quality (anoxia, premature breaching, *etc.*).

13.3.5 Potential Nursery Role of Mainstem Habitats

Question: What role do mainstem habitats play in the life history of steelhead, and in particular, to what extent are they used as nursery areas and promote the growth of juveniles prior to emigration to the ocean as smolts? What specific ecological factors contribute to mainstem quality (survival, growth) for steelhead rearing? What ecological factors contribute to mainstem reliability?

Discussion: There may be other freshwater habitats that support high survival and robust growth of juveniles, and so constitute nursery habitat specifically for the anadromous form of the species. Low-gradient mainstem habitats, such as the trunks of the Pajaro and Salinas Rivers may also have once supported rapid growth of juveniles, particularly if reaches received enough sunlight to support primary productivity, but artesian flows or other groundwater inputs kept water cool in the summer (C. Swift, personal communication). Most mainstem habitats have now been highly altered by agricultural clearing and groundwater pumping, so an effort to determine their potential to contribute to steelhead recovery would require a focused effort.

Recommendation: The potential nursery role of mainstem habitat is much more speculative than the nursery role of lagoons. Initial assessment of the potential nursery role could take the form of 1) empirical study of mainstem habitat use by juvenile steelhead, at broad and fine scales; and 2) water-temperature modeling that accounts for effects of climate, insolation, and groundwater interaction on mainstem water temperatures, especially during the summer. The empirical work would be most useful if it applied mark-recapture techniques to assess growth and survival as a function of habitat use, and in managed rivers, as a function of the flow regime.

13.3.6 Potential Positive Roles of Intermittent Creeks

Question: Do intermittent creeks, serving as steelhead nursery habitat, positively influence the anadromous fraction of *O. mykiss* populations, or otherwise enhance viability of the anadromous form of the species?

Discussion: Juvenile *O. mykiss* are common in intermittent creeks (Boughton *et al*. 2009), but it is unclear whether these only function as sink habitat (a net drain on productivity) or play a more positive role in population viability. Boughton *et al.* (2009) observed that during the early summer in a moderately wet year, densities of young-of-the-year *O. mykiss* were nearly identical in the perennial and intermittent creeks of the Arroyo Seco watershed in Monterey County. Much of the intermittent creeks dried up and killed juveniles later in the summer, and indeed such mortality has been observed in the region for many years (Shapovalov, 1944), although it is also common to find scattered residual pools or reaches packed with fish in late summer. For example, Spina *et al.* 2005 observed fish in San Luis Obispo creek moving into sections of the stream network retaining perennial flow as other streams dried out over the summer months. The important issue for recovery purposes is identifying the potential positive, rather than negative, roles of intermittent creeks in sustaining the viability of steelhead populations.

The most obvious positive role is that intermittent creeks provide migration corridors to perennial creeks during the wet season. Perennial reaches often occur in low-order streams upstream of intermittent sections, so the corridor role increases the amount of accessible perennial habitat, and thus the size of the steelhead population that can be supported. In dry years, the corridor function would fail in some areas.

Boughton *et al*. (2009) found that most spawning habitat in the Arroyo Seco system tended to occur in intermittent streams, and argued that hydrologic and geomorphic processes would tend to produce such a pattern in general. This suggests a second positive function of intermittent streams—significantly expanding the amount of spawning habitat beyond what is available in perennial streams—but it also suggests a need for an additional corridor function. In this case, the corridor function is for young-of-the-year to emigrate to perennial reaches before the summer dry season traps and kills them.

It is possible that intermittent streams enable a high-risk, high-reward strategy on the part of young steelhead. Many individuals may be killed during the summer drying season, but those surviving in the residual pools may benefit from enhanced growth. One mechanism for enhanced growth may be cannibalism of trapped cohorts. Another mechanism for rapid growth may be rapid recolonization of the dried stream channels as flows become re-established with cooler, wet weather in the fall.[2] Such fish would find few competitors, and perhaps even an enhanced opportunity to feed on eggs and fry of the following winter's spawners (Ebersole *et al.* 2006). In this manner, intermittent creeks could serve as steelhead nursery habitat

In wet years, the seasonal drying may be substantially reduced, increasing summer survival and allowing large pulses of juveniles to be recruited to the subpopulation of adult steelhead in the ocean. Under some scenarios, such as a highly plastic life history strategy (see next section), it is possible that such pulses would be the primary mode of production for anadromous individuals, and sustain the anadromous form of the species over the long term.

Recommendation: Intermittent creeks comprise a large proportion of freshwater *O. mykiss* habitat in the region. Despite an obvious negative role in the species ecology, they may have important positive roles as well. These potentially positive roles have the status of hypotheses with general implications for recovery strategies and viability targets, and should be tested.

[2] Fall rains can re-establish flows, but flows may also be re-established by cooler fall weather, which presumably lowers transpiration demands of riparian vegetation, leaving more groundwater to maintain base flows in stream channels.

13.3.7 Spawner Density as an Indicator of Viability

Question: What spawner density (at what spatial and temporal scale) is sufficient to indicate a viable population of steelhead?

Discussion: Answering this question requires that one or more robust anadromous populations be carefully characterized. The answer is more useful in the long-term, as an indicator of progress toward recovery, than it is in the short term for achieving recovery. The most useful data would be a time-series of observations of spawner density over many years.

Recommendation: Monitor a select number of core and non-core populations to determine the numbers of spawners using both mainstem and tributary spawning habitats.

13.3.8 Clarify Population Structure

Population structure concerns the ecological and biological factors that cause fish to naturally group into functional units known as independent populations. Independent populations are defined as "a collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time period is not substantially altered by exchanges of individuals with other populations" (McElhany *et al*. 2000).

If groups of fish regularly exchange individuals, they are members of the same population, whereas if exchange is rare or does not significantly affect population dynamics, they are members of separate populations. This definition of "separateness between, exchange within" means that the proper context of most management strategies is the independent population: a strategy that directly affects only a portion of a population will soon have significant indirect effects on the rest of the

population, but few immediate effects on other populations. [3]

The independent population is also the fundamental functional unit of species persistence, and hence viability. As a result, many of the viability criteria described by Boughton *et al.* (2007b) were defined in terms of population traits such as anadromous fraction and mean spawner abundance over time. The collections of fish to which these criteria should be applied are a function of what is known about the patterns of exchange of fish among breeding biological units. Open questions about such exchange result in uncertainty about how to apply the criteria.

Thus, an analysis of a simple quantitative model led Boughton *et al*. (2007b`) to conclude that an annual adult abundance of 4,150 fish were necessary for an independent population to be considered viable. But it was unclear, due to questions of exchange patterns, whether the criteria should be applied to:

- anadromous fish in a particular watershed, or
- the sum of anadromous fish across several watersheds, or
- the sum of anadromous and freshwater-resident fish in a particular watershed, or
- the sum of anadromous and freshwater-resident fish across several watersheds

The answer has implications for the scope and scale of recovery efforts. The answer depends on the level of exchange of fish across separate coastal watersheds, and on the level of exchange between the anadromous and resident forms of the species within a particular watershed—termed 'life history crossovers". A life history crossover is a freshwater parent that has anadromous fish among its progeny, and/or vice versa. Questions about inter-watershed exchanges and life history crossovers, and the implications for viability criteria, are key issues addressed in this section.

13.3.9 Partial Migration and Life History Crossovers

Partial migration is the phenomenon in which a population consists of both migratory and resident individuals (Jonsson and Jonsson, 1993), implying the regular or at least occasional occurrence of life history crossovers. A diversity of crossover patterns have been observed in the small number of studies conducted on *O. mykiss* to date. Zimmerman and Reeves (2000) observed no crossovers in resident and anadromous *O. mykiss* of the Deschutes River in Oregon, suggesting two demographically distinct (independent) populations. For one natural and eight hatchery populations in California, Donohoe *et al.* (2008) found that anadromous females sometimes produced resident progeny, but resident females did not produce anadromous progeny, suggesting a one-way flow of crossovers away from the anadromous form.

The Babine River *O. mykiss* in British Columbia apparently exhibit modest levels of crossover (*c.* 9%) in both directions (Zimmerman and Reeves, 2000), suggesting a single population that is partially subdivided, whereas J. R. Ruzycki (personal communication in Donohoe *et al.* 2008, p. 1072) reports a high level of bidirectional crossover in various tributaries of the Grande Ronde River in Oregon (0% to 33% of anadromous adults were progeny of resident females, and 44% of resident adults were progeny of anadromous females), indicating a fully integrated population in which the two life history forms functionally coexist.

[3] Over the longer term, a permanent change in population dynamics *would* be expected to trickle out to other independent populations, due to occasional exchanges of individuals. Occasional exchanges are expected to drive important processes such as gene exchange and recolonization of stream systems following a drought.

This continuum has significant implications for viability criteria. Are the populations in South-Central California fully integrated, or does each form more or less breed true, implying demographically independent populations that share stream systems but play no role in supporting one another, and perhaps even compete? Boughton *et al.* (2007b) made recommendations that embodied these two possibilities (actually two endpoints of a continuum). In one scenario, one should specify criteria that would secure the ocean-going fish if they turn out to comprise a demographically independent population. Under the other scenario, one should specify criteria that secure the ocean-going fish if they turn out to depend on the resident form with which they coexist. However, it is possible that resolution of this uncertainty would eliminate some of the need for hedging and thus lead to a more efficient and effective recovery plan. Resolution would involve two fundamental questions:

Question 1: What is the mechanism for, and frequency of, life history crossovers in South-Central California?

Question 2: How does crossover affect the persistence of the anadromous form?

Discussion: Answering the first question will take an extended research effort. Currently, Devon Pearse and S. Sogard (NOAA Fisheries) and M. Mangel (UC Santa Cruz) are leading a research effort to better understand life history crossovers in California steelhead; Mangel and Satterthwaite (2008) give an overview of the framework being used. The hypothesis being examined is that the anadromy/residency life history crossover made by individual *O. mykiss* is cued by the environment, using a mechanism similar to what has been observed in Atlantic salmon (*Salmo salar)*, a better-studied species that also exhibits variation in the timing of the smolting process during life history. Specifically, the hypothesis is that the smolting/residency life history crossover is made by individual fish during a sensitive period some months before the actual process of smolting is observed, and that the cues for the crossover are the fish's size and growth rate during the sensitive period. This might be expected because size and growth in the freshwater habitat integrate information about the quality of that habitat, as well as about the expected survival and fecundity in the marine environment versus the freshwater environment. What is hypothesized is a physiological (and perhaps hormonal) process that processes information from the environment to produce an adaptive life history crossover (see Satterthwaite *et al.* 2012, 2010, 2009, Hayes, *et al*. 2011a, 2011b).

Though the research effort of Sogard and Mangel is important progress on the anadromy/residency life history crossover phenomenon in steelhead recovery planning, it has important limitations at this time. First, it has the status of a hypothesis and at this writing no one has actually experimentally induced life history crossovers in *O. mykiss* by manipulating size, growth rates or any other environmental factor. Second, even if the Atlantic salmon model is useful for understanding life history plasticity in *O. mykiss*, there are almost certain to be important differences and indeed surprises in the *O. mykiss* life history story. Finally, the existence of a plastic life history strategy does not preclude the possibility of important genetic constraints. For example, one might expect that even if the model is broadly correct, the specific timing of sensitive periods, and the thresholds for the size and growth cues, would probably vary quite markedly among populations of steelhead due to genetic differences. In short, the responses to environmental cues would likely have a heritable component, and this component would likely exhibit local adaptation to specific conditions. A response that is adaptive in one watershed may be selected against in another watershed, depending on environmental factors such as those discussed in the previous section.

Recommendation: It is essential for rigorous research on the mechanisms of life history plasticity in *O. mykiss* to be pursued vigorously,

for it is difficult to envision a successful recovery effort without a better understanding of the functional relationship between resident and anadromous fish. The current effort of Sogard, Mangel, and coworkers should yield useful information over time, but it focuses on two systems outside South-Central California: Soquel Creek in Santa Cruz County (a coastal redwood forest system), and the American River near Sacramento (a large Central Valley River system). One should expect local adaptation of steelhead populations in South-Central California.

Because of the likelihood of local adaptation, it would be useful and practical to address some related questions about the frequency of life history crossovers and their implications for recovery planning in the South-Central California. In particular:

- Identify environmental factors that specifically promote anadromy (discussed in the previous section). It is clear that the abundance of anadromous fish needs to be increased, and identifying relevant environmental factors would usefully inform this goal. The principal uncertainty is how much the abundance of anadromous fish needs to be increased, a separate question that depends on the frequency of life history crossovers and the mechanisms underlying them. This question can be addressed over the longer term as more is learned about the mechanism, and used to refine the viability criteria described by Boughton *et al.* (2007b).

- Estimate the frequency of life history crossovers in populations of interest, to determine whether it even occurs with any regularity. The most practical method for doing so is by analyzing otolith microchemistry of juvenile *O. mykiss* (see Donohoe *et al.* 2008), but this requires lethal sampling of juveniles. Modest lethal sampling of juveniles (as opposed to adults) may pose only a negligible increase extinction risk, due to the low reproductive value of juveniles.

- Determine how life history crossover affects the persistence of the anadromous form. This could be done using existing frameworks in population modeling, such as individually-based models or integral projection models, but would require assumptions about typical mortality and growth rates in freshwater and marine environments, as well as about frequency of life history crossovers. However, it might produce important insights. For example, persistence of anadromous runs could be strongly affected by the difference between complete lack of crossovers and a modest rate, such as 5%. However, effects would be much smaller between a 10% rate versus a 50% rate. It would be useful to more rigorously evaluate the validity and relevance of these levels of life history crossovers.

13.3.10 Rates of Dispersal Between Watersheds

Question: How common is dispersal of anadromous *O. mykiss* between watersheds, and how does it relate to population structure, especially in small coastal watersheds?

Discussion: Just as life history crossovers may knit resident and anadromous *O. mykiss* into integrated populations, frequent movement of anadromous fish through the ocean to neighboring watersheds may knit neighboring *O. mykiss* into integrated "trans-watershed" populations. If inter-watershed exchange is common, the most effective recovery strategies might be those that emphasize integration of recovery efforts across a set of linked watersheds. If inter-watershed exchange is rare,

the most effective strategies would be those that identify watersheds having stable conditions that protect small, inherently vulnerable populations.

The places where the implications of the single-watershed versus trans-watershed scenarios are most distinct are those areas along the coast where numerous small coastal watersheds occur in close proximity. In the SCCCS Recovery Planning Area, these areas include the small watersheds along Big Sur Coast BPG in Monterey and northern San Luis Obispo County, and the small watersheds within the northern portion of the San Luis Obispo Terrace BPG, in San Luis Obispo County.

Recommendation: Answering this research question will involve tracking the populations from multiple watersheds, including groupings of small, closely spaced watersheds as well as groupings involving large and small watersheds more spatially dispersed. However, it is not clear at this time what is the most practical and effective way to try to estimate exchange rates in the Recovery Planning Area. Genetic and Radio Frequency Identification (RFID) tags and ecological traps may have potential to effectively address this question, particularly in small basins where it is possible to sample a significant fraction (perhaps all) of a given cohort of adults.

13.3.11 Revision of Population Viability Targets

In the framework described by Boughton *et al.* (2007b), the key criteria for establishing population viability was that a population be demonstrated to sustain a long-term mean run size of at least 4,150 anadromous spawners per watershed per year. However, the authors noted that the criteria were chosen to be precautionary due to scientific uncertainty about key issues, and that better information might allow the criteria to be revised without increasing the risk of extinction. There were three types of information that seemed most likely to lead to useful revisions of the viability criteria:

1. The threshold run size might be able to be revised downward from 4,150 spawners per year if it was determined that year-to-year variation in run size was modest enough to be consistent with a lower threshold. The necessary information—annual estimates of run size over several decades—would come from the types of monitoring programs described below.

2. Data on the frequency of life history crossovers might justify that the 4,150 threshold could include some fraction of adult resident fish, rather than the 100% anadromous fraction currently recommended (*i.e.*, because the resident and anadromous forms are shown to comprise functionally integrated populations). The necessary information would come from successfully implementing the recommendations identified above.

3. Data on inter-basin exchanges might justify that the 4,150 threshold include spawners from neighboring watersheds (*i.e.*, because inter-watershed exchanges is sufficiently high that the fish in neighboring watersheds comprise a single, trans-watershed population). The necessary information would come from successfully implementing the recommendations identified above.

It should be noted that data for item 1 would arise over time as a byproduct of a comprehensive monitoring program, which is necessary to assess risk in any case. The priority item, however, is probably item 2, since the integration of the resident and anadromous forms is not well understood, but has profound implications for a very diverse set of management issues beyond just revision of recovery criteria.

13.4 MONITORING PROGRESS TOWARD RECOVERY GOALS

Monitoring should be conducted for each BPG, with monitoring initially focused on Core 1 populations. Monitoring involves two different but related activities: status and effectiveness monitoring. Status monitoring is intended to assess the status of a population (or a DPS) as a whole, and to assess its progress toward recovery or further decline toward extinction. It should also be designed to gather data for assessing the viability criteria described by Boughton *et al*. (2007b). Monitoring the annual run size of populations is the most important objective of status monitoring. Effectiveness monitoring is intended to assess the response of populations to specific recovery actions, and thereby develop a better understand of their effectiveness. Effectiveness monitoring will generally be more powerful if it focuses on the specific life stage affected by the recovery actions in particular habitats, and it if compares it to the same life stage in similar unaffected habitats that serve as controls.

As described by Boughton *et al*. (2007b), the general goal of recovery is to establish a diverse and geographically distributed set of populations, each of which meets viability criteria over the long term. These viability criteria are expressed in terms of mean annual runs size, persistence over time, spawner density, anadromous fraction, as well as the continued expression of life history diversity, and the spatial structure of the population. Strategies for monitoring these properties of steelhead populations over the long term are essential for assessing the attainment of recovery goals.

13.4.1 Strategy for Monitoring Steelhead in South-Central California Coast

South-Central California Coast steelhead habitats exhibit characteristics that must be considered in formulating a monitoring plan. These characteristics include differences in geology, climate and hydrology, as well as the fact that other species of anadromous salmonids are absent. The differences in the geology, climate, and hydrology are described in Adams *et al.* 2011, Boughton and Goslin (2006), and Boughton *et al*. (2006). The strategy described below considers these factors, as well as the spatial and temporal distribution of South-Central California Coast steelhead. The basic components of the South-Central California Coast steelhead monitoring strategy include:

- Reconnaissance surveys and assessments of steelhead populations
- Reconnaissance surveys and assessments of riverine and estuarine habitat conditions
- Counting stations stratified at both the BPG and population levels
- Life cycle stations (LCS) stratified at both the BPG and population levels

Presently there is no current comprehensive assessment of the condition and distribution of steelhead populations and habitats in South-Central California that use standard population and habitat assessment protocols. However, NMFS and the DFG have begun to develop a comprehensive coastal salmonid monitoring program and have identified a basic strategy, design, and methods of monitoring California coastal salmonid population (Adams *et al.* 2011).

The monitoring strategy outline here includes an, initial assessment both of the fish populations and habitat conditions. Assessments should initially focus on Core 1 populations in each BPG, and ultimately include all populations that are necessary for full recovery of the species. Stream habitat assessments should be conducted using the protocol in the California Department of Fish and Game's California Salmonid Stream Habitat Restoration Manual (Flosi *et al*. 2010).

Counting stations comprised of fixed structure utilizing technologies such as DIDSON cameras

are the most effective means of establishing abundance and trends of adult anadromous runs of steelhead and juvenile out migration. Counting stations should initially be located in Core 1 populations in each BPG.

Life cycle monitoring can be co-located with counting stations, but may also be conducted in one or more of the non-core populations which support smaller but less impacted populations. LCS monitoring efforts provide the foundation for evaluating the relationship of fish habitat use and habitat condition over time and should focus on:

- Estimation of marine and freshwater survival
- Spawning success (spawning ground distribution, redd to adult ratio)
- Juvenile rearing success (over-summering and winter growth)
- Major life history traits (anadromy/resident relationships, sex ratio, age and size structure, habitat utilization patterns, emigration age and timing, maturation patterns, run-timing, and physiological tolerances)

These LCSs could also be used in evaluating nutritional needs, predation, disease, and other environmental factors relevant to assessing the status of individual populations. Where permanent LCSs are not established, temporary stations should be deployed to maximize the development of population information in Core population watersheds.

Table 14-1 lists the preliminary sites where counting stations and LCSs should be established. LCS sites should be sited based on two criteria: their relation to the DPS and whether they are necessary to represent the full range of watershed types for each BPG.

Table 13-1. Potential South-Central California Coast Steelhead Life Cycle Monitoring Stations (alternative populations are listed in parentheses).*

Life Cycle Monitoring Station	Population	Potential Locations
1	Pajaro River (Uvas, Corralitos, Little Arthur, Llagas, Dos Picachos, Pacheco)	Highway 1 Highway 101 Bloomfield Road Redwood Retreat Road
2	Salinas River (Arroyo Seco, Nacimiento, San Antonio)	Salinas Diversion Dam Highway 101 (various crossings)
3	Carmel River	Highway 1 Rancho San Carlos Road Sleepy Hallow Crossing
4	Little Sur River	Highway 1 Old Coast Highway
5	Big Sur River	Highway 1
6	San Carpoforo Creek	Highway 1
7	Arroyo de la Cruz Creek	Highway 1
8	San Simeon Creek	Highway 1 San Simeon Creek Road
9	Santa Rosa Creek	Highway 1 Santa Creek Rosa Road
10	San Luis Obispo Creek	Avila Road Highway 101
11	Pismo Creek	Highway 101 Price Canyon Road Ormonde Road
12	Arroyo Grande Creek	Highway 1 Highway 101 Lopez Drive

* Note: Additional evaluation of other locations may identify more suitable locations than those provisionally identified here.

To the maximum extent possible, monitoring the status and trends of steelhead populations should be undertaken simultaneously with restoration efforts. Watersheds where restoration has occurred or is occurring should be considered a high priority for monitoring. Monitoring stations, whether counting or life cycle stations, should serve as a magnet for research efforts depending on fish and fish related field data.

13.4.2 Monitoring Protocols

There are various ways that status and effectiveness monitoring can be integrated, but the focus of the following discussion is on status monitoring. Below is a brief summary of potential methods to monitor run-size of steelhead (number of anadromous spawners per year per population). All these methods necessarily involve two components:

1. Observed counts for some life history stage of *O. mykiss* that contains information about run size

2. Some method for estimating the number of unobserved fish

For the first component, the observed count may actually be the run, but if it is some other life stage, there is a need to collect data to estimate a conversion factor. For example, if redds are counted, it is necessary to estimate redds per female and sex ratio to get an estimate of the full run size (Gallagher and Gallagher 2005).

The second component is necessary because simple observations can confound the true number of fish with the detection rate of the observer: A large population with poor observing conditions looks the same as a small population with excellent observing conditions. Thus, one must also estimate the number of unobserved fish, which corresponds to estimating the detection rate of the observer.

There are numerous ways to do this (Williams *et al*. 2001 provides a comprehensive technical review), but they all involve making repeated observations (often only two times) of the same group of fish. This redundancy is necessary for estimating unobserved fish. Doing so, and getting an estimate of the full population, is often far more informative than obtaining partial counts in which abundance and detection rate are confounded, because detection rates can be highly variable (Rosenberger and Dunham 2005)

13.4.2.1 Counting at Fish Ladders

Fish ladders can provide important opportunities to count upstream migrants, assuming the fish passage facilities themselves provide effective unimpeded fish passage opportunities. There are a number of technical challenges in operating fish detection and counting devises in extremely flashy systems characteristic of South-Central California (see discussion below). Additionally, this method is only relevant to watersheds that have fish ladders, and cannot quantify the portion of the run that spawns below the fish ladder. Depending on the location of the ladder and the amount and type of habitat downstream of the ladder, the spawners below the ladder can be an important component of the run.

13.4.2.2 Redd Counts

Gallagher and Gallagher (2005) have shown that salmon and steelhead runs can be estimated using redd counts. A summary of their method and is provided below:

To estimate Chinook salmon *Oncorhynchus tshawytscha*, coho salmon *O. kisutch*, and steelhead *O. mykiss* escapement in several coastal streams in northern California a stratified index redd method was developed, based on the assumption that redd size is related to the number of redds a female builds. Redd area escapement estimates were compared with estimates from more conventional methods and releases of fish above a counting structure. Reduction of counting errors and uncertainty in redd identification, biweekly surveys

throughout the spawning period, and the use of redd areas in a stratified index sampling design produced precise, reliable, and cost-effective escapement estimates for Chinook salmon, coho salmon, and steelhead.

This method has considerable promise, but has not been systematically applied in the South-Central California setting, where stream turbidity and channel geomorphology, or repeated disturbance of redds by winter storms, may make redds difficult to detect under certain circumstances. The method has high personnel requirements, because it requires the survey reaches to be visited biweekly throughout the spawning season. On the other hand, it is simple, requires only modest training in field personnel, and has modest costs other than the hiring of personnel.

13.4.2.3 Monitoring runs using the DIDSON Acoustic Camera

Dual-frequency identification sonar (DIDSON) is an off-the-shelf device that uses high frequency sound waves to produce near video-quality images of underwater objects. It can potentially be used to identify and count all migrating steelhead at some survey point in a stream system, for the entire spawning season. Its advantages are similar to those of using a weir to make counts, but has two additional advantages that are key: 1) There is no need for a weir or other device that impedes flow, and so fouling, destruction by high-flow events, etc., are not a major constraint; and 2) it can see through turbid waters (unlike a regular video camera). These two traits appear well suited to the flashy, turbid conditions typical of South-Central California streams.

DIDSON has been successfully used to estimate adult salmon escapement in high-abundance rivers in Alaska, Idaho, and British Columbia. In principle it should be suitable for low-abundance creeks, such as those in South-Central California. NOAA's' Southwest Fisheries Science Center have evaluated field methods for using the device to monitor steelhead runs in South-Central California streams (Pipal *et al.* 2010).

The principal disadvantages are: (1) the cost of the device; (2) deployment constraints for getting good images; and the risk of "flashy flows" damaging or destroying the installation. These constraints have to do with maintaining a good "insonified region" of the channel being monitored for migrants. Some channel shapes are better than others, and there also need to be a strategies for maintaining a completely insonified cross section during the advance and retreat of high flow events. In addition, there is a need to learn how to interpret poor images when they occur. However, the method has the potential to solve some of the intractable problems of monitoring steelhead in South-Central California, including counting very small numbers of migrants in very turbid waters during and after very flashy high-flow events.

13.4.2.4 Tagging Juveniles and Monitoring Migrants (T-JAMM design)

Steelhead runs can potentially be estimated by tagging juveniles with Radio Frequency Identification (RFID) tags during their freshwater phase, and subsequently monitoring migrants using in-stream tag readers.

The tagging phase use standard block-netting and electro-fishing techniques during the summer low-flow season. Depletion-sampling can be used to estimate juvenile abundances. However, Rosenberger and Dunham (2005) found that capture-recapture methods gave more robust estimates than depletion sampling, and Temple and Pearsons (2006) showed that the customary 24-hour period in capture-recapture sessions can be shortened to one or two hours, which simplifies logistics so that capture-recapture sampling can have a time-efficiency similar to that of depletion sampling.

The monitoring phase is accomplished using instream tag readers such as those described by

Bond, *et al.* (2007), Zydlewski *et al.* (2006, 2001), Ibbotson *et al.* (2004). These must be deployed for the duration of the migration season (both outgoing and incoming) each year.

The design has promise for monitoring runs of steelhead for which many other methods are problematic. In unpublished simulations, Boughton has found that the precision of run size estimates is primarily controlled by the number of tagged spawners that ultimately return and get detected. The number required is modest: around 30 to 90 tagged spawners are necessary to obtain 50% confidence intervals that stay below one-third of the estimated of run size. However, with marine survival typically falling between 0.3% and 3%, the required tagging effort would usually be between 3,400 and 45,000 juvenile fish tagged per generation per population. Other considerations in using implanted tags are the mortality/fitness risks and the permitting requirements to allow some level of take of the species. The tagging effort could perhaps be spread across a set of populations if one were willing to assume uniform marine survival across the populations.

The estimation method is robust to imperfect detection of tagged fish by the instream tag readers, as long as there are at least two readers that independently scan for tags. Reach-sampling allows the entire run to be estimated using fish from a sample of reaches. In the simulations, the number of reaches needed for acceptable precision could be as low as 30-40 under scenarios of high marine survival, with a sampling fraction of around 2% in large watersheds, such as the Arroyo Seco watershed used in the simulations.

Under low marine survival, the necessary sampling fraction was around 10% in the simulations. A side-benefit of this method is that one would obtain very good estimates of ocean survival. This is useful because it allows the overall trajectory of steelhead runs to be decomposed into marine and freshwater components. This, in turn, will deliver greater statistical power for analyzing patterns in the freshwater component. In short, one would have greater statistical power for determining if recovery actions on the freshwater side are actually having the desired effect.

Boughton has written software to estimate run size from data produced by tagging juveniles and monitoring migrants. It is written in the R computer language, a freely-available statistical programming environment that is widely used in the scientific world. Currently the work is in manuscript form. Staff scientist (T. Williams, D. Rundio, and S. Lindley) at NOAA's Southwest Fisheries Science Center are currently tagging juveniles and monitoring migrants in a case study of Big Creek steelhead population, a member of the Big Sur Coast BPG within the SCCCS DPS.

13.4.2.5 Sampling Young-of-the-Year Otoliths (YOYO design)

This method is similar to tagging juveniles and monitoring migrants, but instead of tracking the fate of captured juveniles to estimate run size, one would collect some fraction of the juveniles, and examine their otoliths and genetic relatedness. From this, one could estimate the number of anadromous mothers (and as a byproduct, non-anadromous mothers) for each annual cohort of young-of-the year fish. This should be suitable for estimating annual run size, at least of female fish.

This method would dispense with the need to implant RFID tags in fish, and the need to maintain instream tag readers during difficult winter conditions. All field work would consist of electrofishing juveniles at randomly-sampled stream reaches each summer. However, the method would require the time and expense of otolith analysis, and it would require collecting (*i.e.* killing) some fraction of the juveniles that are electrofished during the summer field season.

This method is currently not well-developed, but it has promise as a relatively simple and

efficient way to estimate run sizes using established and familiar field methods. A potential drawback is the need to kill juveniles to get their otoliths. The key unknown at this point is how many fish would have to be sampled to get a reasonable estimate of the number of anadromous mothers.

13.5 ADAPTIVE MANAGEMENT: LEARNING FROM RECOVERY EFFORTS

Adaptive management is a systematic process that uses scientific methods for monitoring, testing, and adjusting resource management policies, practices, and decisions, based on specifically defined and measurable objectives and goals (Walters 1997, 1996). Adaptive management is predicated on the recognition that natural resource systems are variable, and that knowledge of natural resource systems is often uncertain. Further, the response of natural resources systems to restoration and management actions is complex, and frequently difficult to predict with precision. The Recovery Plan provides both overall goals in the form of viability criteria, and suite of DPS-wide watershed specific recovery actions. The viability criteria, however, are provisional, and the central recovery actions are couched in broad terms which must be given more specificity on a case-by-case basis, and ultimately assessed for their effectiveness. Hence the need to adapt resource management policies, practices and research decisions to changing circumstances, or a better understanding of natural resource systems and their responses.

The success of an adaptive management program can be enhanced by having stakeholders and scientists engage in developing a shared vision for an indefinitely long future together. The development of a guiding image helps organize an adaptive management program, align interests, and enhance cooperation in a complex process. Focusing on fundamental values, rather than on predetermined means can open up possible alternative solutions; participating in this type of framework, scientists can help construct solutions that may not be self-evident to stakeholders.

Adaptive management can be applied at two basic levels: the overall goals of the recovery effort, or the individual recovery or management actions undertaken in pursuit of overall goals. The research sections above are intended to address the first application. The following discussion is focused on the second application of the concept of adaptive management.

13.5.1 Elements of an Adaptive Management Program

There is no uniformly applicable model for an adaptive management program, and key elements must be identified and tailored to recovery action-specific, site-specific, and impact-specific issues. However, effective adaptive management programs will contain three basic components: 1) adaptive experimentation by which scientists and others with appropriate expertise, learn about ecosystem functions response to recovery or management actions; 2) social learning (through public education and outreach) by which stakeholders share in the knowledge gained about ecosystem functions, and 3) institutional structures and processes of governance by which people respond by making shared decisions regarding how the ecosystem will be managed and the natural services it provides will be allocated.

Six specific elements associated with adaptive management have been identified (Panel on Adaptive Management for Resource Stewardship 2011):

1st Element: Recovery Action Objectives are Regularly Revisited and Revised. Key recovery action objectives (and related questions) should be regularly reviewed in an iterative process to help stakeholders maintain a

focus on objectives and appropriate revisions to them. The recovery goals, objectives, and criteria in Chapter 6, Steelhead Recovery Goals, Objectives & Criteria, should provide a basic framework, and the recovery actions identified for each BPG should be a starting point for the adjustment of recovery action objectives. The mandatory five-year review process can serve as a means of conveying any needed modification to the overall recovery goals, as well as individual recovery actions.

2nd Element: Model(s) of the System Being Managed. Four types of models have been have been identified in the use of adaptive management program to test hypotheses regarding the effectiveness of recovery actions (Thomas *et al.*, 2001):

Conceptual Model: Synthesis of current scientific understanding, field observation and professional judgment concerning the species, or ecological system

Diagrammatic model: Explicitly indicates interrelationships between structural components, environmental attributes and ecological processes

Mathematical model: Quantifies relationships by applying coefficients of change, formulae of correlation/causation

Computational Model: Aids in exploring or solving the mathematical relationships by analyzing the formulae on computers.

River systems are generally too complex and unique for controlled, replicated experiments, or to be the subject of traditional scientific models. However, conceptual models based on generally recognized scientific principles can provide a useful framework for refining recovery actions and testing their effectiveness. Diagrammatic models such as the one used to characterize the parallel and serial linkages in the steelhead life cycle, can also be used *in lieu* of formal mathematical models to test hypotheses regarding the effectiveness of recovery actions. Mathematical and computational models, themselves have their limitations in the context of an adaptive management program: they are difficult to explain, and require specific assumptions that may be difficult to justify. As noted in the discussion above regarding recovery goals, viability criteria are based on a combination of a synthesis of current scientific information and a simplified model which uses data not specific to the SCCCS Recovery Planning Area. Additional quantifiable data is necessary to refine the viability population and DPS models that form the basis of the provisional recovery goals, objectives and criteria. Modification of the model could result in modification of the priorities assigned to the individual recovery actions in individual populations or BPGs.

3rd Element: A Range of Management Choices. Even when a recovery action objective is agreed upon, uncertainties about the ability of possible recovery or management actions to achieve that objective are common. The range of possible recovery or management choices should be considered at the outset. This evaluation addresses the likelihood of achieving management objectives and the extent to which each alternative will generate new information or foreclose future choices. A range of recovery actions and management measures should be considered, either through a planning process or the environmental review process prior to permitting the individual recovery action.

4th Element: Monitoring and Evaluation of Outcomes. Gathering and evaluation of data allow for the testing of alternative hypotheses, and are central to improving knowledge of ecological and other systems. Monitoring should focus on significant and measurable indicators of progress toward meeting recovery objectives. Monitoring programs and results should be designed to improve understanding of environmental systems and models, to evaluate the outcomes of recovery actions, and to provide a basis for better decision making. It is critical that "thresholds" for interpreting the monitoring results are identified during the

planning of a monitoring program. This element of adaptive management will require a design based upon scientific knowledge and principles. Practical questions to be addressed include what indicators to monitor, and when and where to monitor. Guidance on a number of these issues is provided in the sections above regarding research and monitoring.

5th Element: A Mechanism for Incorporating Learning Into Future Decisions. This element recognizes the need for means to disseminate information to a wide variety of stake-holders, and a decision process for adjusting various management measures in view of the monitoring findings. Periodic evaluations of the proposed recovery action, the monitoring data and other related information, and decision-making should be an iterative process in which management objectives are regularly revisited and revised accordingly. Public outreach, including Web-based programs, should be actively pursued. Additionally, the mandatory five-year review process can serve as a means of conveying any needed modification to the Recovery Plan, and well as individual recovery actions.

6th Element: A Collaborative Structure for Stakeholder Participation and Learning. This element includes information dissemination to a variety of stakeholders, as well as a proactive program focused on soliciting decision-related inputs from a variety of stakeholder groups. Inevitably, some of the onus for adaptive management goes beyond managers, decision makers, and scientists, and rests upon interest groups and even the general public. NMFS has provided a general framework by which a shared vision can be further developed and pursued for restoring a set of watersheds supporting a network of viable steelhead populations, and providing sustainable ecological services to the human communities of South-Central California (Boughton, 2010a, Tallis *et al*. 2010, Levin *et al*., 2009, Ruckelshaus *et al*. 2008). Such a vision also provides opportunities for the protection and restoration of other native freshwater and riparian species which form an integral part of the ecosystems upon which steelhead depend.

14. Implementation by NMFS

"If anthropogenic changes can be shaped to produce disturbance regimes that more closely mimic (in both space and time) those under which the species evolved, Pacific salmon should be well equipped to deal with future challenges, just as they have throughout their evolutionary history."

Dr. Robin R. Waples, NOAA Fisheries, Research Fish Biologist

14.1 INTEGRATION OF RECOVERY INTO NMFS ACTIONS

NMFS must formally incorporate the Recovery Plans within its daily tasks and decision-making, including the actions identified in the DPS-wide Recovery Action narratives and the Recovery Action summaries for each BPG. All of NMFS' missions can be accomplished with due consideration to the needs of listed salmon and steelhead. If NMFS is to promote species and ecosystem conservation (and meet its obligations under section 7(a)(1) of the ESA), then means of incorporating recovery goals and actions must be incorporated into all of the programs and actions we administer and implement. This includes, for example, listing reviews and critical habitat designations under ESA section 4, ESA consultations under section 7, and permit actions under ESA section 10.

Implementation of the Recovery Plan by NMFS will take many forms and is generally and specifically described in the NMFS Protected Resources Division (PRD) Strategic Plan. The Interim Recovery Planning Guidance (National Marine Fisheries Service 2010a) also outlines how NMFS shall cooperate with other agencies regarding plan implementation. These documents, in addition to the ESA, shall be used by NMFS to set the framework and environment for plan implementation. The PRD Strategic Plan asserts that species conservation (in implementing Recovery Plans) by NMFS will be more strategic and proactive, rather than reactive. To maximize existing resources with workload issues and limited budgets, the PRD Strategic Plan champions organizational changes and shifts in workload priorities to focus efforts towards "those activities or areas that have biologically-significant beneficial or adverse impacts on species and ecosystem recovery" (National Marine Fisheries Service 2006a). The resultant shift will reduce NMFS engagement on those activities or projects not significant to species and ecosystem recovery.

NMFS actions to promote and implement recovery planning shall include:

- Formalizing recovery planning goals on a program-wide basis to prioritize work load allocation and decision-making (including developing mechanisms to assure the effective and timely implementation of the Recovery Plan);
- Conducting an aggressive outreach and education program aimed at all stakeholders, including federal, tribal, state, local, non–governmental organizations, landowners, and interested individuals;

- Facilitating a consistent framework for research, monitoring, and adaptive management that can directly inform recovery objectives and goals;
- Participating in the land use and water planning process at the federal, state, and local level to ensure that the provisions of the steelhead Recovery Plan are reflected in the full range of decision making processes;
- Establishing an implementation tracking system that is adaptive and pertinent to annual reporting for the Government Performance and Results Act, Bi-Annual Recovery Reports to Congress and 5-Year Reviews of each species listing status.

14.1.1 Work with Constituents and Partners

Successful implementation of Recovery Plans will require the efforts and resources of many entities, from federal agencies to the individual contributions of members of the public. NMFS commits to working cooperatively with other individuals and agencies on implementation of recovery actions and to encourage other federal agencies to implement the actions for which they have responsibility or authority. The benefits of a successful plan to the species and the currently regulated communities are immense, but the costs can be counted in time, money, and changed behaviors. NMFS is committed to using Recovery Plans as the guiding mechanism for its daily endeavors and can directly implement some of the actions called for in the plans. However, our primary role in plan implementation will be to promote the recovery strategy and provide the needed technical information and expertise to other entities implementing the part of the plan or contemplating actions that may impact the species' chances of recovery.

NMFS is engaged in outreach to various constituencies where we provide technical assistance regarding listed salmonids, their habitat needs, and various life history requirements. Developing partnerships through providing technical assistance will be critical for recovery. Our outreach efforts will need to increase both towards those constituencies with which we already engage and to expanded sets of constituencies including communities, Non-Governmental Organizations (NGOs), and Federal and State legislative representatives.

To focus efforts in areas critical for recovery, NMFS shall:

- Develop outreach and educational materials to increase public awareness and understanding of the multiple societal benefits that can be gained from steelhead recovery in South-Central California watersheds;
- Inform federal, state, and local governmental agencies of the provisions of the South-Central California Coast Steelhead Recovery Plan, and how these respective agencies' activities or planning and regulatory efforts may assist the implementation of the Recovery Plan;
- Advise watershed groups and other non-governmental organizations about the Recovery Plan, and the role of on-going watershed conservation efforts in implementing recovery actions and achieving steelhead recovery within their respective watersheds;
- Facilitate and participate in public forums designed to provide interested parties with an opportunity to directly share experiences and ideas, and learn about the methods and means of implementing steelhead recovery actions;
- Provide technical support and assistance to partners engaged in implementing steelhead recovery actions identified in the South-Central California Coast Steelhead Recovery Plan, including research and monitoring;
- Work with Federal and State agencies to coordinate and develop programmatic

permits for incidental take authorization for actions that contribute to the recovery of South-Central California Coast steelhead and their habitats;

- Work to assure adequate funding and staff support for full compliance with the legal requirements of land use, water, and natural resource protection laws, codes, regulations and ordinances across the SCCCS DPS; and
- Support the development of information networks that allow collaborators to disseminate information to a broad array of interested and affected parties about steelhead recovery efforts;

- Work with EPA Region 9 and other partners to support the amendment of the Federal Insecticide and Rodenticide Act (FIFRA) to require registrants to collect information relevant to impacts to ESA-listed salmonid species; support the implementation of best management practices (BMPs) that effectively remove pesticides from runoff;

- Work with California Regional Water Quality Control Boards to promulgate methods to detect and manage impacts from pesticides and other contaminants of especial concern (CECs) identified under 40 C.F.R. Part 136.

14.1.2 Funding Implementation of Recovery Plans

As a means of providing funding to the States, Congress established the Pacific Coastal Salmon Recovery Fund (PCSRF) to contribute to the restoration and conservation of Pacific salmon and steelhead populations and their habitats. The states of Washington, Oregon, California, Nevada, Idaho, and Alaska, and the Pacific Coastal and Columbia River tribes receive PCSRF appropriations from NMFS each year. The fund supplements existing state, tribal, and local programs to foster development of Federal-state-tribal-local partnerships in salmon and steelhead recovery and conservation. NMFS has established memoranda of understanding (MOU) with the states of Washington, Oregon, California, Idaho, and Alaska, and with three tribal commissions on behalf of 28 Indian tribes. The MOUs establish criteria and processes for funding priority PCSRF projects.

For as long as these funds are available to the State of California, NMFS intends on working with the State to ensure the South-Central California Coast steelhead recovery strategy and priorities are included in the considerations of funding for projects. NMFS also intends on using PCSRF reports as a mechanism to highlight those areas and actions where PCSRF funds have been used to implement needed recovery actions that might not otherwise occur in the absence of PCSRF funds.

NMFS has also identified other potential funding sources to support the implementation of recovery actions identified in the South-Central California Coast Steelhead Recovery Plan (for a list of additional funding sources, see Appendix E, Habitat Restoration Cost References for Steelhead Recovery Planning).

14.2 ONGOING REGULATORY PRACTICES

The ESA provides NMFS with various tools for first protecting and then recovering listed species. The ESA focuses on first identifying species and ecosystems in danger of immediate or foreseeable extinction or destruction and protecting them as their condition warrants. Then, the ESA focuses on the prevention of further declines in their condition through the consultation provisions of section 7(a)(2), habitat protection and enhancement provisions of sections 4 and 5, take prohibitions through sections 4(d) and 9, cooperation with the State(s) in which these species are found (section 6) and needed research and enhancement as well as conservation of species taken by non-federal actions through section 10. Ultimately, the ESA focuses on the conservation (commonly equated with the term recovery) of these species and

ecosystems through the recovery planning provisions of section 4, cooperation with States in section 6, and direction to all federal agencies to conserve species in section 7(a)(1). Clean Water Action Section 404 is an important tool for regulating the discharge of material or the additional of fill material to the rivers, streams, and estuaries of California, and is one of the principle means by which consultations under section 7(a)(2) can be initiated.

In the case of listed salmon and steelhead in California, NMFS has already used the listing and designation of critical habitat provisions to protect the current populations of these species. For the past two decades, NMFS has also worked closely with federal agencies and private landowners pursuant to sections 7(a)(2) and 10(a)(1) of the ESA to avoid and minimize additional harm to these species during the course of land and water-use activities. Significant benefits have already accrued to these listed species from changes in land and water-use practices. Unfortunately, in many areas, salmon and steelhead populations continue to decline. The development and implementation of Recovery Plans has a greater scope and objective than the project-by-project focus of most section 7 and 10 efforts, however. NMFS intends to use this broader perspective to effect more significant and focused beneficial change for salmon and steelhead. In addition, NMFS intends to implement every action within this Recovery Plan for which it has authority.

The following sections describe the methods NMFS intends to use when implementing various sections of the ESA. These methods are intended to institutionalize the Recovery Plans in the daily efforts and decision-making at NMFS in the Southwest Region. Of necessity, some of these methods address the urgent issues of staffing and workload that NMFS faces. As a result, our commitment to implementing Recovery Plans extends to the ways in which we prioritize the many requests for consultations and permits we receive.

14.2.1 ESA Section 4

Section 4 provides the mechanisms to list new species as threatened or endangered, designate critical habitat, develop protective regulations for threatened species, and to develop Recovery Plans. The currently designated critical habitat includes only a portion of the habitat which may be necessary for recovery of the DPS. NMFS intends on using our recovery strategy, recovery criteria and recommended recovery actions to review the SCCCS DPS critical habitat designation. A review of the current critical habitat designations may result in modifications of the current critical habitat designations, including the addition of unoccupied habitat which exhibit Primary Constituent Elements (PCEs).

14.2.2 ESA Section 5

Section 5 is a program that applies to land acquisition with respect to the National Forest System. The Los Padres National Forest is present within the range of South-Central California Coast steelhead. As funds become available, NMFS will work with the U.S. Forest Service to acquire important habitat areas for the purpose of protecting habitat features and functions needed to support the expression of diversity and spatial structure in the species.

14.2.3 ESA Section 7

14.2.3.1 Section 7(a) (1)

Section 7(a)(1) provides that all Federal agencies shall "…in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species…". Section 7(a)(1) provides that Federal agencies give the conservation of threatened species a high priority.

To prompt Federal agencies to develop conservation programs to fulfill their Federal obligations, NMFS shall:

- Prepare, and send, after Recovery Plan approval, a letter to all other appropriate Federal agencies outlining section 7(a)(1) obligations and meet with these agencies to discuss listed steelhead conservation and recovery priorities;
- Incorporate recovery actions in formal consultations as Conservation Recommendations;
- Encourage meaningful and focused mitigation, in alignment with recovery goals for restoration and threats abatement, for all actions that incidentally take steelhead or affect their habitat;
- Encourage Federal partners to include recovery actions in project proposals; and
- Incorporate conservation actions, including BMPs, as appropriate, into the actions that NMFS authorizes, funds, or carries out.

14.2.3.2 Section 7(a) (2)

The purpose of section 7(a)(2) is to "insure that any action authorized, funded, or carried out by [a Federal agency] is not likely to jeopardize the continued existence of any [listed species] or result in the destruction or adverse modification of [a listed species' critical habitat]." Federal agencies request interagency consultation with NMFS when they determine an action may affect a listed species or its critical habitat. NMFS then conducts an analysis of potential effects of the action. In the process of consultation, NMFS currently expends considerable effort to assist agencies in avoiding and minimizing the potential effects of proposed actions, and to ensure agency actions do not jeopardize a species or destroy or degrade habitat. Whether the action has a negative effect on the likelihood of the species recovering is considered as part of the analysis; the action may not appreciably reduce the likelihood of recovery. As a result, these consultations have helped avoid and minimize direct take and contributed to recovery of SCCCS DPS.

Because section 7(a)(2) applies only to Federal actions, its applications are limited only to those areas and actions with federal ownership, oversight, or funding. In the SCCCS DPS, land ownership varies across the watersheds from areas with significant levels of public ownership to areas almost entirely privately owned. Most of the land use practices on private ownership do not trigger interagency consultation.

Currently, NMFS expends most of its staff time and resources on conducting section 7 consultations. Implementation of the Recovery Plan will require improvements to the process and application of section 7(a)(2) consultation requirements across the SCCCS DPS.

In order to devote more resources towards recovery action implementation and to ensure section 7(a)(2) consultations are effective, NMFS will utilize its authorities to:

- Use recovery criteria, objectives, and ongoing monitoring efforts as a reference point to determine effects of proposed actions on the likelihood of species' recovery;
- Utilize information on threats to species recovery and needed actions to address such threats when evaluating the impacts of proposed Federal actions on South-Central California Coast steelhead;
- Place high priority on consultations for actions that implement the recovery strategy or specific recovery actions;
- Develop and maintain databases to track the amount of incidental take authorized and effectiveness of conservation and mitigation measures;

- Incorporate recovery actions in formal consultations as Reasonable and Prudent Measures, Reasonable and Prudent Alternatives, and Conservation Recommendations as appropriate;
- Focus staff priorities towards section 7 and 9 compliance in watersheds identified as core populations for the purpose of recovery of the SCCCS DPS;
- Streamline consultations for those actions with little or no effect on recovery areas or priorities. Develop streamlined programmatic approaches for those actions that do not pose a threat to the survival and recovery of the species; and
- Apply the VSP framework and recovery priorities to evaluate population and area importance in jeopardy and adverse modification analyses.

Within this framework NMFS will utilize its authorities to encourage:

- Federal Emergency Management Agency (FEMA) to fund upgrades for flood-damaged facilities to meet the requirements of the ESA and facilitate recovery;
- Environmental Protection Agency (EPA) to prioritize actions on pesticides known to be toxic to fish and/or are likely to be found in fish habitat; and to take protective actions, such as restrictions on pesticide use near water;
- Development of section 7 Conservation Recommendations to help prioritize Federal funding towards recovery actions (NFMS, USFWS, NRCS, EPA, *etc.*) during formal consultations;
- All Federal agencies that designate a non-Federal representative to conduct informal consultation or prepare a biological assessment to ensure the associated documentation comports to 50 CFR 402.14(c) prior to initiating consultations with NMFS; Compliance with these requirements is expected to increase consultation effectiveness and timeliness;
- All Federal agencies, or their designated representatives, to field review projects and actions upon project completion to determine whether or not the projects were implemented as planned and approved. Encourage all Federal agencies, or their designated representatives to report the initial findings of field review to NMFS; and
- Federal agencies to coordinate and develop programmatic incidental take authorization for activities that contribute to the recovery of South-Central California Coast steelhead to streamline their permitting processes

14.2.4 ESA Section 9

Section 9 prohibits any person from harming members of listed species including direct forms of harm such as killing an individual, or indirect forms such as destruction of habitat where individuals rear or spawn. The Recovery Plan will assist NMFS' Office of Law Enforcement (OLE) personnel by targeting focus watersheds essential for species recovery. NMFS PRD staff will work closely with NMFS' OLE regarding the identification of threats and other activities believed to place steelhead at high risk of take.

Towards this end, NMFS will:

- Conduct outreach and provide the NMFS' OLE a summary of the recovery priorities and threats;
- Prioritize those actions and areas deemed of greatest threat or importance for focused efforts to halt illegal take of listed species
- Periodically review existing protocols establishing responsibilities and priorities between PRD and Enforcement to ensure activities by NMFS staff, when supporting NMFS' OLE are focused on the highest recovery priorities; and

- When take has occurred in a primary focus area, NMFS PRD will work with NMFS' OLE, to the extent feasible, with the development of a take statement.

14.2.5 ESA Section 10

Section 10(a)(1)(A) provides permits for the authorization of take of listed species for scientific research purposes, or to enhance the propagation or survival of listed species. Typically NMFS has authorized conservation hatcheries and research activities under section 10(a)(1)(A). Section 10(a)(1)(B) provides permits for otherwise lawful activities that incidentally take listed species. Habitat conservation plans minimizing and mitigating the incidental take of listed species from non-federal activities are prepared under section 10(a)(1)(B). Currently, both processes take a long time to implement and Recovery Plans have not been available to guide priorities for permit issuance. To improve the section 10 authorization process, NMFS will utilize its authorities in the following ways:

14.2.5.1 Section 10(a) (1) (A) Research Permits

In order to assure that the best available science is developed and used to recover the SCCCS DPS NMFS will:

- Prioritize permit applications that address identified research, monitoring, and/or enhancement activities, including any conservation hatchery operations, in the South-Central California Coast Steelhead Recovery Plan;
- Evaluate all proposed research and/or enhancement activities within the framework of identified threats, recovery strategy, and recovery actions identified in the Recovery Plan;
- Develop a streamlined process for permitting priority research activities to facilitate the implementation of the research program identified in the Recovery Plan; and
- Support and maintain the national research and enhancement database to track the amount of take authorized and the effectiveness of conservation and mitigation measures identified in the Recovery Plan.

14.2.5.2 Section 10(a) (1) (B) Habitat Conservation Plans

To ensure that all of the mechanisms available to achieve the goals, objectives and criteria of the South-Central California Coast Steelhead Recovery Plan, NMFS will:

- Place the highest priority on cooperation and assistance to landowners proposing activities or programs designed to achieve recovery objectives; and
- Prioritize those areas and actions where threats abatement has the potential to provide the most significant contribution to species recovery based on the threats assessment developed and updated as part of the Recovery Plan.