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 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. The upper watersheds in the San Luis Obispo Terrace BPG are similar to the Big Sur Coast BPG, but because the spine of the Santa Lucia Range veers inland to the south, the lower portions of the watersheds are relatively flat and cut across raised marine coastal terraces before entering the Pacific Ocean.

The 12 watersheds (north to south) analyzed in this BPG were: San Carpoforo Creek, Arroyo de la Cruz, Little Pico Creek, 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 (see Figure 12-1).

The Morro Bay region al includes the separate watersheds of Morro Creek, which now empties directly 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 complex. 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.

Arroyo de la Cruz Estuary

San Simeon Creek Estuary

In general, the higher elevations receive greater amounts of precipitation as a result of the orographic effect of winter storms passing over the coastal ranges, 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).

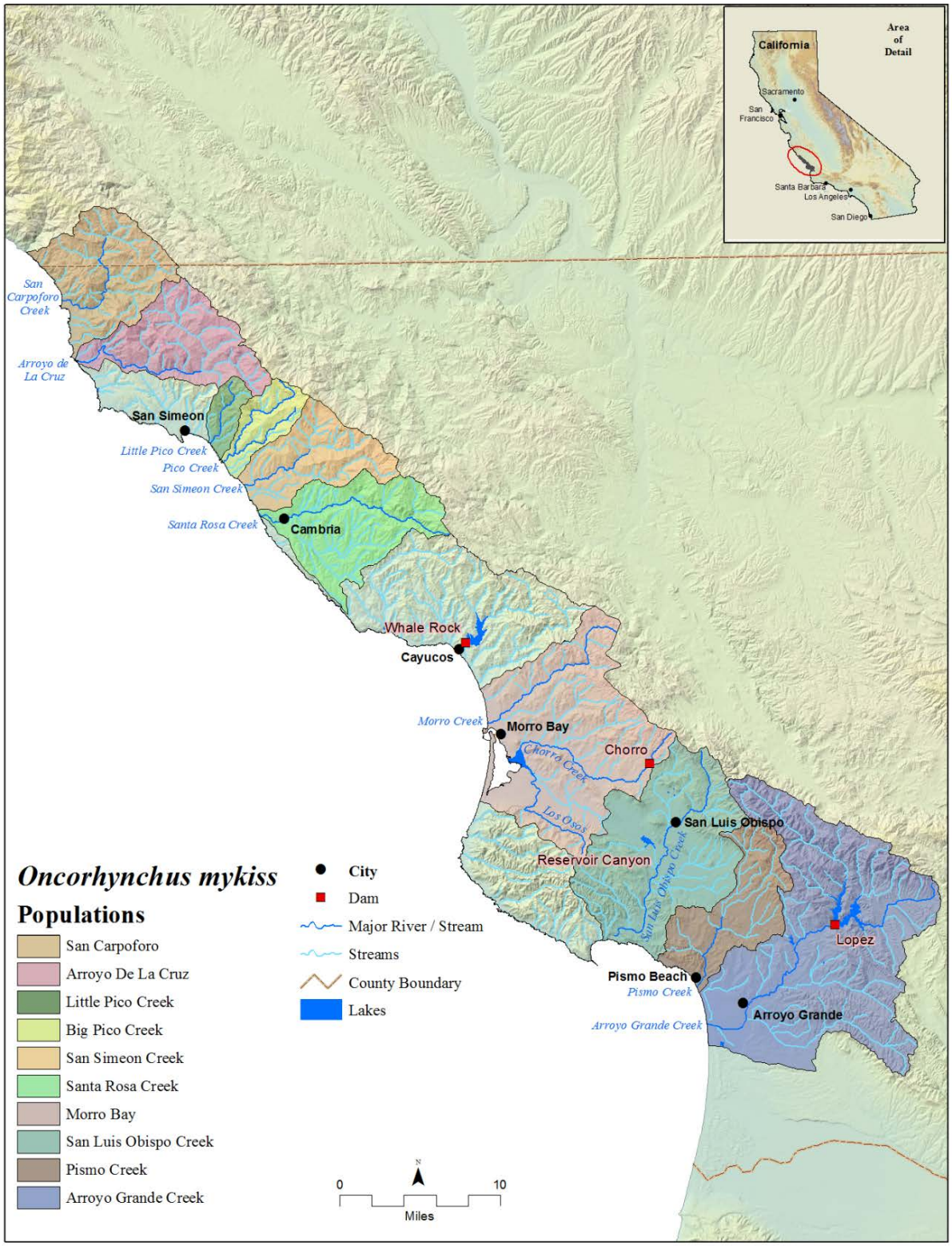

Figure 12-1. The San Luis Obispo Terrace BPG. Twelve steelhead populations/watersheds were analyzed in this region, including three in the Morro Bay region.

12.2 LAND USE

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.

Pico 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, 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. Table 12-1 summarizes land use and population density in this BPG region (Hunt & Associates 2008b, Kier Associates and National Marine Fisheries Service 2008b, Callenberger *et al.* 2002, Stephenson and Calcarone 1999, California Department of Water Resources 1978).

The increasing population density towards the southern portions of this BPG region is reflected in land-use changes, such as 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), private ownership of land, and correspondingly lower amounts of open space. The coastal terraces of the southern watersheds receive high recreational and urban use. The estuaries associated with the watersheds of the southern portion of the San Luis Obispo Terrace BPG have been subjected to extensive development (with the notable exceptions of Little Pico and Pico Creeks). 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 (Hunt & Associates 2008b, Biotic Resources Group 2006, California Department of Water Resources 1988). See Figures 12-2 through 12-5 for the pattern of federal and non-federal land ownership within the San Luis Obispo Terrace BPG.

San Luis Obispo Creek Estuary

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

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%
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.*

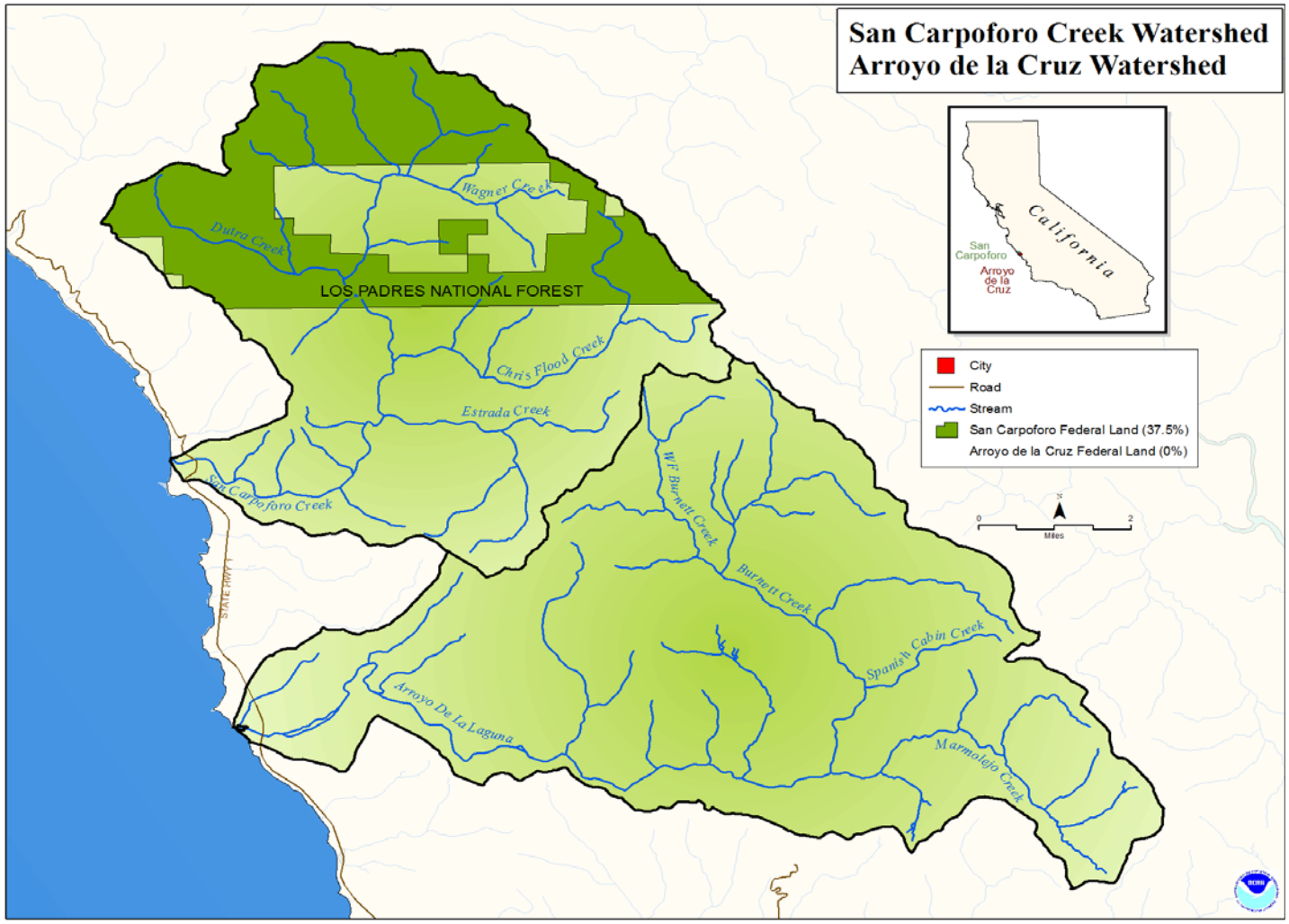

Figure 12-2. Federal and Non-Federal Land Ownership within the San Carpoforo Creek and Arroyo de la Cruz Watersheds.

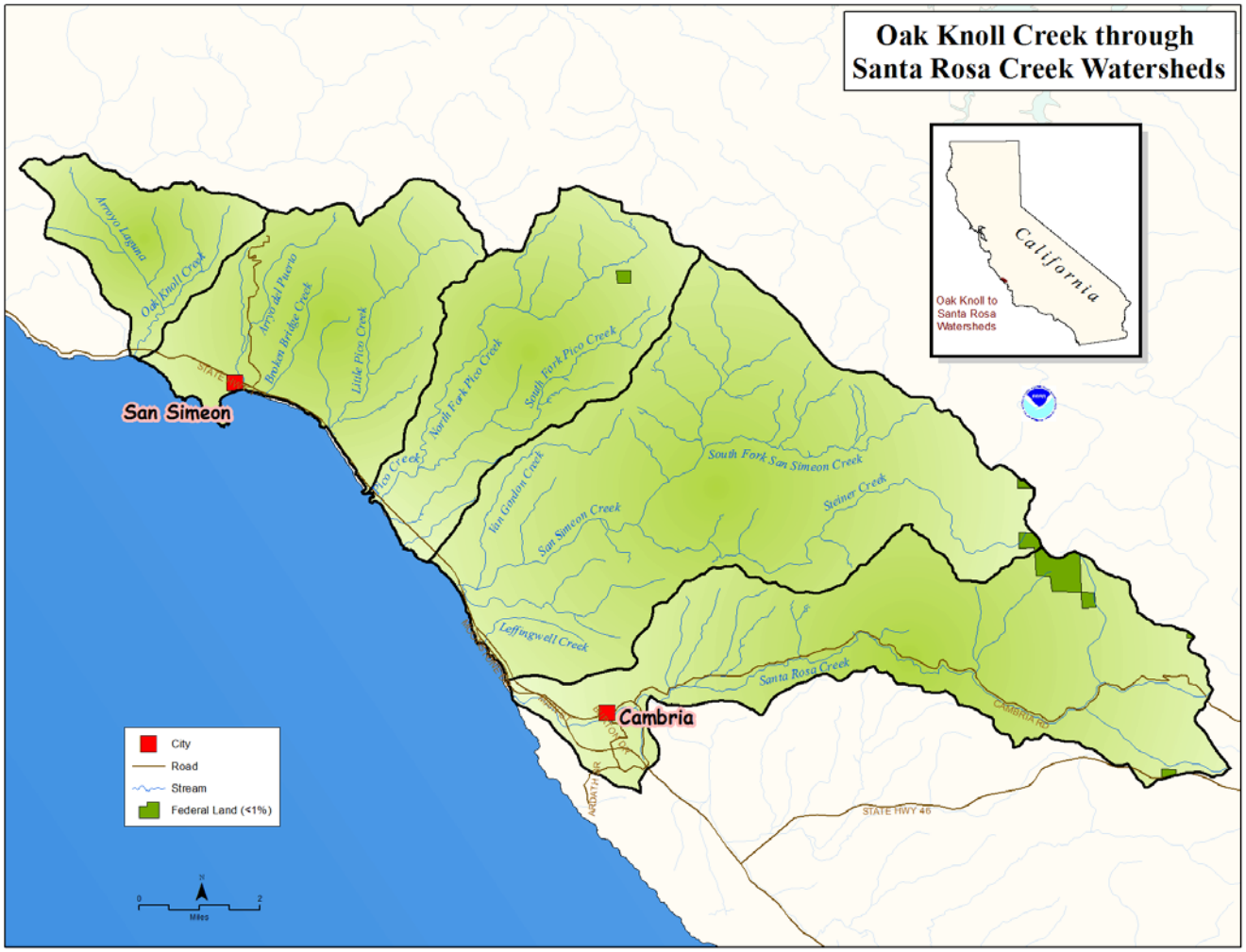

Figure 12-3. Federal and Non-Federal Land Ownership within the Oak Knoll Creek through the Santa Rosa Creek Watersheds.

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

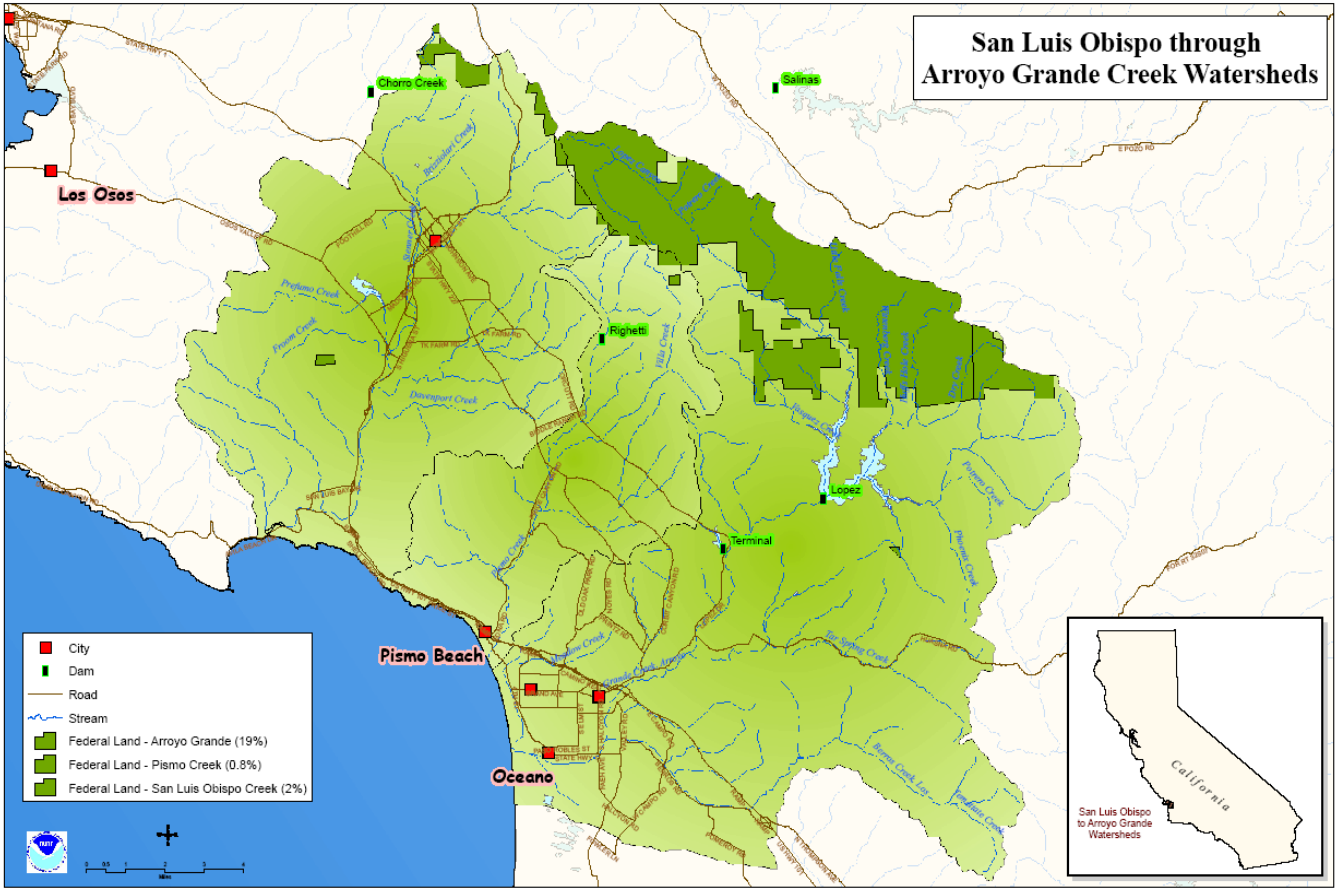

Figure 12-5. Federal and Non-Federal Land Ownership within the San Luis Obispo through the Arroyo Grande Creek Watersheds.

12.3 CURRENT WATERSHED CONDITIONS

Watershed conditions were assessed for 12 watersheds and sub-watersheds in the San Luis Obispo Terrace BPG chosen from those identified by the TRT, with the focus on conditions most directly relevant to steelhead. 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.

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, though the presence of limited agricultural operations (including grazing) have impacted some watersheds in this BPG. (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008b, Watson *et al.* 2008, California Conservation Corps 2005, Nelson *et al.* 2005a, 2005b, Jones and Stokes and Cambria Forest Committee, 2002, Wurster *et al.* 2002, Stephenson and Calcarone 1999, Nelson 1994, Jones and Stokes 1985, 1981, California Department of Water Resources 1978, Knable 1978).

The southern portion of the San Luis Obispo Terrace BPG is developed with a number of urban communities, including San Simeon, Cambria, Avila, and the Cities of San Luis Obispo, Pismo Beach, Grover Beach, and Arroyo Grande. Many of the lower or middle reaches of the steelhead bearing streams in the southern portion of the San Luis Obispo Terrace BPG run through developed communities and have been impacted by urbanization; these impacts include encroachment into the riparian corridor, channelization of the natural stream bottom and banks, various fish passage impediments at road crossings (as well as flood control structures and water diversions), and impacts to water quality from both urban runoff, and increased sedimentation stemming from road and hill, and in some cases, agricultural development.

Arroyo Grande Creek

There are also a number of dams in the southern portion of the San Luis Obispo Terrace BPG (*e.g.*, Whale Rock, Chorro Creek, and Lopez dams) which impact steelhead by limiting access to upstream spawning and rearing habitats and modifying the natural pattern of flow (and

related sandbar breaching at the estuaries). As noted above, reservoirs associated with these dams can also act as refugia for non-native warm water species (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

See Figure 12-6 for an overview of the dams and other fish passage impediments within the Carmel River Basin BPG, but note the status of fish passage impediments is in flux, with old impediments being removed or modified, while new impediments may be installed, or discovered through updated inventories; a current list of fish passage impediments can be found on the California Department of Fish and Wildlife website: http//www.cafishpassageforum.org/

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 threats 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. The 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).

San Simeon Creek

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 lower floodplain of San Simeon Creek, thereby concentrating land-use impacts in this area. The stream and riparian corridor are subject to a number of 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.

A wastewater discharge program via a groundwater infusion program within the lower San Simeon groundwater basin has potential to modify both ground and surface water levels and water quality (Harrington *et al.* 1997, Bein and Frost & Associates 1991a, 1991b, Jones and Stokes 1991, Matthews & Associates 1990, 1991, McClelland Engineers 1998). A proposed desalination plant and associated groundwater withdrawals adjacent to the Santa Rosa Creek estuary have the potential to adversely affect the lower stream reaches and estuary by periodically reducing the groundwater table that contributes to and maintains estuarine water levels, particularly during the summer when the sandbar closes the estuary off to the ocean; however, the final design of this facility has not been determined, and the precise nature and scope of any potential impacts have not been established (Cooley and Donnelly 2012, Fryer 2012, California Coastal Commission 2010, Advanced Geoscience, Inc. 2008, Cambria Community Services District 2008, 1994, D. W. Kelley & Associates 2008, 2006a, 2006b, 2001, California Department of Water Resources 2003).

Pismo Creek Estuary - Storm Drain

Development of recreational facilities at the mouth of the San Simeon Creek (San Simeon State Park) and the placement of the Highway 1 bridge abutments has eliminated 50 percent of the estuary. (Kier Associates and National Marine Fisheries Service 2008b; see also, D. W. Alley & Associates, 1997a, 1993, 1992a, Nelson *et al*. 2005b).

Fourteen anthropogenic activities ranked as the top five sources of threats to anadromous *O. mykiss* viability in the San Luis Obispo Terrace BPG (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, with less than 10 percent of any watershed converted to agricultural production, watersheds south of San Simeon Creek (*e.g.,* Santa Rosa, Cayucos, San Luis Obispo, and Arroyo Grande Creeks) share a common pattern of urban and agricultural development that 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, and placement of roads in or near the riparian corridor, and the growth of towns and cities on the floodplains, frequently at or near the estuaries. Other important sources of threats to anadromous *O. mykiss* in this BPG include: sedimentation, substrate embeddedness, excessive groundwater extraction, numerous culverts and road crossings that act as passage barriers, recreational facilities, non-point pollution as well as nutrient and coliform bacteria loading from agricultural and wastewater treatment effluents, and stream 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.

Arroyo Grande Creek – Lopez Dam

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 *et al.* 2006). The reservoirs behind these also 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 or vectors for the transmission of disease).

Arroyo del Corral Creek Estuary – Juvenile Northern Elephant Seals

Non-native fishes, crayfish, and/or amphibians also occur in the mainstems of the many watersheds in the San Luis Obispo Terrace BPG (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, 2006a, 2006b, 2001, 1997c, 1996, Rischbieter 2008, 2007, 2006, 2004, The Land Conservancy of San Luis Obispo County 2008, Allen 2007, 2001, D. W. Kelley & Associates 2007, 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 2006, 2005, 2003, Stark and Wilkison 2002, Otte and McEwan 2001, Yates 1998, Cleveland 1995, Leggett 1994, Nelson 1994b, Prunuske Chatham Inc. 1993, Rathbun *et al.* 1993, 1991a, 1991b, Russell 1990, 1991).

A newly emerging potential issue is the expansion of some marine mammal populations (*e.g.*, Northern elephant seals *Mirounga angustirostris* at Piedras Blancas near San Simeon) which seasonally gather near several small estuaries where juvenile steelhead rear.

San Luis Obispo Creek – Marre Dam

The interactions, if any, between Northern elephant seals and steelhead has not been the subject of any systematic investigation within the SCCCS DPS and its significance is therefore unknown; however, juveniles Northern elephant seals are not known to pursue prey prior to entering the marine environment. Marine mammals are protected under the Marine Mammals Protection Act of 1972 (MMPA), and their management is subject to the provisions of the MMPA (National Marine Fisheries Service 2011, Steele and Anderson 2006, Middlemas *et al*. 2005, Hinton 2003, Yurk and Trites 2000, Lowry 2002, Le Boeuf 1996, Lowry *et al.* 1987, 1996, Le Boeuf 1996, Fresh 1997, Le Boeuf and Laws 1994, Antonelis *et al.* 1994, Stewart *et al.* 1994, Stewart and Huber 1993, United State General Accounting Office, 1993, Beddington *et al.* 1985, DeMaster *et al.* 1985, Cooper 1983, Reiter *et al.* 1978, Radford *et al.* 1965).

Little Pico Creek

The original areal extent of the Pico, San Simeon, Santa Rosa, Morro, San Luis Obispo, Pismo, and Arroyo Grande Creek estuaries has been reduced between 50 and 80 percent as a result of development of recreational facilities (*e.g.*, State and County parks), Highway 1 bridge construction, and/or agricultural or urban development (Kier Associates and National Marine Fisheries Service 2008b, Wurster *et al.* 2000, Ferren *et al.* 1995, Gerdes *et al.* 1994, Dahl 1990).

Pismo Creek Estuary

Fires have been relatively minor source of disturbance in the northern watersheds of the San Luis Obispo Terrace BPG 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, Chorro, Los Osos, San Luis Obispo, Pismo, and Arroyo Grande Creek watersheds to the south have burned over this period. Increased road density and human population density in these fire-prone watersheds has served to increase fire frequency. Sedimentation and increased substrate embeddedness resulting from overgrazing and agricultural developments are also significant habitat stressors in these watersheds.

Finally, the spread of exotic and invasive species, including plant species, continues to increase with the increasing human population and related changes in land uses within the San Luis Obispo Terrace BPG; for example, Pampas Grass (*Cortaderia jubata*) along the northern coast of the San Luis Obispo Terrace BPG is extensive, and has the potential to invade most of the watersheds within the BPG. Reservoirs associated with dams can also act as refugia for non-native warm water species. The early detection, rapid response to, and preferably prevention of, these introductions is an important component in any comprehensive steelhead recovery effort within the San Luis Coast Terrace BPG.

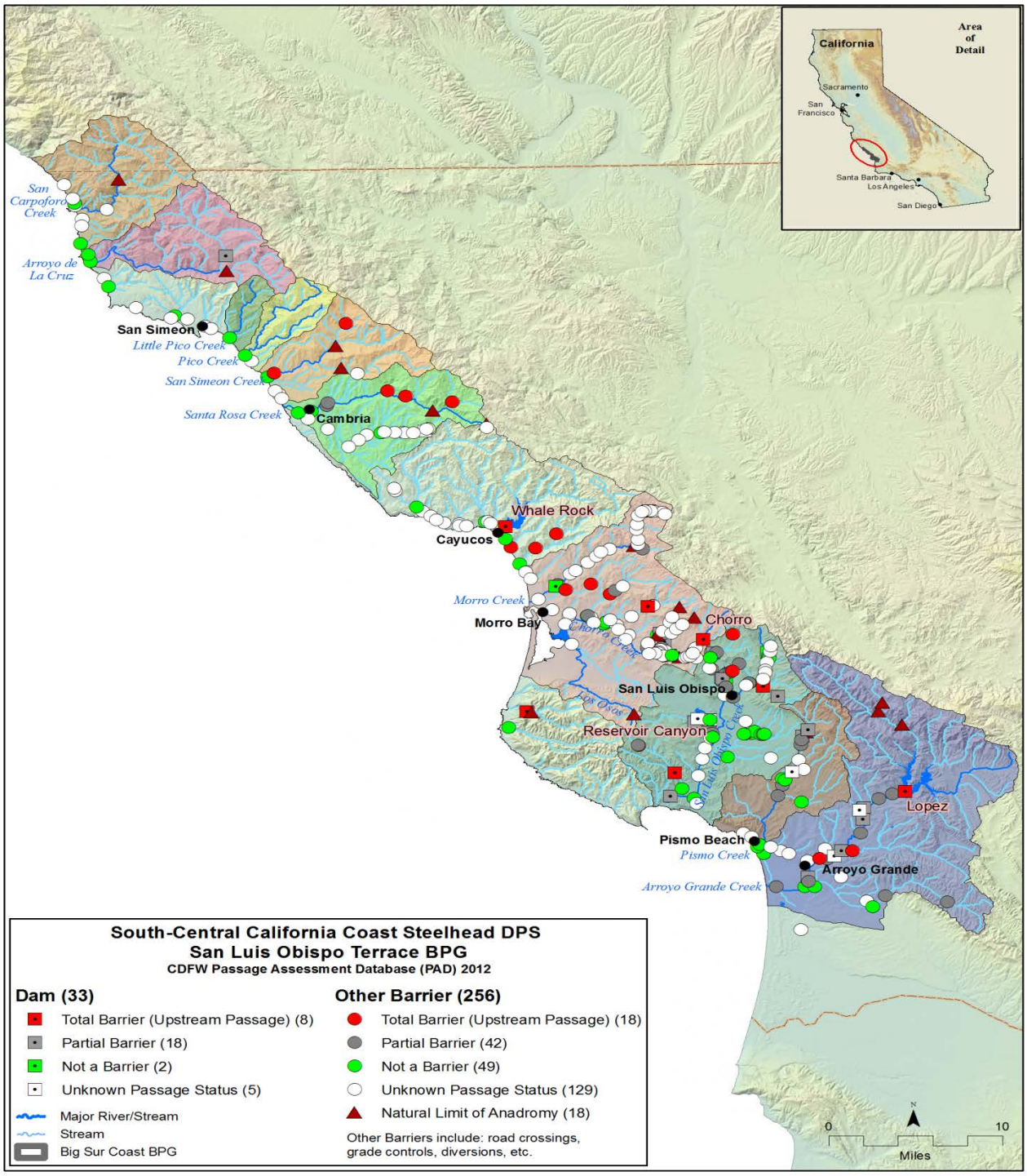

Figure 12-6. Major Fish Passage Impediments, San Luis Obispo Terrace BPG. Note: the status of fish passage impediments is in flux, with existing one being removed or modified, while new ones may be installed, or discovered through updated inventories; a current inventory of fish passage impediments can be found on the California Department of Fish and Wildlife website: http://www.cafishpassageforum.org/

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 threa

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, Arroyo de la Cruz, Little Pico, 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 developments and agricultural operations. Additionally, conditions could change in the future because much land in San Luis Obispo Terrace BPG 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, Pismo, and Arroyo Grande Creeks 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, 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.

San Carpoforo Creek Steelhead – 1970

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 guide specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the recovery actions or to target additional recovery actions as part of any recovery strategy for the San Luis Obispo Terrace BPG.

Management of the steelhead populations of the San Luis Obispo Terrace BPG will require additional investigations of the population structure of the BPG; these studies should include, but not be limited to, the role of the various individual watersheds in the maintenance of the BPG as a whole (including dispersal rates between watersheds and the relationship between the anadromous and non-anadromous forms of *O. mykiss*), how these individual populations contribute to the diversity of the BPG, and the role and use of the estuaries by steelhead, particularly rearing juveniles. The San Carpoforo and Arroyo de la Cruz Creek watersheds are south of the southernmost extent of coast redwoods and exhibit a suit of watershed characteristics (fire-prone chaparral dominated vegetation, highly erosive soils, flashy, intermittent and perennial stream flows, moderated by coastal climate, and a seasonally closed estuary). These features combined with their relatively unimpaired condition and the protection afforded by the watersheds' inclusion in public lands (U.S. Forest and State Parks) and conservation easements, makes them ideally suited for long-term ecological and population investigations (Capelli 2013).

Table 12-3 below highlights critical Recovery Actions recovery actions for the San Luis Obispo Terrace BPG. The following Tables 12-4 through 12-10 describe and prioritize recovery actions for each watershed in the San Luis Obispo Terrace BPG. These tables also provide provisional cost estimates 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	Develop and 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, including management of the artificial breaching of the creek's mouth.
Santa Rosa Creek	Develop and 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, including management of the artificial breaching of the creek's mouth.
San Luis Obispo Creek	Develop and 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, including management of the artificial breaching of the creek's mouth.
Pismo Creek	Develop and 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	Develop and 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, including management of the artificial breaching of the creek's mouth.