Historical Distribution and Current Status of Steelhead/Rainbow Trout *(Oncorhynchus mykiss)* in Streams of the San Francisco Estuary, California

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Center for Ecosystem Management and Restoration

Codornices Creek Watershed

Codornices Creek drains an urbanized watershed of about 1.1 square miles. The creek is channelized or lies underground through a large portion of its 2.9-mile length. It flows west from the Berkeley Hills, entering central San Francisco Bay at the border of the cities of Albany and Berkeley.

Codornices Creek

As part of a fish distribution study, three sites on Codornices Creek were sampled in July 1981 (Leidy 1984). No *O. mykiss* were collected.

In June 1996 a resident reported two "foot-long" *O. mykiss* just downstream of Stannage Avenue (Harvey 2003). *Oncorhynchus mykiss* (50-200 mm) have been observed regularly between the BART tracks and10th Avenue from 1997 to the present (Harvey 2003).

A group supporting urban creek restoration has been monitoring Codornices Creek since at least 1997, when trout were observed where the creek passes under the BART tracks. In November 1999, the group electrofished the creek and collected one *O. mykiss* (S. Schwartz pers. comm.). *Oncorhynchus mykiss* juveniles and adults (to 300 mm) are apparently seen regularly throughout the year in several holes from just upstream from 9th Street to Monterey Street, and the population is believed to be increasing (S. Schwartz pers. comm.).

As part of a watershed restoration project, downstream migrant trapping for *O. mykiss* was conducted on Codornices Creek in April and May 2002. A total of 33 *O. mykiss* were trapped, including 29 YOY (<75 mm FL), one *O. mykiss* between 76 and 105 mm FL, and three larger steelhead greater than 105 mm FL (Kier 2002).

Assessment: Codornices Creek likely supported *O. mykiss* historically. *Oncorhynchus mykiss* have been recorded in Codornices Creek since 1997. While habitat modification such as channelization has limited the amount of suitable habitat and created migration barriers that prevent access of *O. mykiss* to the upper watershed, successful reproduction occurs in the lower reaches of the creek. Although many of these fish are resident, anecdotal accounts suggest small numbers of anadromous spawners may sporadically enter the stream.

Strawberry Creek Watershed

Strawberry Creek drains a largely urbanized watershed. It flows west from the Oakland-Berkeley Hills, where it enters central San Francisco Bay near the Berkeley Marina. The Department of Fish and Game estimates that only 5,000 feet of the stream's more than two-mile length flows above ground (Cleugh 2002).

Strawberry Creek

Needham and Gard, in their classic study of geographic variation in coastal rainbow trout of California and Mexico, noted that Strawberry Creek on the Berkeley Campus contained steelhead runs originally (Needham and Gard 1959).

Assessment: Strawberry Creek historically supported *O. mykiss* before the cumulative effects of urbanization (*e.g.,* pollution, channelization, *etc.*) contributed to the species' extirpation from the watershed. The upper south fork of Strawberry Creek still provides fish habitat, some of which is suitable for *O. mykiss*; however, underground culverts in the lower watershed are complete barriers to upstream migration. A 2002 DFG report stated that obstacles to steelhead restoration in the watershed include frequent sewage spills and the lack of aboveground habitat (Cleugh 2002).

Temescal Creek Watershed

Temescal Creek is a 2.7-mile perennial stream that originates in the Oakland Hills. The dam forming Lake Temescal is a complete barrier to fish passage, dividing the creek into upper and lower sections. Below Lake Temescal, the creek is largely culverted as it passes through heavily urbanized portions of Oakland before entering central San Francisco Bay at the city of Emeryville.

Temescal Creek

In August 1856, at a meeting of members of the California Academy of Natural Sciences in San Francisco, Mr. D. E. Hough donated to the cabinet a specimen of *Salmo rivularis* (= *O. mykiss*) from Temescal Creek (Donations 1854-1862). No additional information was provided on the collection location or the morphology of the specimen. Trout are stocked in Lake Temescal, although successful reproduction in tributary areas has not been documented (P. Alexander pers. comm.).

Assessment: Similar to several other small streams flowing from the Berkeley-Oakland Hills, Temescal Creek supported viable populations of *O. mykiss* before the cumulative effects of urbanization led to the species' extirpation from the watershed. Temescal Creek upstream from Lake Temescal and Highway 13 contains short, remnant reaches of habitat suitable for *O. mykiss*. However, underground culverts and the dam at Lake Temescal in the lower watershed serve as complete barriers to upstream migration.

Glen Echo Creek Watershed

The headwaters of Glen Echo Creek are in the Oakland Hills upstream of Blair Park. The creek has been placed in culverts under the park, under Mountain View Cemetery, and at points in the lower watershed. It enters Lake Merritt before joining the Oakland Estuary.

Glen Echo Creek

Glen Echo Creek was sampled in June 1998 as part of an aquatic resource inventory for the city of Oakland. *No O. mykiss* were found (Hagar and Demgen 1998).

Assessment: Insufficient information is available to determine the historical status of anadromous salmonids in the Glen Echo Creek watershed. It is likely that small numbers of *O. mykiss* utilized the system historically, but that habitat degradation led to the species' extirpation from the drainage.

Sausal Creek Watershed

Sausal Creek consists of approximately 5.1 miles of stream channel. The creek has two main tributaries in the Oakland Hills, Shephard Creek draining Shepard Canyon, and Palo Seco Creek, which originates in Joaquin Miller Park. Although main stem Sausal Creek is largely channelized, an approximately two-mile reach is above ground in the vicinity of Dimond Canyon Park. Sausal Creek enters central San Francisco Bay at the Oakland/Alameda Estuary near the Fruitvale Avenue Bridge.

Sausal Creek

As part of a fish distribution study, three Sausal Creek sites were sampled in July 1981. No fish were collected (Leidy 1984). The above ground portions of Sausal Creek were surveyed in June 1998 as part of an aquatic resource inventory for the city of Oakland. No *O. mykiss* were found. The survey report concluded that the culvert under Highway 13 was impassable for upstream movement of fish (Hagar and Demgen 1998). A subsequent electrofishing survey from Dimond Canyon Park upstream into Palo Seco Creek (to the Montclair golf course) and Shephard Creek along Scout Road did not find *O. mykiss* in Sausal Creek (Lowe 2000).

In November 1999, a dead *O. mykiss* (est. TL 100 mm) was found upstream of the Leimert Boulevard Bridge (Richardson 2000). EBRPD staff concluded that successful propagation had occurred since the 1998 survey (P. Alexander pers. comm.).

Since then, numerous sightings of *O. mykiss* have occurred. A 125 mm *O. mykiss* was observed at El Centro Avenue within Dimond Canyon Park in May 2000. In August 2000, an approximately 300 mm TL *O. mykiss* was observed in the same location (Friends of Sausal Creek 2002; Lowe 2000). Two "large" *O. mykiss* were observed at El Centro Avenue on numerous occasions throughout the spring and summer of 2001 (Friends of Sausal Creek 2002). In addition, 12 juvenile *O. mykiss* (~50 mm TL) and a single 200 mm *O. mykiss* were noted within Dimond Canyon Park during a June 2001 fish survey conducted by the Friends of Sausal Creek. Three adult *O. mykiss* (300+ mm, 330 mm, 355 mm TL) were found dead on different occasions between November 2001 and February 2002; three *O. mykiss* (125-230 mm TL) were observed at El Centro Avenue in June 2002 (Friends of Sausal Creek 2002; Lowe 2000).

DFG conducted a partial survey of Sausal Creek in November 2001, but ended the survey "due to low potential to restore salmonids" (Cleugh 2002). The Department of Fish and Game staff apparently deemed the quality of the habitat in Sausal Creek to be insufficient to support an *O. mykiss* population.

Shepherd Creek

Shepard Creek was surveyed in June 1998 as part of an aquatic resources inventory of Oakland streams. A 240 mm *O. mykiss* was collected downstream of the Scout Road crossing, and was deemed to be of hatchery origin due to the lack of a reproducing population in the stream (Hagar and Demgen 1998). A subsequent electrofishing survey from Dimond Canyon Park upstream

into Palo Seco Creek (to the Montclair golf course) and Shephard Creek along Scout Road did not find *O. mykiss* in Shephard Creek (Lowe 2000).

Palo Seco Creek

Although portions of the upper watershed of Palo Seco Creek are relatively undeveloped, upstream migration from lower reaches of Sausal Creek is believed to be prevented by a culvert under the Montclair Golf Club grounds (Hagar and Demgen 1998).

In October 1997, EBRPD reported finding 15 juvenile *O. mykiss* in Palo Seco Creek (P. Alexander pers. comm.). During an aquatic resources inventory in June 1998, four *O. mykiss* (150-200 mm TL) were observed in Palo Seco Creek near Palos Colorados trailhead (Hagar and Demgen 1998). The survey report noted that the *O. mykiss* "generally gave the appearance of wild fish" (Hagar and Demgen 1998, p. 21). Another wild *O. mykiss* (190 mm TL) was found downstream from Highway 13 in 1998 (Lowe 2000). In June 2000, a 100-125 mm TL trout was spotted in Palo Seco Creek by a bird monitoring team, and two trout (~50 mm, ~100 mm TL) were observed in June 2001 during a fish survey**.**

Assessment: Sausal Creek historically supported *O. mykiss*, and it appears that currently wild fish may persist in the upper watershed, although individuals with hatchery characteristics have been found in the population as well. There is no evidence of anadromy. Barriers existing near the Montclair Golf Course separate the lower and upper watershed in terms of salmonid populations. An assessment of downstream barriers within urbanized Oakland is recommended for this drainage.

Peralta Creek Watershed

Peralta Creek originates in the Oakland hills and has a watershed consisting of low- and high-density urban residential and commercial areas (Hagar and Demgen 1998). The stream enters a culvert under Wisconsin Avenue that may be a barrier to upstream migration of fish, and additional culverted and channelized portions of the creek are found downstream of this point that may impede migration (Hagar and Demgen 1998).

Peralta Creek

As part of a fish distribution study, one site was sampled on upper Peralta Creek in July 1981. No fish were collected (Leidy 1984).

Peralta Creek was surveyed in June 1998 from Wisconsin Avenue upstream to near Jordan Avenue as part of an aquatic resource inventory of Oakland streams. No fish were seen during the survey (Hagar and Demgen 1998).

Assessment: Insufficient information is available to assess the historical occurrence of anadromous salmonids in the Peralta Creek watershed. *Oncorhynchus mykiss* has not been seen in the creek during the surveys for which we have records, and we believe that the species is absent from the drainage.

Lion Creek Watershed

Lion Creek originates in the Oakland Hills, flowing largely through culverts and channels to its mouth at San Leandro Bay. A culvert under Highway 13 is believed to be a barrier to upstream fish migration (Hagar and Demgen 1998).

Lion Creek

Lion Creek was electrofished during June 1998 from the upper end of the culvert under Highway 13 upstream for a distance of approximately 240 meters, extending to the culvert emerging from under Carson Road. No fish were collected or observed (Hagar and Demgen 1998). A city of Oakland employee reported seeing three trout in Lion Creek, probably in 1997. Two of the *O. mykiss* were adults and the third fish measured 100-125 mm TL (Trapp 1997).

Horseshoe Creek

Horseshoe Creek joins Lion Creek under Highway 13. The uppermost 0.7 miles of Horseshoe Creek on the Merritt College campus are channelized in an underground culvert (Hagar and Demgen 1998).

Electrofishing was performed for an aquatic resources inventory of Oakland streams in June 1998. A pool just below Mountain Boulevard produced ten *O. mykiss* (221-295 mm FL) (Hagar and Demgen 1998). Eroded dorsal fins on two of the fish suggested a hatchery origin. Further upstream, eight *O. mykiss* (168-262 mm) were captured in a 308-meter reach (Hagar and Demgen 1998). The largest of these fish also bore eroded pectoral, dorsal and caudal fins, again suggesting a hatchery origin. All other fish "had the appearance of wild stream fish" (Hagar and Demgen 1998, p. 11).

Chimes Creek

Chimes Creek extends from the Oakland Hills and under Highway 13. It is a tributary to Lion Creek near Seminary and MacArthur Boulevard (Demgen 1998 # 765). A June 1998 visual survey along about 270 meters of Chimes Creek conducted on behalf of the city of Oakland found no fish and the study report concluded that "the stream may be too small to support fish species" (Hagar and Demgen 1998).

Assessment: We conclude that the Lion Creek watershed historically supported anadromous *O. mykiss*. Suitable habitat upstream from Highway 13 in the Oakland Hills supports a small, isolated and apparently self-sustaining population of what may be wild *O. mykiss*, originally derived from steelhead. Further, if the trout in Horseshoe Creek are not of hatchery origin then they represent a "unique and valuable resource" (Hagar and Demgen 1998, p. 2). Extensive channelization and culverting of Lion Creek between the Bay and Horseshoe Creek near Highway 13 likely serve as barriers to migrating steelhead, although an assessment of possible downstream barriers is recommended (Hagar and Demgen 1998).

Arroyo Viejo Watershed

Arroyo Viejo drains a portion of the Oakland hills including low-density residential areas and park land in the upper reaches and highly urbanized lands in the lower drainage. The creek enters the San Francisco Estuary near San Leandro Bay.

Arroyo Viejo

As part of a fish distribution study, four Arroyo Viejo sites were sampled in July 1981. No salmonids were collected (Leidy 1984).

Two branches of Arroyo Viejo were surveyed in June 1998 as part of an aquatic resources inventory of Oakland streams. The main branch survey was upstream 1.2 miles from the Oakland Zoo, while the "Country Club" branch survey began at Calafia Avenue and was conducted upstream to the culvert at the base of Oak Hill Road. No fish were seen during the survey (Hagar and Demgen 1998).

Assessment: Arroyo Viejo likely historically supported *O. mykiss* given suitable remnant habitats remaining in the upper watershed above Highway 13. A future assessment of downstream barriers within urbanized Oakland and sampling of the upper watershed are recommended.

San Leandro Creek Watershed

San Leandro Creek is located on the eastern side of the Berkeley-San Leandro Hills and western slopes of Rocky Ridge near Moraga. The watershed is 44 square miles including areas drained by Moraga, Indian, Redwood, Buckhorn, Kaiser, Miller, and Grass Valley creeks. The construction of Chabot Reservoir in 1874-5 at approximately RM 6 completely blocked steelhead migration to these tributaries. Construction of Upper San Leandro Reservoir in 1926 further isolated the tributaries with the exception of Grass Valley Creek. Below Chabot Reservoir, San Leandro Creek passes through the highly urbanized San Leandro, entering central San Francisco Bay at the southern end of the Oakland Estuary.

San Leandro Creek

San Leandro Creek flows from its headwaters about five miles to Upper San Leandro Reservoir. From Upper San Leandro Reservoir the creek runs another 3.5 miles to Lake Chabot. San Leandro Creek consists of six miles of channel below Lake Chabot, with perennial flow occurring from Chabot Dam downstream approximately one mile to near Bancroft Street.

In March 1855, Dr. W.P. Gibbons, founder of the California Academy of Sciences described and named a new coastal variety of rainbow trout as *Salmo iridia* (later changed to *irideus*, Latin for rainbow) based on three specimens from San Leandro Creek (Ayres 1855).

The Sportsman Gazetteer for 1877 reported that rainbow trout could be caught at "San Leandro" immediately upstream from the waterworks (Hallock 1877). The reference likely pertains to San Leandro Creek above Lake Chabot.

A February 1957 letter from Willis Evans, DFG, to Dr. Paul Needham, U. C. Berkeley, noted that DFG Warden George Smalley, a 30-year resident of the San Leandro Creek area, reported that runs of steelhead occurred in San Leandro Creek "in the early days" (Evans 1957). Mr. Evans further noted that after the completion of Upper San Leandro Reservoir, a run persisted to the base of the dam for many years (Evans 1957). Needham and Gard, in their 1959 study of geographic variation in coastal rainbow trout of California and Mexico, noted that San Leandro Creek originally supported steelhead runs (Needham and Gard 1959).

A study of *O. mykiss* spawning activity in the San Leandro Creek watershed involved weekly visual observations of fish between April and September 1972. A San Leandro Creek site consisted of a 90-meter reach located upstream from Upper San Leandro Reservoir near the culvert immediately downstream from the intersection of Pinehurst and Canyon roads. Qualitative observations along the study section verified the presence of *O. mykiss* fry, and adults were seen throughout the study period (Arnold 1973).

In August 1975, DFG visually surveyed 6.2 miles of San Leandro Creek from the mouth to Lake Chabot. In the survey report, DFG noted that the study reach supported a remnant steelhead run, which was considered the only known viable steelhead trout population on the east shore of San Francisco Bay (Curtis and Scoppettone 1975a). The report also stated that a resident rainbow trout population existed upstream from Lake Chabot. The survey found numerous 50-75 mm steelhead trout between Lake Chabot to approximately 100 yards downstream from Interstate 580 (Curtis and Scoppettone 1975a). Also, the report cited accounts by local anglers of age 1+ and 2+ steelhead taken frequently. The report noted a four-foot high flashboard barrier 0.3miles upstream from Interstate 580 that is passable for steelhead during winter flows with the flashboards removed. The survey observed that spawning habitat was "fair" and shelter "good" and further concluded that San Leandro Creek should be managed to protect the remnant steelhead resource, including obtaining minimum in-stream releases from Lake Chabot (Curtis and Scoppettone 1975a).

As part of fish a distribution study, ten sites were sampled on San Leandro Creek during July and August 1981. Approximately 100 feet downstream from the Chabot dam spillway, seven *O. mykiss* ranging from 42-106 mm FL, and one fish of 311 mm FL, were collected (Leidy 1981-1984, 1984). Approximately 0.45 miles upstream from the Canyon post office, 27 *O. mykiss* (40-68 mm FL) were collected. At a site approximately 0.5 miles upstream from Upper San Leandro Reservoir, 12 YOY *O. mykiss* (33-72 mm FL) and one larger fish (212 mm FL) were collected from a series of isolated pools. No *O. mykiss* were found at seven sampled sites near and downstream from MacArthur Boulevard and Interstate 880 (Leidy 1981-1984, 1984).

DFG surveyed San Leandro Creek between Interstate 880 and 2.3 miles above Lake Chabot in December 1982 (Berthelsen 1982). Two *O. mykiss* (~300 mm TL) were observed under the Interstate 880 overpass and were presumed to have been washed out of Lake Chabot (Berthelsen 1982). The survey report noted that San Leandro Creek below Lake Chabot supported the last known steelhead run on the east shore of San Francisco Bay and that rainbow trout were known to move up the creek from Lake Chabot. The report concluded that Lower San Leandro Creek appeared to provide good spawning habitat for steelhead except for siltation problems. It further recommended investigating summer flow releases into the creek from Upper San Leandro Reservoir (Berthelsen 1982).

In September 1983, EBRPD electrofished three upper San Leandro Creek reaches. The first reach, located 100 yards downstream from the Indian Creek confluence, yielded 25 *O. mykiss* including YOY (not measured) and adults to 178 mm FL (Alexander 1984a). Sampling in various pools along the creek adjacent to Pinehurst Road produced 26 trout, including YOY (not measured) and adults to 198 mm FL. The third reach was more than 300 yards below a complete barrier to fish passage at the abandoned Southern Pacific railroad crossing. This reach yielded three *O. mykiss* year classes, including "many" YOY (not measured), age 1+ (>15), and age 2+ (8: 125-200 mm FL) (Alexander 1984a).

In April and June 1984, EBRPD electrofished two reaches on upper San Leandro Creek. The first site, a 90-meter reach upstream from the intersection of Pinehurst and Moraga roads produced nine *O. mykiss* (89-369 mm FL). The second site, a single pool above Canyon Road at RM 4.0, produced 13 trout (89-445 mm FL) (Alexander 1984b).

During June 1986, EBRPD electrofished upper San Leandro Creek at three locations. Station 1, a 90-meter reach upstream of Pinehurst Road did not produce any *O. mykiss*, and staff noted that a culvert under Pinehurst Road was a barrier to upstream fish passage (Alexander 1984b). At stations 2 and 3, reaches downstream from Pinehurst Road, abundant YOY *O. mykiss* and adults (14: <200 mm FL; 1: 400-600 mm TL) were found (Alexander 1987).

In June 1989, EBMUD observed abundant *O. mykiss* YOY at five different locations on upper San Leandro Creek, including upstream from "The Farm", at McCosker Ranch Road, downstream from McCosker Ranch Road, immediately upstream from the Canyon Post Office, at Canyon School, and at the Redwood Trail crossing (Hagar 1989a). During July 1989, EBMUD followed up with an electrofishing survey at two sites and visual surveys at several other locations. YOY were abundant at all locations. At the Redwood Trail crossing, 37 YOY were caught but not measured (Hagar 1989a). At Canyon School, 16 YOY (not measured) and nine older *O. mykiss* (101-337 mm FL) were caught (Hagar 1989a).

From March through July 1990, EBMUD trapped upstream- and downstream-migrating *O. mykiss* in tributaries of the upper San Leandro Creek watershed. Within upper San Leandro Creek, the trapping effort found 1,524 individuals captured and measured, yielding the following age class distribution: 1,316 YOY, 141 juveniles and 67 adults (EBMUD 1991). Age determinations were made by analyzing scales from a sample of the population, leading the researchers to characterize YOY as 70 mm TL or below, juveniles as 71-220 mm TL, and adults as fish larger than 220 mm TL. The study found that more than 90% of the adult spawners, and YOY and older juvenile trout, in the study area were trapped in San Leandro Creek (EBMUD 1991).

In July and August 1990, EBRPD electrofished 28 randomly chosen sites on upper San Leandro Creek in conjunction with habitat surveys to estimate the total *O. mykiss* population size. *Oncorhynchus mykiss* sampled had a mean length of 62 mm TL (Holsinger et al. 1991). Densities ranged from 4-237 fish per 86 square meters, and the *O. mykiss* population in San Leandro Creek was estimated at between approximately 6,000-11,000 individuals (Holsinger et al. 1991).

During March 1993, EBMUD electrofished three sites on San Leandro Creek from immediately downstream from the spillway of upper San Leandro Reservoir at the confluence with Miller Creek downstream to approximately 400 yards upstream from the Willow Park Golf Course. No *O. mykiss* were caught or observed (Hartwell 1993).

In June 1993, Leidy electrofished three sites on San Leandro Creek. One site was below Chabot Reservoir immediately downstream from the bridge at the entrance to San Leandro City Park, where Leidy collected four *O. mykiss* (68-82 mm FL) (Leidy 2002). Leidy also electrofished three sites on San Leandro Creek above upper San Leandro Reservoir. In one reach approximately 50 meters downstream from the confluence of Indian Creek, he caught 23 *O. mykiss* (42-82 mm FL). In the reach immediately downstream from this station, also downstream from a major intersecting fire road culvert along Pinehurst Road, Leidy caught 41 *O. mykiss* (26-110 mm FL) and one larger *O. mykiss* (154 mm FL) which was an age 1+ fish (Leidy 2002). At a site 0.3 miles upstream from the lower Pinehurst Road crossing he caught 24 *O. mykiss* (33-123 mm FL).

In February 1997, Leidy electrofished a 30 meter reach on lower San Leandro Creek centered on the footbridge upstream of East 14th Street and the school in San Leandro. He caught one *O. mykiss* (465 mm FL) that exhibited spawning coloration (Leidy 2002). Results of the EBMUD sampling of San Leandro Creek upstream of Upper San Leandro Reservoir between 1996 and 2001 are offered in Table IV-1.

Table IV-1. EBMUD *O. mykiss* sampling results from San Leandro Creek, 1996-2001

Date	No.	Size (mm)	Date	No.	Size (mm)
June 1996	9	40-142	April 1999	12	119-370
Sept. 1997	59	43-189	July 1999	66	26-215
June 1998	18	34-175	Feb. 2001	2	410-420
Dec. 1998	20	45-215	Feb. 2001	5	331-490
Dec. 1998	9	48-139			

(Source: Hartwell 2002b; Setka 2003c)

EBMUD conducted electrofishing on San Leandro Creek below Chabot Dam on three dates in 2000. All surveys occurred at San Leandro City Park. In April 2000, 32 *O. mykiss* (188-350 mm) were collected. Thirteen *O. mykiss* (73-220 mm) were collected in October, one of which displayed smolt characteristics. In December, 12 *O. mykiss* (74-218 mm) were collected, with two displaying smolt characteristics (Setka 2000).

In November 2001, DFG surveyed the San Leandro Creek channel below Lake Chabot and identified a possible migration barrier consisting of a four-foot concrete weir off Marlow Avenue, 0.3 miles upstream from Interstate 80 (Cleugh 2002).

Grass Valley Creek

Grass Valley Creek flows into the northern-most arm of Lake Chabot. EBRPD staff noted *O. mykiss* in this creek, and speculated that their likely source was introduced fish of hatchery origin (P. Alexander pers. comm.).

Miller Creek

In March 1993, EBMUD electrofished the lower 98 meters of Miller Creek above its confluence with San Leandro Creek. No *O. mykiss* were caught or observed (Hartwell 1993).

Kaiser Creek

Kaiser Creek is a tributary of Upper San Leandro Reservoir. In November 1983, EBRPD electrofished Kaiser Creek from the area surrounding its confluence with Upper San Leandro Reservoir upstream approximately 60 meters. Staff from EDRPD also electrofished the upper sections of the creek. Two *O. mykiss* were caught at each sampling site (79 and 89 mm and 183 and 188 mm, respectively) (Alexander 1984a). However, the possibility exists that the creek sampled was actually Buckhorn Creek (Alexander 1988).

During May 1984, EBRPD electrofished two Kaiser Creek locations. Four *O. mykiss* YOY (38-42 mm FL) were collected within a 400-meter reach upstream from the "Old Orchard" (Alexander 1984b). Fifteen individuals from two age classes (13 YOY; 2 1+: <220 mm FL) were collected 0.25 miles upstream from the "Old Orchard" reach, immediately downstream from a debris dam (Alexander 1984b).

In August 1986, EBMUD obtained 52 yearling *O. mykiss* from Kaiser Creek for genetic analysis. Allele frequencies for 17 biochemical marker-loci were compared between the Kaiser Creek fish and *O. mykiss* from 13 present and former California steelhead streams including Redwood Creek. The study report stated that *O. mykiss* from Redwood and Kaiser creeks represents a unique population of non-hybridized coastal rainbow trout that has been isolated from migrating steelhead for over 112 years (*i.e.,* since construction of Chabot Dam in 1875) (Bentley and Gall undated; Gall et al. 1990).

In June 1989, Jeff Hagar, a consulting fisheries biologist to EBRPD, sampled three sites on Kaiser Creek. Adult *O. mykiss* (2: 337, 466 mm FL) were caught upstream from the confluence with Buckhorn Creek, and downstream from the confluence with Callahan Creek (2: 221, 380 mm FL) (Hagar 1989a). YOY *O. mykiss* (2: 45, 55 mm FL) also were sampled at the Callahan Creek site, indicating that trout were able to spawn successfully despite drought conditions (Hagar 1989a).

From March through July 1990, EBRPD trapped migrating *O. mykiss* in several tributaries to Upper San Leandro Reservoir. Although 1,670 *O. mykiss* were collected in other tributaries, none were caught in Kaiser Creek (EBMUD 1991). The study report stated that trout occurred in Kaiser Creek though none utilized the creek during the study period (EBMUD 1991).

In July and August 1990, EBRPD electrofished 43 randomly chosen sites on Kaiser Creek in conjunction with habitat surveys to estimate the total *O. mykiss* population size. *Oncorhynchus mykiss* sampled had a mean length of 176 mm TL (Holsinger et al. 1991). Densities ranged from 3-25 per 86 square meters, and the *O. mykiss* population in Kaiser Creek was estimated to be 35-68 individuals (Holsinger et al. 1991).

Staff from EBRPD electrofished Kaiser Creek on seven occasions between March 1998 and January 2000. *Oncorhynchus mykiss* were found at six locations throughout the watershed, with sizes ranging from 35-308 mm. Multiple age classes were identified in each year (Setka 2003a).

Buckhorn Creek

Buckhorn Creek is a tributary of Upper San Leandro Reservoir. In November 1983, EBRPD electrofished what staff thought was Kaiser Creek (but may have been Buckhorn Creek) at its mouth and also in its upper sections. Two *O. mykiss* were caught near the mouth (79 and 89 mm), and two *O. mykiss* were caught in the upper sections (183 and 188 mm) (Alexander 1984a, 1988).

In June 1989, DFG electrofished two sites on Buckhorn Creek, 0.3 miles upstream and 0.2 miles downstream from "Buckhorn Barn." No fish were observed or collected (Hagar 1989a). The survey report concluded that Buckhorn Creek did not provide suitable summer habitat conditions for juvenile and older trout during the on-going drought (Hagar 1989a).

From March through July 1990, EBRPD trapped upstream and downstream migrating *O. mykiss* in tributaries to Upper San Leandro Reservoir. Although 1,670 *O. mykiss* were collected in other tributaries, none were caught in Buckhorn Creek (EBMUD 1991). The study report concluded that Buckhorn Creek did not support trout, especially in dry years (EBMUD 1991). During July and August 1990, EBRPD electrofished two sites on Buckhorn Creek in conjunction with habitat surveys to determine the total *O. mykiss* population size. No *O. mykiss* were caught and the total population in Buckhorn Creek was estimated to be zero (Holsinger et al. 1991).

EBMUD staff visually observed *O. mykiss* spawning in the lower portions of the Buckhorn Creek in winter 2001-2002<Setka, 2003 #25>. While successful reproduction may occur in some years, this tributary is believed to have limited habitat value, due to low flows in most water years, and high levels of sedimentation occurring in the basin (J. Setka pers. comm.).

Redwood Creek

Redwood Creek is a tributary of Upper San Leandro Reservoir and is formed by two tributaries, west branch and east branch, which originate in Redwood Regional Park. A study of *O. mykiss* spawning activity in the San Leandro Creek watershed involved weekly visual observations of fish between April and September 1972. A Redwood Creek site consisted of a 90-meter reach located upstream from Upper San Leandro Reservoir beginning at the culvert at the intersection of Pinehurst and Redwood roads. Adult and fingerling *O. mykiss* were noted between the intersection of Pinehurst and Redwood roads and Redwood Park throughout the study period (Arnold 1973).

In March 1978, EBRPD and DFG electrofished several reaches of Redwood Creek in Redwood Regional Park. Five *O. mykiss* were collected (351–399 mm FL) downstream of a barrier formed by a masonry bridge with an inoperative fish ladder (Paulsen et al. 1978b).

In June 1978, EBRPD and DFG electrofished two reaches of Redwood Creek immediately downstream from the Redwood Creek Fire Station on Redwood Road. One 45-meter reach yielded 38 *O. mykiss* (25-64 mm FL) (Paulsen et al. 1978a). The other 45-meter reach yielded 64 *O. mykiss* (23–65 mm FL). According to the study report, the estimated *O. mykiss* density in the main fork of Redwood Creek was 180 fish per 45 meters of stream. The report concluded that Redwood Creek below the masonry road bridge crossing within Redwood Regional Park was "excellent" nursery and spawning habitat for rainbow trout (Paulsen et al. 1978a).

In March 1979, DFG, EBRPD and CALTROUT electrofished seven reaches in the Redwood Creek watershed above Upper San Leandro Reservoir to verify the presence of spawning adult *O. mykiss*. Young of the year *O. mykiss* were observed in all sampled reaches (23: 58-127 mm FL) (Paulsen 1979). Adults were found below the masonry road crossing to Redwood Regional Park, and in the west fork (11: 201-445 FL) (Paulsen 1979).

In April 1979, DFG and EBRPD electrofished a 420 meter reach of Redwood Creek upstream from the mouth at Upper San Leandro Reservoir. One sexually mature *O. mykiss* (404 mm) was collected as well as 70 juveniles (76-170 mm FL) (Paulsen 1979). In March 1980, DFG and EBRPD electrofished five sites in Redwood Creek as part of an on-going monitoring program on spawning success of adfluvial rainbow trout using the Upper San Leandro Reservoir. The sampling documented 68 *O. mykiss* ranging in size from 76-437 mm FL (Paulsen 1980).

In April 1981, DFG and EBRPD electrofished three stations on Redwood Creek and the West Fork of Redwood Creek upstream from Upper San Leandro Reservoir. The first sampling station on Redwood Creek from the masonry bridge to the confluence with the West Fork yielded 33 fish (51-381 mm FL) (Burger 1981). A second station on Redwood Creek from Pinehurst Road upstream to the confluence of the West Fork produced 108 fish (66-417 mm FL). The station on the West Fork adjacent to Redwood Road near Big Springs yielded 17 trout (94-381 mm FL). Three stations yielded a total of 158 *O. mykiss* representing 5-year classes according to scale analyses (66-417 mm FL). The final report concluded that Redwood Creek had value as a nursery

for immature fish as well as providing spawning habitat. Summer "carryover" of young rainbow trout in isolated pools was considered to be good (Burger 1981).

As part of a fish distribution study, Redwood Creek was sampled by seine in August 1981. *Oncorhynchus mykiss* (14: 41-127 mm FL) was confined to one of five isolated pools sampled 3.7 miles downstream from the junction of Redwood and Pinehurst Roads (Leidy 1984). Forty-six *O. mykiss* (22-62 mm FL) along with two larger *O. mykiss* (146, 146 mm FL) were found in the pool immediately below the second bridge crossing within the main entrance to Redwood Regional Park. *Oncorhynchus mykiss* also were found in pools at the first upstream crossing above the main park entrance (16: 40-130 mm FL), immediately above the parking lot bridge at the McDonald Trail entrance (27: 35-76 mm FL), at the bridge 0.8 miles downstream from the junction of Skyline and Redwood Road (10: 42-80mm FL), and on the McDonald Branch of Redwood Creek 0.25 miles upstream from its confluence with main stem Redwood Creek (3: 40, 52, 56 mm FL) (Leidy 1984).

Redwood Creek upstream of Upper San Leandro Reservoir was sampled by DFG and EBRPD in April 1982. Eight sites were electrofished from Redwood Road marker 2.48 upstream to the confluence of the east and west branches, and up the north branch to the masonry bridge, yielding 37 *O. mykiss* ranging from 29-438 mm FL (Alexander 1982). Scale analysis later found the following relationship between age and size: 1+, 153.5 mm; 2+, 191.3 mm; and, 3+, 291.5 mm. Only one age 4+ individual (328 mm) and one age 5+ (438 mm) individual were analyzed (Alexander 1982).

In September 1983, EBRPD electrofished Redwood Creek to procure *O. mykiss* for stocking into Wildcat Creek within Tilden Regional Park. An estimated 30-40 percent of "trout bearing areas" within Redwood Creek were shocked, yielding 615 individuals (Alexander 1984a).

In April 1984, the EBRPD and DFG electrofished Redwood Creek at five locations below and three locations above a newly installed Denil fishway. Results are listed in Table IV-2.

Table IV-2. EBRPD and DFG Redwood Creek *O. mykiss* sampling results, April 1984

Location	**Number Juveniles (number YOY)**	**Size Range (mm FL)**
Main stem		
Pinehurst and Redwood roads	24	45-156
	(1)	
Below fire station	38	95-358
Fire station to east and west branch confluence	13	38-332
	("several")	
East branch		
Confluence up to masonry bridge	19	83-297
Below and in fishway	3	142-168
Above fishway near Laurel Grove	1	317
	(10)	
At old church	7	84-190
West branch		
At Grass Valley water tank tributary	27	81-320
	("many")	

(Source: Alexander 1984b).

In October 1984, EBRPD obtained 53 yearling *O. mykiss* from Redwood Creek for genetic analysis. As discussed in the Kaiser Creek section, above, these fish appeared to be non-hybridized descendants of coastal *O. mykiss* (Bentley and Gall undated; Gall et al. 1990).

In April 1985, DFG and EBRPD electrofished five Redwood Creek stations upstream of Upper San Leandro Reservoir. Sampling stations were along Redwood Road, as well as in the east branch within Redwood Regional Park. A total of 68 *O. mykiss* were collected and numerous fry were observed at all stations sampled (Burger 1986). Age/length analysis based on scale samples from ten *O. mykiss* revealed the following mean lengths for each age class: 1+, 132 mm FL; 2+, 332 mm FL; and, 3+, 356 mm FL (Burger 1986).

In June 1986, EBRPD electrofished three sites on Redwood Creek. One site located in the east branch near the Prince Road intersection within Redwood Regional Park produced 45 YOY and ten adults (100-180 mm FL) (Alexander 1987). A second site located on the west branch at Redwood Road yielded abundant YOY and six adults (105-360 mm FL). The third site in a nearby pool produced four adults (105-335 mm FL) (Alexander 1987).

In July 1989, EBRPD electrofished seven sites on Redwood Creek upstream from upper San Leandro Reservoir. The total collection of *O. mykiss* from pools at these locations was approximately 193 individuals representing at least three age classes (Hagar and English 1989). Sampling in May 1990 by EBRPD at the same stations yielded 35 *O. mykiss* likely consisting of YOY, 1+ and 2+ fish (Hagar and English 1990).

From March through July 1990, EBRPD trapped upstream and downstream migrating *O. mykiss* in Redwood Creek upstream of San Leandro Reservoir. According to the trapping report, 144 individuals were captured and measured, and 125 fish (almost 87 percent) were found to be downstream-migrating juveniles. Only eight adults were captured and only five of these fish were upstream migrating. The study report cited a possible near failure of trout reproduction in Redwood Creek in 1990 (EBMUD 1991).

In July and August 1990, EBRPD electrofished 44 randomly chosen sites on Redwood Creek in conjunction with habitat surveys to estimate the total *O. mykiss* population size. *Oncorhynchus mykiss* sampled had a mean TL of 133 mm (Holsinger et al. 1991). Densities ranged from 4-74 fish per 86 square meters, and the *O. mykiss* population in Redwood Creek was estimated to be 266-484 individuals in the west branch and 50-152 in the east branch (Holsinger et al. 1991).

Leidy electrofished three stations on Redwood Creek in June 1993. Thirty-nine *O. mykiss* (33-90 mm FL) were caught in a 42 meter reach at the junction of Redwood Road and Pinehurst Road, three *O. mykiss* (41, 45, 48 mm) in the 30 meter reach at the Old Church picnic site in Redwood Regional Park, and 61 *O. mykiss* (38-82 mm FL) in the 54 meter reach downstream from the culvert at the East Bay/Skyline Trail intersection with Redwood Road (Leidy 2002).

In July and August 1994, EBMUD electrofished three stations on Redwood Creek upstream of upper San Leandro Reservoir. Electrofishing on the main stem and north fork yielded 52 *O. mykiss* (39-161 mm FL). A follow-up visual survey of the same reach found an estimated 495 YOY. Electrofishing on the west fork yielded 59 *O. mykiss* (48-187 mm FL) (EBMUD 1994).

Staff from EBRPD electrofished Redwood Creek on five occasions between March 1999 and April 2002. *Oncorhynchus mykiss* were found at four locations upstream from upper San Leandro Reservoir, with sizes ranging from 28-445 mm. Multiple age classes were observed in each year (Setka 2003b).

Moraga Creek

Moraga Creek is a tributary of Upper San Leandro Reservoir and is formed by three branches that together drain the sub-urbanized Moraga Valley. In August and September1974, DFG electrofished eight sites on the north and six sites on the west branch of Moraga Creek from their confluence upstream. No *O. mykiss* were caught or observed. The survey report concluded that the stream reaches observed did not appear to provide good spawning or nursery habitat for salmonids (Strohschein and Anderson 1974).

As part of a fish distribution study, ten sites on Moraga Creek were sampled by seine in August 1981. No *O. mykiss* were found (Leidy 1984). In June 1987, DFG electrofished Moraga Creek near Miramonte High School. The survey collected 57 *O. mykiss* ranging in size from 25-275 mm FL. Many of the fish were characterized as YOY, and the largest fish was determined to be age 2+ (Gray 1987a).

From March through July 1990, EBRPD trapped migrating fish in the tributaries to San Leandro Reservoir. Water delivery operations and possibly chlorination activities made results obtained in Moraga Creek unreliable for characterizing typical *O. mykiss* use of the creek. Two individuals were trapped and dead and five *O. mykiss* individuals were noted outside the trap (EBMUD 1991). In July and August 1990, EBRPD electrofished several sites on Moraga Creek to determine fish species composition. Five *O. mykiss* were caught with a mean length of 114 mm TL (Holsinger et al. 1991).

An EBMUD memo from March 1992 included a photograph of a 445 mm *O. mykiss* caught in Moraga Creek adjacent to Miramonte High School (English 1992). EBMUD sampled Moraga Creek upstream of Upper San Leandro Reservoir in June 1999, finding seven *O. mykiss* (50-195 mm FL), and in December 2000, when 13 *O. mykiss* (54-152 mm FL) were collected (Hartwell 2002a).

Indian Creek

Indian Creek flows primarily southeast, parallel to San Leandro Creek, before turning to merge with San Leandro Creek approximately 0.5 miles upstream from Upper San Leandro Reservoir. In August 1981, a dipnet and seine survey of Indian Creek found one living *O. mykiss* (172 mm FL) and one dead *O. mykiss* (140 mm) in an isolated pool immediately upstream from the confluence with San Leandro Creek (Leidy 1984). A second sampling site approximately 0.5 miles upstream from the above site, in a pool below the Canyon Road crossing, contained no fish (Leidy 1984).

In September 1983, EBRPD electrofished Indian Creek from the San Leandro Creek confluence to the Canyon Road intersection. Multiple age classes of *O. mykiss* were found, including YOY and 11 older individuals (81-356 mm FL) (Alexander 1984a). In June 1984, EBRPD electrofished Indian Creek at the upper San Leandro Creek confluence and below an upstream barrier. Each location supported YOY *O. mykiss* and other age classes (18: 72-170 mm FL) (Alexander 1984b). In June 1986, EBRPD electrofished Indian Creek at Canyon Road. No YOY *O. mykiss* were found in a pool below the road crossing that contained older individuals (7: 195-345 mm FL) (Alexander 1987).

In July 1989, DFG electrofished a pool on Indian Creek just below Canyon Road. No *O. mykiss* were found (Hagar 1989a). In July and August 1990, EBRPD electrofished the lower 160 meters of Indian Creek in conjunction with habitat surveys to determine the total *O. mykiss* population size. No *O. mykiss* were caught (Holsinger et al. 1991).

In June 1993, Leidy electrofished 30 meters of stream immediately above Pinehurst Road and caught five *O. mykiss* (146-190 mm FL) (Leidy 2002). He also electrofished a 30 meter reach approximately 0.3 miles upstream along Canyon Road, but caught no fish (Leidy 2002). Leidy electrofished the 30 meter reach immediately upstream from Pinehurst Road again in February 1997 and caught four *O. mykiss* (75-130mm FL) (Leidy 2002).

Assessment: Coastal steelhead were isolated in the Upper San Leandro Creek watershed when Chabot Dam was constructed in 1875. Steelhead were isolated further in the upper reaches of several fragmented drainages following the construction of Upper San Leandro Reservoir in 1926 (Hagar 1989b). Genetic analysis performed on *O. mykiss* from Redwood Creek and Kaiser Creek found the fish to be unique populations of non-hybridized, coastal rainbow trout (Gall et al. 1990).

Adult *O. mykiss* migrate out of Upper San Leandro Reservoir to spawn in several streams including Redwood, San Leandro, Indian, Moraga, Kaiser and Buckhorn Creeks. Redwood and San Leandro creeks support the highest quality and greatest area of suitable spawning and rearing habitats, and the largest populations of *O. mykiss* in the upper watershed. Indian, Moraga, Kaiser and Buckhorn creeks also support populations of *O. mykiss*, although they are much smaller than those found in Redwood and San Leandro creeks. All creeks in the upper watershed are contained largely within protected watershed lands administered by EBRPD and EBMUD. The exception is Moraga Creek, which flows through suburbanized portions of the town of Moraga.

The status of *O. mykiss* within the portions of San Leandro Creek, including Miller Creek, between Upper San Leandro Reservoir and Lake Chabot, is uncertain, although suitable habitat appears to be available in both streams. The status of *O. mykiss* in Grass Valley Creek, which flows into the northern-most arm of Lake Chabot, also is unknown.

San Leandro Creek below Lake Chabot supports a small run of *O. mykiss* of unknown size. Depending largely on the timing and amount of annual rainfall, lower San Leandro Creek supports suitable spawning and rearing habitat for anadromous *O. mykiss* from approximately 0.5 miles downstream of Interstate 580 to Chabot Dam. Restoration of streamflows between December and April below Lake Chabot could benefit *O. mykiss* by expanding the quality and quantity of available spawning and rearing habitats, and providing water for downstream migrating smolts.

San Lorenzo Creek Watershed

San Lorenzo Creek flows generally west, entering central San Francisco Bay near Roberts Landing, west of the city of San Lorenzo. The watershed consists of about 48 square miles, with highly urbanized lower and middle watershed areas. A 4.6-mile concrete channel runs from the mouth upstream. The upper watershed, including areas tributary to Crow and Palomares creeks, is less urbanized. Cull Creek Dam, located at RM 8.9 approximately 0.25 miles upstream from the Crow Creek confluence, was constructed in the early 1960s. The dam created a complete barrier to fish migration. Don Castro Dam, located immediately downstream of the Palomares Creek confluence, also was built in the early 1960s and also created a complete barrier to upstream migration.

San Lorenzo Creek

DFG surveyed San Lorenzo Creek from the mouth upstream 8.3 miles in April 1946. At an upper station near the B Street Bridge (RM 7.77), steelhead (35-50 mm TL) were found to be abundant in shallow gravel areas (Shapovalov 1946). A local resident reported observing adult in-migrants in the year of the survey. The DFG survey also observed two steelhead, one each above and below tide gates near the mouth of San Lorenzo Creek. *Oncorhynchus mykiss* also were observed approximately 0.5 miles upstream from the tide gates. The survey report cited observations made by a local resident in 1941 or 1942 of 400 adult steelhead trying to ascend the concrete apron under the bridge on E. 14th Street in one day. The Department of Fish and Game estimated that about 100 of these fish passed the apron (Shapovalov 1946).

DFG rescued 770 fingerling steelhead from drying portions of San Lorenzo Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

A 1960 DFG stream survey of Crow Creek noted that small, sporadic steelhead runs occurred in the San Lorenzo Creek drainage (Allen and Moore 1960a). A 1961 DFG memo assessing the probable effects of several proposed Corps' flood control projects in the watershed also stated that the San Lorenzo Creek drainage appeared to support a minor steelhead run (Elwell 1961). The assessment estimated that there were 2.5 miles each of available spawning and nursery area of "mediocre" quality in the middle reach of San Lorenzo Creek (Elwell 1961). The assessment estimated a total of approximately 10.5 to 13.5 miles of spawning area considered "mediocre" and seven miles of "mediocre" nursery area scattered throughout the drainage. The Department of Fish and Game considered the winter steelhead fishery to be of little or no value as it did not attract many anglers, and did not propose actions to conserve steelhead as part of mitigation for water and flood control developments in the watershed (Elwell 1961).

In a 1962 report, Skinner indicated that San Lorenzo Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In August 1975, DFG visually surveyed San Lorenzo Creek from Don Castro Dam downstream to the inland limit of the concrete flood control channel at the Highway 238 crossing, a distance of 3.1 miles (Curtis and Scoppettone 1975b). Although no salmonids were observed, the survey report noted that San Lorenzo Creek was a historic steelhead stream (Curtis and Scoppettone 1975b). The report further noted that channelization, dam construction, flow regulation and urbanization of the basin, and siltation of gravels had an adverse impact on the steelhead resource. According to DFG, the downstream 4.3- mile concrete flood control channel likely was a barrier to steelhead passage as a result of high water velocity and absence of resting pools (Curtis and Scoppettone 1975b). The report observed that a program involving installation and maintenance of baffle plates in the low-flow channel to facilitate steelhead passage was terminated in 1963 with the construction of Don Castro Dam, which blocked access to principal spawning and nursery areas (Curtis and Scoppettone 1975b). The report concluded that San Lorenzo Creek did not appear to support a viable steelhead population and that the area below the reservoir should not be managed for trout (Curtis and Scoppettone 1975b).

A DFG memo from 1975 stated that rainbow trout lived in Don Castro Reservoir and main stem San Lorenzo Creek upstream from the reservoir (Anderson 1975a). The memo further noted that trout migrated upstream from Don Castro Reservoir into tributary streams to spawn during the spring months (Anderson 1975a).

As part of a fish distribution study, 11 sites along the entire length of San Lorenzo Creek were sampled during July 1981. *Oncorhynchus mykiss* was not found (Leidy 1984).

Spring migrant trapping, visual surveys for parr, and some electroshocking were performed on San Lorenzo Creek beginning in the Spring 1997 through the Spring 1998 as part of a masters thesis research project. No *O. mykiss* were observed or collected during the study (Kobernus 1998). The thesis concluded that the 4.6-mile concrete channel in lower San Lorenzo Creek was an impassable barrier to migratory fish. The thesis also identified four limitations in steelhead spawning and rearing habitat in San Lorenzo Creek, including few pools, lack of large woody debris, sedimentation of riffle habitats, and low abundance of benthic macroinvertebrates (Kobernus 1998).

As part of fisheries assessment, a July 1998 fisheries electrofishing survey of 16 sites within the San Lorenzo Creek watershed was conducted. A 305 mm TL fish was collected in San Lorenzo Creek downstream from Don Castro Dam and upstream from the confluence of Crow Creek (Hagar 1998). The survey report suggested that this fish might have come from Don Castro Reservoir because of its relatively large size. The second fish measuring 584 mm TL was collected from a large pool in San Lorenzo Creek downstream from the confluence of Crow Creek (Hagar 1998). The origin of this trout was not known, but the report considered that it was possibly anadromous. The report concluded that "the presence of trout in San Lorenzo Creek in July is an indication that the habitat may at least be capable of sustaining trout through the critical summer months" (Hagar 1998, p. 5). The report recommended further monitoring and analysis to determine whether water temperatures in the watershed were suitable for *O. mykiss*, and whether the 5.8 miles of channelized stream below the MacArthur Freeway was a barrier to adult steelhead.

ACFCWCD conducted a fisheries assessment, including fish sampling, of streams in the San Lorenzo Creek watershed during 2001-2002. Six San Lorenzo Creek sites were sampled, revealing four *O. mykiss* within a 75-meter reach upstream of the Castro Valley Creek confluence (ACFCWCD and HES 2002). In May 2002, staff of the ACFCWCD observed two *O. mykiss* in San

Lorenzo Creek between Foothill Boulevard and 2nd Street in the city of Hayward. The fish were estimated to be between 380-510 mm in length (M. da Costa pers. comm.). It was not determined whether the trout had been "washed out" of Don Castro Reservoir or had migrated into the creek from San Francisco Bay.

Castro Valley Creek

Castro Valley Creek is largely underground in its lower reaches in the city of Castro Valley but has more natural reaches toward the headwaters. It flows generally south to join San Lorenzo Creek in the vicinity of Baywood School, east of Highway 238.

In January 1997, a large adult female *O. mykiss* was noted in the lower part of Castro Valley Creek (L. P. Kobernus pers. comm.). The fish appeared to be of hatchery origin. Three Castro Valley Creek sites were surveyed in 2001 as part of a fish study for the San Lorenzo Creek watershed. No *O. mykiss* were found (ACFCWCD and HES 2002).

Crow Creek

Crow Creek is a perennial stream draining an area of approximately ten square miles and is the largest tributary to San Lorenzo Creek. A 1,600-foot-long concrete box culvert was constructed in 1972 upstream of the Cull Creek confluence with San Lorenzo Creek that is a fish passage barrier.

DFG rescued four fingerling steelhead from drying portions of Crow Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

In June 1960, DFG surveyed Crow Creek from the mouth to the headwaters, a distance of 5.5 miles. No salmonids were observed (Allen and Moore 1960a). However, the survey report noted that small, periodic steelhead runs were known to occur in the drainage (Allen and Moore 1960a). The report further concluded that Crow Creek likely represented one of the better spawning and nursery tributaries of the San Lorenzo Creek watershed. In years of normal runoff, parts of the creek were believed capable of supporting a small juvenile steelhead population throughout the summer period (Allen and Moore 1960a). This DFG report cited local residents who had observed *O. mykiss* between 150-200 mm TL being caught early in the trout season in the stream's lower reaches (Allen and Moore 1960a).

A 1961 DFG memo assessing the probable effects of proposed Corps' flood control projects in the watershed stated that Crow Creek contained the best steelhead spawning and nursery areas in the San Lorenzo Creek watershed (Elwell 1961). The Department of Fish and Game estimated that three to four miles of spawning habitat and two miles of rearing habitat were available in Crow Creek (Elwell 1961). However, DFG did not propose actions to conserve steelhead and their habitat as part of mitigation for water development in the drainage watershed.

In a 1962 report, Skinner indicated that Crow Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In July 1975, a pollution-induced fish kill in the vicinity of Crow Canyon Road included a 430 mm TL *O. mykiss* (DeSilva 1975). In August 1975, DFG visually surveyed the lower 8.2 miles of Crow Creek, essentially the entire stream length (Anderson and Scoppettone 1975). Above the confluence with Bolinas Creek, six *O. mykiss* were observed. One fish was netted and measured 230

mm FL, with the others of similar size (Anderson and Scoppettone 1975). The survey report noted that Crow Creek supported a minimal number of rainbow trout in its upper reach and offered poor spawning habitat but sufficient food (Anderson and Scoppettone 1975).

As part of a fish distribution study, two sites on Crow Creek were sampled in July 1981. No *O. mykiss* were collected (Leidy 1984).

ACFCWCD conducted a fisheries habitat assessment of streams in the San Lorenzo Creek watershed during 2001-2002, including fish sampling at six Crow Creek sites. *Oncorhynchus mykiss* were collected at two locations, one near the Cull Creek confluence and a second about one mile upstream. The former site yielded eight *O. mykiss* in a 115-meter reach, while the latter contained two individuals in a 138-meter reach (ACFCWCD and HES 2002). The report cites the sampling results as evidence of successful reproduction of rainbow trout in Crow Creek (ACFCWCD and HES 2002).

Cull Creek

Cull Creek is characterized by about seven miles of intermittent stream between the confluence with Crow Creek and the headwaters. It flows generally south to enter Crow Creek just downstream of the Cull Creek Dam. This dam, built in 1962, is a complete barrier to fish passage (ACFCWCD and HES 2002).

In July 1960, DFG visually surveyed the length of Cull Creek primarily by automobile with occasional stops to check the stream. No fish were observed, but the survey report noted that in 1957 or 1958, 50-100 mm *O. mykiss* were reported below a ranch pond spillway about midway along Cull Canyon Road (Rafra 1960). The Department of Fish and Game estimated that there was little or no steelhead use in years of normal rainfall (Rafra 1960). Another report from the same survey stated that the stream probably received some use as a spawning area in some years (Allen 1960a). A farm pond dam located at about RM 4 was identified as a complete barrier to fish migration. The Department of Fish and Game recommended that Cull Creek be managed as a steelhead spawning stream (Allen 1960a).

In a 1962 report, Skinner indicated that Cull Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be “lightly used” as steelhead habitat (Skinner 1962).

As part of a fish distribution study, one Cull Creek site was sampled in July 1981. No *O. mykiss* were collected (Leidy 1984).

ACFCWCD sampled three Cull Creek sites in April 2001 as part of a fisheries habitat assessment. No *O. mykiss* were collected (ACFCWCD and HES 2002).

Palomares Creek

Palomares Creek and its tributaries drain the hills east of the city of Castro Valley. This stream is an intermittent tributary to San Lorenzo Creek estimated to consist of about five miles of channel that joins San Lorenzo Creek near Don Castro Regional Recreation Area.

In June 1960, DFG surveyed the length of Palomares Creek by automobile with occasional stops to check the stream. In pools in the lower section, *O. mykiss* 38-89 mm TL were observed at an estimated density of 10-20 fish per 30 meters of stream (Allen 1960b). The survey report stated that historically Palomares Creek was probably utilized by steelhead as a spawning area, and that juveniles probably migrated to the lower part of the drainage, remaining in nursery areas in San Lorenzo Creek until they migrated to the Bay (Allen 1960b). The report also estimated that there was approximately three to four miles of "mediocre" to "fair" steelhead spawning areas, and recommended continued management of Palomares Creek for steelhead spawning (Allen 1960b).

As part of a fish distribution study, two Palomares Creek sites were sampled below Don Castro Dam in July 1981 (Leidy 1984). No *O.* mykiss were collected. The Department of Fish and Game reported seeing rainbow trout in Palomares Creek in September 1987 (Gray 1987c).

In July 1996, Leidy electrofished Palomares Creek at the confluence with Eden Canyon Creek, opposite Palomares School**.** No *O. mykiss* were collected (Leidy 2002). Four Palomares Creek sites were sampled in April 2001 as part of a fisheries habitat assessment by ACFCWCD. No *O. mykiss* were collected (ACFCWCD and HES 2002).

Eden Canyon Creek (Eden Creek)

This creek is tributary to Palomares Creek and consists of about three miles of channel between the mouth and the headwaters. A drop structure under Palomares Road and Interstate 580 on Eden Creek is a barrier to fish passage into Eden Canyon Creek (ACFCWCD and HES 2002).

In June 1960, DFG surveyed the length of Eden Canyon Creek primarily by automobile with occasional stops to assess the stream. No fish were observed. The study report concluded that Eden Canyon Creek had little value as a sport fishery (Allen and Moore 1960b).

As part of a fish distribution study, one Eden Canyon Creek site was sampled in July 1981. No *O. mykiss* were collected (Leidy 1984).

ACFCWCD sampled two Eden Creek sites in April 2001 as part of a fisheries habitat assessment. No *O. mykiss* were collected (ACFCWCD and HES 2002).

Assessment: Steelhead probably used much of the San Lorenzo Creek watershed historically, until channelization and other effects of urbanization led to degraded habitat and decreased population size. Steelhead were relatively abundant in this system into the 1950s (ACFCWCD and HES 2002). Construction of Don Castro Dam and Cull Creek Dam completely blocked anadromous fish migration into large portions of the upper watershed in the early 1960s.

According to a fisheries assessment for the drainage, *O. mykiss* persists at extremely low frequency in the watershed, probably as a result of stocking in Don Castro Reservoir (ACFCWCD and HES 2002). The assessment report summarizes conditions in San Lorenzo Creek as follows: "Although suitable habitat for rainbow trout and steelhead exists in the watershed, passage barriers, excess fine sediment, and periodic poor water quality limit the numbers and distribution of these fish" (ACFCWCD and HES 2002, p. 1).

Alameda Creek Watershed

At about 700 square miles, the Alameda Creek watershed is the largest of the San Francisco Estuary. Alameda Creek was channelized from the San Francisco Bay upstream about 12 miles to the vicinity of Niles Canyon between 1965 and the mid-1970s for flood control and water supply purposes. Geographic features referenced in the following discussion include Niles Canyon, Sunol Valley, and upper Alameda Creek. Important tributaries include Arroyo de la Laguna, San Antonio Creek and Calaveras Creek, each of which contains a major reservoir (*i.e.,* Lake del Valle, San Antonio and Calaveras Reservoirs, respectively).

Alameda Creek

A series of DFG memoranda written by Mr. Leo Shapovalov during 1938 discuss several observations of *O. mykiss* in Alameda Creek. One memo reported on Shapovalov's interview with construction workers for the San Francisco Water Department at the Calaveras Diversion Dam, who described seeing steelhead jumping at the Sunol Dam in Niles Canyon because they were unable to use the fishway (Shapovalov 1938a). The memo noted that steelhead were impeded by an 18-20 foot dam at the second railroad bridge downstream from Sunol, in Niles Canyon, the location of the Hetch Hetchy pipelines.

In another entry on the same date, Shapovalov noted an interview with a local rancher, who reported that in May 1938 a fisherman caught 20 steelhead (~300 mm) at Rooney Ranch near the Pirate Creek confluence (Shapovalov 1938a). In May 1938, DFG staff observed abundant trout (to 40-50 mm TL) that had recently emerged from gravel near the Calaveras Creek confluence and in Calaveras Creek (Shapovalov 1938a). The memo also noted that 4,000 rainbow trout were planted in this reach of Alameda Creek in 1937; however the hatchery source of these fish is not stated.

DFG formerly stocked *O. mykiss* in Alameda Creek for a "put-and-take" fishery during the summer months. This practice dates back to at least 1937 according to DFG records (Shapovalov 1938a). Also, field notes from EBRPD staff report that property owners have planted trout below the Ohlone section of upper Alameda Creek intermittently over the 50 years before 1995 (Alexander 1995-1999).

DFG rescued 200 fingerling steelhead from drying portions of Alameda Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

DFG staff observed 40 miles of Alameda Creek from the mouth to Mt. Hamilton and vicinity, as well as 22 miles of major tributaries, in a one-day survey on foot and by car in May 1957. The report concluded that upper Alameda Creek and its tributaries provided "excellent" habitat both for survival and for reproduction of trout (Pintler 1957).

An ichthyology class's sampling data sheets noted capture by seining of one adult *O. mykiss* in April 1967 (Barlow 1967). The fish was collected at the Stanley Bridge, Old Canyon Road in Niles and, based upon an assessment of condition, was apparently a steelhead.

DFG sampled six Alameda Creek locations in June 1973 by electrofishing: three sites in Lower Alameda Creek, one in Niles Canyon and two in Upper Alameda Creek near the Calaveras Creek confluence. No *O. mykiss* were found during the sampling and the resulting report placed a "?" value in the table indicating presence/absence for rainbow trout in the 1973 collections

(Aceituno et al. 1976). In 1973 and 1974, steelhead were reported attempting to migrate upstream through the Alameda Creek flood control channel. Also, in 1974, "three runs of from 20 to 60 fish" were seen.

In a 1977 paper, Scoppettone and Smith describe results of sampling conducted using seines and electroshockers in three Alameda Creek locations between 1972 and 1977. These locations were a site 0.3 miles upstream from the Calaveras Creek confluence and a site at Mile Post 5, Ohlone Camp Road. The two locations revealed *O. mykiss* at relative abundances of "2" on a 5-point scale with "5" indicating "very abundant" (Scoppettone and Smith 1977).

DFG and EBRPD staff sampled Alameda Creek immediately upstream of the Calaveras Creek confluence in September 1987. Electrofishing results included 15 *O. mykiss* (50-81 mm FL) (Gray 1988b).

Leidy electrofished sites (typically 30 m) on Alameda Creek in 1992, 1993, 1994 and 1996. All *O. mykiss* were found immediately above the Alameda Creek Diversion Dam within or below Camp Ohlone Regional Park, or just below Alameda Creek Diversion Dam. Two exceptions were for two *O. mykiss*, one found in Niles Canyon in 1992 and one found immediately below the Old Spring Valley Water Company diversion dam at the top of Niles Canyon in October 1993 (Leidy 2002).

Leidy's sampling in 1992 and 1993 is reported in Table IV-3. Three sites in Camp Ohlone, two sites near the confluence of Arroyo de la Laguna, and one site just above the confluence with Calaveras Creek did not produce *O. mykiss* in 1992 (Leidy 2002). In 1993, three sites in or near Sunol Regional Park, one site at the confluence with Arroyo de la Laguna, three sites near the Old Spring Valley Water Co. diversion dam at the top of Niles Canyon, three sites within Niles Canyon, and three sites within the flood control channel produced no *O. mykiss* (Leidy 2002).

Table IV-3. Alameda Creek sampling results for *O. mykiss*, 1992

Date	Location	Number	Size (mm FL)
1992			
April	Camp Ohlone	2	140, 168
		3	unmeasured
May	0.2 mi. upstream SFWD Niles Canyon Rd.	2	268, 275
June	0.75 m. downstream ACDD	1	270
		3	~200-255
June	0.5 mi. downstream Camp Ohlone	19	51-215
June	Immediately downstream Little Yosemite	23	50-250
July	0.5 mi. downstream Camp Ohlone	12	70-220
Sept.	Falls 0.5 mi. downstream Camp Ohlone	16	158-265
		~500	~25-100
Sept.	Little Yosemite, downstream from grate on dirt rd.	11	154-230
		many YOY	~100
1993			
May	Falls 0.5 miles downstream Camp Ohlone	10	35-195
May	Immediately upstream above site	22	50-233
Aug.	0.25 miles downstream ACDD	4	79-106
		1	245
Aug.	0.2 miles below ACDD	14	75-240
Aug.	Immediately downstream ACDD	7	78-192
Oct.	Immediately downstream Old Spring Valley Water Co. diversion dam	1	158
Nov.	Opposite Ranch House, Camp Ohlone	2	128, 134

(Source: Leidy 2002)

Leidy observed three *O. mykiss* (25-50 mm TL) near the Calaveras Creek confluence in March 1994. In April 1994, two sites downstream from Interstate 680 and one site downstream from the Old Spring Valley Water Company diversion dam produced no *O. mykiss* (Leidy 2002). Leidy sampled two sites downstream from the Old Spring Valley Water Company diversion dam again in August 1996 and found no *O. mykiss* (Leidy 2002). Department of Fish and Game staff sampled eight upper Alameda Creek locations in July 1995. Four *O. mykiss* were collected (68-79 mm) by electrofishing (Murphy and Sidhom 1995).

EBRPD periodically samples fish populations in portions of Alameda Creek as part of their resources management program. Staff sampled pools at the downstream end of the Little Yosemite area and recorded four *O. mykiss* (113-188 mm FL) in October 1995. Below the Alameda Creek Diversion Dam, a 40-meter pool was electrofished during the same sampling effort and produced 24 *O. mykiss* (84-189 mm). Also in October 1995, staff sampled Alameda Creek near Camp Ohlone and found ten *O. mykiss* (88-207 mm). Electroshocking in another pool near Camp Ohlone produced 20 *O. mykiss* (103-212 mm) (Alexander 1995-1999).

In October 1996, EBRPD staff sampled immediately above and below the Alameda Creek Diversion Dam. The downstream 86-meter reach produced 12 *O. mykiss* (75-282 mm FL) and six "missed" individuals. Field notes indicated that some of the fish showed steelhead characteristics. The upstream site, consisting of a 43-meter pool, contained 19 *O. mykiss* (66-217 mm) and five "missed" individuals (Alexander 1995-1999). EBRPD staff sampled the Camp Ohlone area extensively in October 1996 by electroshocking. Data for nine sites in this area are summarized in the Table IV-4.

Table IV-4. EBRPD electroshocking on Alameda Creek at Camp Ohlone, October 1996

Reach Length	Number Collected	Size Range (mm)	Number Observed*
"Pool"	1	200	1 (~200)
70 m	43	50-240	
"Pool"	15	70-230	
18 m	8	62-87	2
33 m	22	59-222	
100 m	20	61-254	
161 m	46	60-214	20
19 m	8	62-85	
"Pools"	44	57-182	9

(Source: Alexander 1995-1999)

*not collected

In June 1997, EBRPD staff electroshocked a 52-meter reach in Sunol Regional Park and found one *O. mykiss* (196 mm). EBRPD staff electrofished a 30 meter reach below Little Yosemite in July 1997 and recorded four *O. mykiss* (54-102 mm) as well as two "missed" individuals of similar size (Alexander 1995-1999). Also in July 1997, staff sampled a one mile reach upstream of Camp Ohlone by dip net and seining at "random intervals" and found 13 juvenile *O. mykiss* (51-60 mm) and one resident adult (200 mm).

Adult steelhead have also been reported in lower Alameda Creek in 1997 and the years up to the present (J. Miller pers. comm.). These fish are unable to pass the ten-foot drop structure between the Union Pacific Railroad and BART tracks. Limited numbers of *O. mykiss* have been collected in the flood control channel section of Alameda Creek. Sightings and collections involve between one and 15 individuals, and adult in-migrants measure up to 850 mm and larger. Genetic analyses of fin clips from *O. mykiss* in Alameda Creek and tributaries indicate a very strong relationship between these fish and Central Coast ESU steelhead (Nielsen 2003).

SFPUC has contracted for aquatic resource monitoring, including fish sampling, as part of its facilities planning. In August 1998, a snorkel survey of seven pools in upper Alameda Creek found 20 *O. mykiss* in four pools (Trihey & Associates Inc. 1999). Sampling also included electrofishing in seven reaches, two of which produced *O. mykiss*. Population estimates were reported as Site 1: 12 0+, 2 1+, 11 2+ and Site 3: 12 0+ (Trihey & Associates Inc. 1999).

As part of the SFPUC monitoring program, consultants re-surveyed seven pools by snorkeling in September 1999, and electrofished seven sites in October of that year. Sampling locations were in the approximately four-mile area beginning near the Sunol Valley Water Treatment Plant to approximately 1,500 feet upstream of the Calaveras Creek confluence. Snorkel surveys found YOY *O. mykiss* only upstream of the confluence. The 1999 electrofishing effort produced an abundance estimate of four individuals at one site.

Surveys of Alameda Creek were performed in September and October 1999 as part of an assessment of the feasibility of restoring steelhead to the watershed (Gunther et al. 2000). *Oncorhynchus mykiss* were observed in most pools from the Little Yosemite area upstream to the Alameda Creek Diversion Dam (ACDD), including YOY and adult *O. mykiss* to 305 mm. From ACDD upstream to the Camp Ohlone area, YOY and adults to 250 mm in length were found to be "abundant" in most pools. In the reach above the Camp Ohlone area, *O. mykiss* was again observed in most pools and included YOY and adults to 200 mm. The survey report noted that upstream migration was not possible past ACDD, indicating that trout above the dam are resident (Gunther et al. 2000). Also in October 1999, EBRPD staff found one *O. mykiss* (198 mm) in a 27 meter reach near the Sunol Lower Swim Dam while electroshock sampling (Alexander 1995-1999).

Sampling was conducted in Alameda Creek in May 2001 to collect *O. mykiss* for genetic analysis. Upstream of ACDD, five *O. mykiss* were collected ranging in size from 120-160 mm FL, while the site downstream of the dam produced nine *O. mykiss* (105-218 mm FL). A third site at the Little Yosemite area yielded 16 *O. mykiss* (99-191 mm FL). Tissue samples were taken from each sampled group of fish for analysis. Upper Alameda Creek trout were shown to be closely related to previously sampled fish and to native, wild *O. mykiss* collected in other portions of the watershed (Nielsen 2003).

Dry Creek

Based on the size and location of the Dry Creek drainage, as well as the known fish assemblage, it is probable that the creek historically supported use by *O. mykiss*, at least in wet years. Under current conditions, use by steelhead or resident *O. mykiss* is highly unlikely (S. McGinnis pers. comm.).

Stonybrook Creek

Stonybrook Creek flows south out of Stonybrook Canyon, joining Alameda Creek in Niles Canyon. In October 1955, staff from the California Academy of Sciences seined approximately 20 *O. mykiss* (75-175 mm TL) at a point about 1.5 miles above the Alameda Creek confluence (Follett 1974). Also in October, five *O. mykiss* (~50 mm TL) were collected in a pool 1.2 miles upstream of the Alameda Creek confluence (Follett 1974).

DFG rescued 645 fingerling steelhead from drying portions of Stonybrook Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season. A 1959 DFG letter indicated that steelhead were known to spawn in Stonybrook Creek (Fisher 1959).

In April 1976, DFG electroshocked a 30-meter reach of Stonybrook Creek 150 yards upstream from the Alameda Creek confluence. One 250 mm *O. mykiss* was found, but the associated DFG report concluded that Stonybrook Creek did not support a viable population of rainbow trout due to the "seasonal" nature of the stream (Scoppettone 1976d).

In September 1987, DFG electrofished a small pool on Stonybrook Creek approximately 1.5 miles from the Alameda Creek confluence. Four *O. mykiss* were caught ranging in length from 162-219 mm FL (Gray 1987b).

EBRPD staff electroshocked a 27-meter reach of Stonybrook Creek immediately downstream of the first road crossing, which constitutes a migration barrier, in April 1999. Eight *O. mykiss* were found (189-335 mm) (Alexander 1995-1999).

Two in-migrating steelhead were captured by EBRPD in main stem Alameda Creek at the BART weir in February, 1999. These fish were radio-tagged and released near the bottom of Niles Canyon. Subsequent tracking found that the female steelhead had passed a culvert into Stonybrook Creek (Miller 1999). Becker noted YOY *O. mykiss* in the following year (2000) at the downstream end of the first impassable road crossing on Stonybrook Creek, suggesting that the steelhead had successfully reproduced with a resident *O. mykiss* (Becker 2002).

Sinbad Creek

Sinbad Creek drains the valley formed by Sunol Ridge and Pleasanton Ridge. It runs roughly from north to south, feeding Alameda Creek in the town of Sunol. A local resident fished in Sinbad Creek during his childhood and donated photographs to EBRPD. The photographs indicate *O. mykiss* caught in the creek during the 1940s and 1950s. Fish depicted in the photos are believed to be anadromous from their size and appearance (Mills *n.d.*).

EBRPD records indicate electofishing of Sinbad Creek downstream of 589 Kilkare Road to the first bridge in September 1999. No *O. mykiss* were collected in the sample (Alexander 1995-1999).

Arroyo de la Laguna

Historically, Arroyo de la Laguna drained Tulare Lake, a marsh situated between the present-day towns of Dublin and Pleasanton. Tulare Lake was fed by numerous tributaries, including the Arroyos Valle and Mocho, as well as Tassajara and Alamo Creeks. The marsh was drained and the stream channels realigned, altering the historic relationship of these streams. Arroyo de la Laguna is currently formed by the confluence of Arroyo Valle and a channel that transports the merged drainages of Arroyo Mocho, Tassajara, South San Ramon and several other creeks (Sowers 1995).

In a 1962 report, Skinner indicated that Arroyo de la Laguna was an historical migration route for steelhead (Skinner 1962). DFG and USFWS sampled Arroyo de la Laguna by electrofishing in October and November 1975, February 1976 (four stations), and May 1976 (two stations). No *O. mykiss* were reported in these three surveys (Michny and Ging 1975; Scoppettone 1976a, 1976b).

A fish kill occurred in January 1985 in an unnamed tributary to Arroyo de la Laguna. An investigation noted several species of fish killed, but no salmonids were among them. The Department of Fish and Game again surveyed the creek in May 1985 in relation to flow releases from del Valle Reservoir. The report stated that adequate streamflows were needed to allow the reestablishment of steelhead runs in the Alameda Creek system and were required under Fish and Game Code Section 5937 (Gray 1986a). No *O. mykiss* were found during the sampling (Gray 1986a).

Leidy electrofished Arroyo de la Laguna at ten locations between March and December 1993, one location in May 1994 and one location in July 1996. No *O. mykiss* were found at any of the sampling locations (Leidy 2002).

According to an unpublished study of steelhead use of the Arroyo de la Laguna system, anadromous *O. mykiss* appear to have used Arroyo de la Laguna for migration into spawning tributaries in wet years. We found no records that the arroyo itself provided steelhead habitat historically.

Vallecitos Creek

Vallecitos Creek is tributary to Arroyo de la Laguna. Leidy electrofished this creek at the San Antonio Road Crossing in October 1993, but found no *O. mykiss*. EBRPD records indicate electrofishing in June 1999 at a site upstream from the Sunol-Pleasanton pipeline crossing that did not produce *O. mykiss* (P. Alexander pers. comm.).

Arroyo Valle (Arroyo del Valle)

Arroyo Valle is tributary to Arroyo de la Laguna. In April 1910, the Livermore *Herald* reported game warden and fishermen's statements that the headwaters of Arroyo Valle were "full of fish." One trout (presumably *O. mykiss*) was collected measuring about 750 mm, and numerous smaller fish were noted (Livermore Herald 1910). In June 1953, an angler took a steelhead measuring over 550 mm from Arroyo Valle near Livermore (Livermore Herald 1953).

In a 1962 report, Skinner indicated that Arroyo Valle was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead (Skinner 1962).

Survey work, including electroshocking, in September 1983 and May 1985 was performed at Arroyo Valle below Lake del Valle to document the potential for steelhead habitat. The survey report indicated that there was potential for establishing populations of *O. mykiss* in the creek downstream of Del Valle dam (Gray 1986b). Unpublished studies by Hanson Environmental in 2002-2003 also documented areas of suitable habitat downstream of the dam.

Leidy electrofished Arroyo Valle at three locations between 1993 and 1996. *Oncorhynchus mykiss* was not found (Leidy 2002). EBRPD records document electrofishing at four Arroyo Valle sites in October-November 1999. *Oncorhynchus mykiss* was not collected at any of the sites, which included locations upstream and downstream of Lake del Valle (Alexander 1995-1999).

Portions of Arroyo Valle were surveyed in September 1999 as part of a steelhead restoration feasibility study. No *O. mykiss* were observed in two reaches downstream from Lake del Valle and the survey report noted: "No habitat offering good potential as spawning or rearing habitat was observed" (Gunther et al. 2000, pp. 73-74).

Unpublished studies by Hanson Environmental of steelhead resources of the Arroyo de la Laguna system indicate that Arroyo Valle likely was most commonly used tributary by spawning steelhead. The relatively large watershed was cited as likely to lead to conditions of hydrologic connectivity with Arroyo de la Laguna in moderate water years.

Trout Creek

This creek is tributary to Arroyo Valle above Lake del Valle and consists of about eight stream miles. *Oncorhynchus mykiss* are noted in Trout Creek in a DFG stream survey believed to date from 1944 that notes perennial stream flow in the upper catchment and "common" spawning grounds, but speculates that natural propagation probably does not occur in the creek (Shapovalov 1944b).

Colorado Creek

Colorado Creek is a headwater tributary of Arroyo Valle. The creek consists of about six miles of channel draining the northeast flank of the Burnt Hills.

Leidy sampled Colorado Creek by dip net about 0.5 miles upstream from the Mines Road crossing in August 1981. He collected *O. mykiss* ranging between 48-282 mm FL (Leidy 1984).

Arroyo Bayo

Arroyo Bayo originates east of Mt. Hamilton and flows generally north to its confluence with San Antonio Creek, when it becomes Arroyo Valle, upstream of Lake del Valle. No records concerning fish in this creek were found. Informal surveys of Arroyo Bayo indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

San Antonio Creek

This creek originates in the area east of Mt. Hamilton and south of the Burnt Hills. It flows north, then east, to its confluence with Arroyo Bayo when it becomes Arroyo Valle. No records concerning fish in this creek were found. Informal surveys of San Antonio Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Beauregard Creek

This creek is tributary to San Antonio Creek. It flows generally west from the area east of San Antonio Valley. No records concerning fish in this creek were found. Informal surveys of Beauregard Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Arroyo Mocho

From its relatively undeveloped headwaters area, the creek runs generally northwest to the city of Livermore where it turns west and flows to its confluence with the drainage channel feeding Arroyo de la Laguna. Potential passage barriers have been identified on Arroyo Mocho, including a drop structure at Stanley Boulevard and an access road at the LLNL.

A newspaper report from May 1911 notes anglers' reports of catching trout over 280 mm in Arroyo Mocho within six miles of Livermore. Fish also were noted in the creek's headwaters, resulting from plantings in the previous two seasons (Livermore Herald

1911). A 1944 DFG stream survey reported *O. mykiss* present in Arroyo Mocho, but cited past stocking as the likely source of the fish, due to a low probability of natural propagation in the creek (Shapovalov 1944a).

In a 1962 report, Skinner indicated that Arroyo Mocho was an historical migration route and habitat for steelhead (Skinner 1962). A report on fish sampling between 1972 and 1977 produced a relative abundance estimate for *O. mykiss* of "4" on a 5-point scale (Scoppettone and Smith 1977). Sampling was performed by seining and electrofishing at a site near the LLNL pumping station. A site 0.6 miles above del Valle Road received an *O. mykiss* relative abundance rating of "2" (Scoppettone and Smith 1977).

An ichthyofaunal survey was conducted in February 1976 at three Arroyo Mocho stations: (1) LLNL pumping station; (2) Cedar Brook Ranch; and (3) near Mines Road. All three stations were electroshocked and produced *O. mykiss*. Combined results indicated 44 individuals with the following size distribution: 21 fish: 67-139 mm FL; 15 fish: 153-195 mm; and 8 fish: 211-318 mm (Scoppettone 1976c).

In December 1993, Leidy electrofished Arroyo Mocho at Wente Road and Marina Avenue. No *O. mykiss* were found (Leidy 2002). Portions of the creek were surveyed in September 1999 as part of a steelhead restoration feasibility study. One *O. mykiss* (150-200 mm) was observed upstream from the LLNL road crossing and the survey report noted pools with potential to hold trout during rearing (Gunther et al. 2000).

Sampling was conducted in Arroyo Mocho in April 2001 to collect *O. mykiss* for genetic analysis. At the property of J. Norton, 31 *O. mykiss* were collected (89-189 mm FL) and tissue samples taken for analysis. Arroyo Mocho trout were shown to be more closely related to Central Valley hatchery strains than to other Alameda Creek watershed populations (Nielsen 2003).

Tassajara Creek

This creek is tributary to the drainage channel feeding Arroyo de la Laguna. In May 1994, Leidy electrofished a 50 meter reach on Tassajara Creek at the Tassajara Regional Land Bank and found no *O. mykiss* (Leidy 2002). Informal surveys of Tassajara Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Arroyo las Positas

Arroyo las Positas is tributary to Arroyo Mocho. In a 1962 report, Skinner indicated that Arroyo las Positas was an historical migration route for steelhead (Skinner 1962).

The creek was surveyed from the mouth in September 1999 as part of a study of the feasibility of restoring steelhead to the Alameda Creek system. No *O. mykiss* were found and the survey report noted that the creek and its tributaries had no spawning/rearing potential (Gunther et al. 2000).

Cayetano Creek

This creek is tributary to Arroyo las Positas. The creek was surveyed from the mouth in September 1999 as part of a study of the feasibility of restoring steelhead to the Alameda Creek system. No *O. mykiss* were found and the survey report noted that the creek had no spawning/rearing potential (Gunther et al. 2000).

South San Ramon Creek

This creek appears to have been re-constructed as a flood control channel parallel to Interstate 680 on the freeway's east side. It is tributary to the drainage channel feeding Arroyo de la Laguna. No records regarding fish in this creek were found. Informal surveys of South San Ramon Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

San Antonio Creek

San Antonio Creek originates in the hills near the Ohlone Regional Wilderness and flows generally west to its confluence with Alameda Creek. The majority of the San Antonio Creek catchment was impounded by construction of San Antonio Reservoir in the mid-1960s. The dam forming San Antonio Reservoir is a complete barrier to upstream migration.

According to a 1954 DFG field note, San Antonio Creek formerly supported a small steelhead run each year (Evans 1954). The Department of Fish and Game rescued eight fingerling steelhead from drying portions of San Antonio Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

Leidy sampled two locations on San Antonio Creek above San Antonio Reservoir in 1997. At the first road crossing above the reservoir, a 35-meter reach yielded ten *O. mykiss* (68-148 mm FL) (Leidy 2002). These fish were assumed to be migrating from the reservoir. A 30-meter reach immediately above the confluence with La Costa Creek yielded 13 *O. mykiss* (58-90 mm) (Leidy 2002).

In order to develop information regarding life history characteristics of *O. mykiss* in San Antonio Reservoir, a fish trapping program has been developed for the SFPUC. In February-March 2002, a total of 149 smolts and 44 adults were collected by fish traps operating over the course of 25 days in San Antonio Creek upstream of the reservoir (Entrix 2002). Juvenile *O. mykiss* were found from 111-140 mm FL, while adults ranged from 347-525 mm FL (Entrix 2002).

Trout samples were taken from San Antonio Reservoir in 2002 for genetic analysis. *Oncorhynchus mykiss* using the reservoir and its tributaries were shown to be closely related to previously sampled fish and to native, wild *O. mykiss* collected in other portions of the watershed (Nielsen 2003).

Indian Creek

This creek was formerly tributary to San Antonio Creek. Its mouth was drowned by creation of San Antonio Reservoir, to which the creek is now tributary. San Antonio Creek flows generally north from its headwaters in the Ohlone Regional Wilderness.

In July 1953, DFG inspected Indian Creek and found large numbers of stranded steelhead, ranging in size from 75-150 mm (Johnson 1953b). A rescue was performed in August of that year, with *O. mykiss* moved to Alameda Creek (Johnson 1953a). The DFG field notes from the rescue indicated that about one-quarter of the rainbow trout observed in Indian Creek pools in early August were remaining by the third week, and that these fish ranged in size from 100-300 mm.

DFG rescued 75 fingerling steelhead from drying portions of Indian Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

Leidy sampled a 30-meter reach of Indian Creek in February 1997 at a site approximately 0.2 miles upstream from the road crossing along San Antonio Reservoir. Four *O. mykiss* (75-150 mm FL) were found, primarily in a single pool (Leidy 2002). He noted that this reach of the creek dries completely in summer, although perennial flow occurs in the creek's headwaters.

La Costa Creek

La Costa Creek flows generally north from its headwaters in the Ohlone Regional Wilderness to the San Antonio Creek confluence. Construction of San Antonio Reservoir isolated *O. mykiss* in this system from anadromous steelhead.

A May 1938 DFG survey noted trout to 75 mm as "common" in La Costa Creek (Shapovalov 1938c). The Department of Fish and Game rescued 250 fingerling steelhead from drying portions of Alameda Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

Leidy found *O. mykiss* at all of three locations electrofished on La Costa Creek in October 1993 (Leidy 2002). At a site 0.25 miles upstream from the confluence with San Antonio Creek he caught 15 *O. mykiss* (52-115mm FL). Immediately upstream from this site, Leidy collected seven *O. mykiss* (70-165mm), and in a reach downstream from the SFPUC property boundary, he caught 18 *O. mykiss* (53-115mm) (Leidy 2002).

Indian Joe Creek

Indian Joe Creek is primarily contained within the Sunol Regional Wilderness. According to the personal account of a descendant of ranch owners in the area of present-day Sunol Regional Park, anadromous fish were observed to spawn in Indian Joe Creek in the early 1900s (Larson 2000). Mr. Larson told Sunol Park staff that his relatives were able to scoop the fish up for food.

Staff from EBRPD staff sampled this creek at the Alameda Creek confluence by dip net and electroshocking in June 1997. Nine *O. mykiss* were recorded (44-154 mm FL). Parks district staff again sampled this creek by electrofishing in June 1999. A 56-meter reach located just upstream from the Alameda Creek confluence yielded 26 *O. mykiss* (38-67 mm FL) as well as 37 YOY (Alexander 1995-1999). Field notes stated that no larger trout were found at this location or farther upstream.

Calaveras Creek

Calaveras Creek drains the hills area east of the town of Milpitas. It flows generally north to the Alameda Creek confluence. Most of the runoff from this catchment is impounded in Calaveras Reservoir, constructed in the 1920s. The Department of Fish and

Game visually surveyed the 1.5-mile reach between the Alameda Creek confluence and Calaveras Dam in May 1938. The survey report noted abundant trout (40-50 mm) emerging from gravel in Calaveras Creek (Shapovalov 1938b).

In April 1988, DFG staff electrofished "selected" pools and riffles between the Alameda Creek confluence and about 0.5 miles downstream of Calaveras Dam. The survey report noted that habitat appeared to be suitable for rainbow trout, but *O. mykiss* was not caught or seen (Gray 1988a).

A lake survey by DFG from June 1940 indicated the presence of *O. mykiss* in Calaveras Reservoir (Shapovalov 1943). The Department of Fish and Game sampled the reservoir by electroshocking and gill net in at least five sampling events between April and September of 1973. Twenty-six *O. mykiss* were collected ranging from 244 to 546 mm FL (Anderson 1973; CDFG 1973; Meints and Anderson 1973; Strohschein 1973a, 1973b).

Arroyo Hondo

Arroyo Hondo flows generally north from its headwaters on Mt. Hamilton. Formerly a tributary to Calaveras Creek, it now feeds Calaveras Reservoir. A 1905 report noted *O. mykiss* in this stream (Snyder 1905). Construction of Calaveras Dam isolated this population from anadromous *O. mykiss*.

DFG reported that analysis of scales of *O. mykiss* indicated that two adults sampled in 1937 were found to be five years old. These fish probably migrated from Calaveras Reservoir two separate times to spawn in Arroyo Hondo (Shapovalov 1937). A September 1953 field note stated that trout of various sizes were seen in Arroyo Hondo at the bridge on Hondo Road (Evans 1953).

Sampling was performed by seining and electrofishing at a site near Arroyo Hondo Road between 1972 and 1977. The survey produced a relative abundance estimate for *O. mykiss* of "5" on a 5 point scale with "5" being "very abundant" (Scoppettone and Smith 1977).

In September 1993, Leidy electrofished five locations on Arroyo Hondo 0.15 miles, 0.2 miles, 0.6 miles, 0.8 miles, and 1.3 miles upstream from Marsh Road. The first site yielded three *O. mykiss* (72, 78, 82 mm); the second had six *O. mykiss* (70-200 mm); and the third contained three *O. mykiss* (50, 71, 79 mm) and ten fish seen but not collected (Leidy 2002). The fourth site produced four *O. mykiss* (64-100 mm) with three observed but not collected (>175 mm). The fifth and final site had three *O. mykiss* (60, 89, 105 mm) (Leidy 2002).

In order to develop information regarding life history characteristics of *O. mykiss* in Calaveras Reservoir, a fish trapping program has been developed for the SFPUC. In February-March 2002, a total of eight smolts and 23 adults were collected by fish traps operating over the course of ten days in Arroyo Hondo upstream of the reservoir (Entrix 2002). Juvenile *O. mykiss* were found from 98-142 mm FL, while adults ranged from 395-508 mm FL (Entrix 2002).

Trout samples were taken from Arroyo Hondo in 2002 for genetic analysis. *Oncorhynchus mykiss* using the creek were shown to be closely related to previously sampled fish and to native, wild *O. mykiss* collected in other portions of the watershed (Nielsen 2003).

Smith Creek

This creek is tributary to Arroyo Hondo and is about eight miles in length. Smith Creek flows generally north past Mt. Hamilton to its confluence with Isabel Creek, when it becomes Arroyo Hondo. A 1905 report notes *O. mykiss* in Arroyo Hondo (Snyder 1905). This population was isolated from anadromous *O. mykiss* by construction of Calaveras Dam.

A 1940 DFG survey report for the creek noted only that "very good" natural production occurs in one section of Smith Creek (Shapovalov 1940a). A DFG field note from July 1953 indicated the presence of *O. mykiss* fry to 150 mm in length, and called the creek "excellent" for trout (CDFG 1953b). These notes also referred to planting of *O. mykiss* fingerlings in 1952.

A 1957 DFG report noted that rescued juvenile steelhead from Uvas Creek had been planted in the Smith Creek headwaters (Pintler 1957). Sampling was performed by seining and electrofishing at a site near Mt. Hamilton Road between 1972 and 1977. The survey produced a relative abundance estimate for *O. mykiss* of "2" on a 5-point scale (Scoppettone and Smith 1977).

DFG visually surveyed five miles of Smith Creek from its mouth upstream to the Highway 130 Bridge. The survey report referred to 1993 population surveys that discovered *O. mykiss* averaging 82 mm in length, with individuals up to 282 mm in length present (Boydstun 1994). These surveys yielded a population density estimate of approximately 4,400 individuals per mile. The 1994 survey found "numerous" YOY, 1+ and 2+ *O. mykiss*, with the largest up to 250 mm in length. According to the report, the stream appeared to be producing a large and healthy *O. mykiss* population (Boydstun 1994). Spawning areas for *O. mykiss* were noted as "small" and "quite good," while pool habitats were "very good" (Boydstun 1994).

Leidy electrofished a 30 meter reach on Smith Creek about 220 yards upstream from Mt. Hamilton Road in March 1996 and caught two *O. mykiss* (89, 145mm FL) (Leidy 2002). He also electrofished a 60 meter reach immediately above the road crossing in June 1997, catching ten *O. mykiss* (42-52mm) and observing about 50 more *O. mykiss* in the same size range (Leidy 2002).

Sulphur Creek

Sulphur Creek is tributary to Smith Creek. A 1940 DFG survey cited a report by Warden C.H. Holladay that excellent natural reproduction of *O. mykiss* occurred in this stream (Shapovalov 1940b).

In May 2002, Leidy surveyed Sulphur Creek from the Smith Creek confluence upstream about 1.5 miles to a natural falls. He observed juvenile *O. mykiss* (25-125 mm TL) to be "common" (10-15 per 30 meters), and noted adults between 200 and 300 mm TL (Leidy 2002).

Isabel Creek

Isabel Creek joins Smith Creek to become Arroyo Hondo, which is tributary to Calaveras Reservoir. A 1905 report noted *O. mykiss* in this stream (Snyder 1905). Lake Isabel, constructed in the mid-1940s impounds the creek in the headwaters portion of the catchment. The Lake Isabel Dam and the Calaveras Dam isolated *O. mykiss* populations in upstream and downstream reaches.

According to a July 1948 DFG memorandum, the reach seven miles below the Lake Isabel is intermittent in character but several miles of "good" trout habitat exist downstream of the lake (Shapovalov 1948). Department of Fish and Game notes from 1953

referred to the presence of *O. mykiss* and called the creek "excellent" for rainbow trout (CDFG 1953a). The notes also referred to the planting of *O. mykiss* fingerlings, but did not provide a date of occurrence. A 1957 DFG report noted that rescued juvenile steelhead from Uvas Creek had been planted in the Isabel Creek headwaters (Pintler 1957).

Sampling was performed by seining and electrofishing at a site near Kincaid Road between 1972 and 1977. The survey produced a relative abundance estimate for *O. mykiss* of "4" on a 5-point scale (Scoppettone and Smith 1977). A separate DFG visit was performed in June 1975 at this location. Fingerling *O. mykiss* were observed, and interviews with anglers noted individuals 150-215 mm taken (Anderson 1975b). The visit report indicated that Isabel Creek rainbow trout were considered a resident population as a natural falls downstream (in Arroyo Hondo) prevented passage by fish from Calaveras Reservoir.

A 1998 report concerning steelhead resources notes that a "healthy" *O. mykiss* population occurs in Isabel Creek (Smith 1998). These fish are assumed to be native.

W Tree Creek

W Tree Creek enters Alameda Creek from the north near Camp Ohlone Regional Park. EBRPD staff sampled a 55-meter reach of this creek by electrofishing in June 1999. Staff recorded ten *O. mykiss* (53-60 mm) as well as two "missed" YOY (Alexander 1995-1999).

Bear Creek (Bear Gulch)

Bear Creek enters Alameda Creek from the north upstream of Camp Ohlone Regional Park. A 1942 DFG stream survey report noted that a local landowner had observed trout in this three-mile long creek with perennial flows (Curtis 1942).

Assessment: The Alameda Creek watershed, including numerous tributary catchments, formerly supported *O. mykiss* populations of unknown size. Based on the size of the watershed and the presence of perennial streams in the headwaters, it is likely that this catchment supported one of the largest historical steelhead runs in the San Francisco Estuary.

Construction of the Calaveras Dam in the 1920s blocked access to many of the tributaries known to have contained *O. mykiss*. Similarly, San Antonio Dam was constructed without provision for fish passage and this construction led to further restriction of habitat in the Alameda Creek watershed. Habitat restriction and degradation from water projects and other development related to urbanization caused substantial decline in the population of steelhead entering the watershed to spawn. In the 1970s, flood control and water diversion projects in the lower portion main stem Alameda Creek were approved and constructed without regard for anadromous fish passage. These structures completely blocked access to suitable spawning and rearing habitat in the system.

Nonetheless, small numbers of steelhead continue to enter Alameda Creek regularly, and plans to remove or otherwise mitigate migration barriers have been developed. Addressing seven or more barriers in main stem Alameda Creek is likely to allow access to spawning and rearing habitat, and may lead to successful re-establishment of a steelhead run in the creek. Non-hybridized descendants of Central Coast *O. mykiss* in San Antonio and Calaveras Reservoirs may be used to jump-start a run in the future.

Laguna Creek (Arroyo de la Laguna) Watershed

The Laguna Creek basin covers 25 square miles and has been substantially altered for the purposes of flood control. A map from 1870 indicates that Laguna Creek originally flowed from a lagoon that was also the terminus of Mission Creek (Jones & Stokes Associates Inc. 2000). Most of Laguna Creek and its tributaries are maintained as flood control channels (Jones & Stokes Associates Inc. 2000).

Laguna Creek

Laguna Creek begins at Lake Elizabeth and flows south through Fremont, then west to enter the San Francisco Estuary near Don Edwards National Wildlife Refuge. No records related to observations of salmonids were found for Laguna Creek.

Mission Creek

Mission Creek originates in the hills east of Mission San Jose and feeds the current Lake Elizabeth, formerly called Stivers Lagoon. Mission Creek was sampled by dipnet near Mission San Jose High School in August 1981 as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984).

Assessment: Insufficient information exists to determine if Mission Creek historically supported populations of *Oncorhynchus* spp. Under present conditions, riparian corridors along Laguna Creek and its tributaries are narrow and discontinuous due to portions of the creeks being placed underground, and to the effects of development and flood control practices (Jones & Stokes Associates Inc. 2000). The potential for migration of anadromous salmonids through the lower Laguna Creek area appears to be very limited.

Table IV-5. Distribution status of O. mykiss in San Francisco Estuary streams of Alameda County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
Codornices Creek	Codornices	9/1	1995-2003	0, 1, 2	J/8; R/8	Y	DF	DF	-	1, 2, 3	67, 76 (7)
Strawberry Creek	Strawberry	0	0	-	-	N	DF	NP	Y	0	31, 86
Temescal Creek	Temescal	1/0	1856	3	-	N	DF	NP	Y	0	36
Glen Echo Creek	Glen Echo	1/0	0 **1998**	2	-	N	UNK	NP	-	0	60
Sausal Creek	Sausal	6/0	1998-2002	1,2	J/4; R/3	UNK	DF	DF	Y	1	31, 47, 60, 76, 80, 94
	Shepherd	1/1	1998	2	R/1	UNK	DF	DF	Y	1	60, 80
	Palo Seco	4/1	1997-2001	0,1,2	J/3; R/1	UNK	DF	DF	Y	1	60, 80 (1)
Peralta Creek	Peralta	2/0	0 **1998**	1, 3	-	N	UNK	NP	-	0	60, 76
Lion Creek	Lion	2/0	1997	0, 2	J/1; R/1	UNK	DF	DF	Y	1	60, 122
	Horseshoe	1/1	**1998**	2	R/1	UNK	DF	DF	Y	1	60
	Chimes	1/0	0 **1998**	1	-	N	UNK	NP	-	0	60
Arroyo Viejo Creek	Arroyo Viejo	2/0	0 1998	0, 2, 3	-	N	PS	NP	-	0	60, 76

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
San Leandro Creek	San Leandro	20/14	1855-2001	1, 2, 3	J/14; M/1; R/16	Y	DF	DF	Y	1, 2, 3	4-6, 18, 19, 23, 31-33, 37, 44, 57, 63, 64, 66, 68, 75-77, 86, 100, 103
	Miller	1/0	0 **1993**	2	-	N	UNK	UNK	-	0	64
	Kaiser	8/7	1983-2000	2, 3	J/7; R/7	N	DF	DF	-	1, 2, 3	4, 5, 7, 22, 37, 48, 57, 68, 101
	Buckhorn	4/0	2001-2002	1, 2, 3	R/2	N	DF	DF	Y	1	4, 7, 37, 57, 68 (8)
	Redwood	17/15	1972-2002	1, 2, 3	J/16; R/14	N	DF	DF	Y	1, 2, 3	3-6, 18, 22, 26, 36-38, 48, 56, 58, 61, 62, 64, 68, 71, 77, 88-91, 102
	Moraga	7/5	1987-2000	2, 3	J/4; R/3	N	DF	DF	Y	1, 2	37, 40, 51, 65, 68, 76, 121,
	Indian	8/6	1981-97	2, 3	J/5; R/5	N	DF	DF	Y	1	4-6, 48, 57, 68, 76, 77
San Lorenzo Creek	San Lorenzo	9/1	1942-2002	0, 1, 3	J/1; R/3; M/4	N	DF	DF	Y	1	2, 10, 12, 15, 34, 39, 59, 73, 76, 113, 115 (2)
	Castro Valley	2/0	1998 **2001**	1	R/1	N	DF	NP	-	0	2, (4)
	Crow	4/2	1960-2002	0, 1, 3	R/2	N	DF	DF	Y	1	2, 10, 12, 17, 35, 39, 76, 115
	Cull	4/0	1958 **2001**	0, 1,3	J/1	N	DF	NP	Y	0	2, 9, 76, 93, 115

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Palomares	5/1	1960-87 **2001**	0, 1, 2	J/1	N	DF	NP	Y	0	2, 11, 53, 76, 77
	Eden Canyon	2/0	0 **2001**	1,3	-	N	PS	NP	Y	0	2, 13, 76
Alameda Creek	Alameda	18/9	1938-2002	0, 1, 2, 3	J/10; R/9; M/11	N	DF	DF	Y	1, 2, 3	1, 8, 10, 20, 52, 56, 77, 85, 87, 92, 99, 105, 123 (6)
	Dry	0/0	0	-	-	N	PB	NP	-	0	(5)
	Stonybrook	5/4	1955-2000	0, 2, 3	J/3; R/4; M/1	N	DF	DF	Y	1, 2	8, 10, 21, 45, 46, 52, 83, 98
	Sinbad	2/0	1940s-1950s **1999**	2, 3	M/1	N	DF	NP	Y	0	8, 84
	Arroyo de la Laguna	6/0	0 **1996**	2	-	N	DF	NP	Y	0	49, 77, 82, 95, 96, 115, 118
	Vallecitos	1/0	0 **1993**	2	-	N	UNK	NP	-	0	(1)
	Arroyo Valle	7/2	1910-1953 **1999**	0, 1, 2, 3	M/2	N	DF	NP	Y	0	8, 27, 50, 56, 77, 115
	Trout	1/0	1944	1	-	N	DF	UNK	-	0	112
	Colorado	1/1	1981	1	-	N	DF	UNK	-	0	76

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Arroyo Bayo	0	0	-	-	N	UNK	NP	-	0	(3)
	San Antonio	0	0	-	-	N	UNK	NP	-	0	(3)
	Beau-regard	0	0	-	-	N	UNK	NP	-	0	(3)
	Arroyo Mocho	11/2	1911-2001	1, 2, 3	J/2; R/4	N	DF	DF	Y	1, 2, 3	56, 77, 79, 87, 97, 99, 111, 115
	Tassajara	1/0	0 **1994**	2	-	N	UNK	NP	-	0	77 (3)
	Arroyo Las Positas	1/0	0 **1999**	1	-	N	PB	NP	-	0	56, 115
	Cayetano	1/0	0 **1999**	-	-	N	UNK	NP	-	0	56
	South San Ramon	0	0	-	-	N	UNK	NP	-	0	(3)
	San Antonio	2/2	1954-97	0, 2, 3	J/2; S/1; R/1	N	DF	DF	Y	1, 2, 3	10, 41, 43, 77, 87
	Indian	2/1	1953-97	1, 2, 3	J/2; R/1	N	DF	DF	Y	1, 2, 3	10, 69, 70, 77
	La Costa	2/1	1938-93	1, 2	J/2	N	DF	DF	Y	1, 2, 3	10, 77, 107
	Indian Joe	2/2	1997-99	0, 2, 3	J/2;	N	DF	DF	Y	1, 2, 3	8, 74

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Calaveras	4/1	1938-2002	1, 2, 3	J/1; R/1	N	DF	DF	Y	1	14, 30, 54, 81, 106, 110, 119, 120
	Arroyo Hondo	6/3	1905-2002	1, 2, 3	J/2; R/2; S/1	N	DF	DF	Y	1, 2, 3	41, 42, 77, 87, 99, 104, 117,
	Smith	8/5	1905-97	1, 2, 3	J/6; R/3	N	DF	DF	-	1, 2, 3	24, 29, 77, 92, 99, 108, 117
	Sulphur	2/1	1940-2002	1	J/1; R/1	N	DF	DF	-	1, 2, 3	77, 109
	Isabel	6/2	1905-2002	0, 1, 2, 3	J/1; R/1	N	DF	DF	-	1, 2, 3	16, 28, 92, 99, 114, 116, 117
	W Tree	1/1	1999	2	J/1	N	DF	DF	-	1	8
	Bear Gulch	1/0	1942	0	-	N	DF	PS	-	1	32
Laguna Creek	Mission	1/0	0 **1981**	3	-	N	UNK	NP	-	0	76

[a] Table headings and codes are defined in the Methods section of this report.

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ALAMEDA COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Alameda County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Alameda County, Caliornia.