RUSSIAN RIVER BIOLOGICAL ASSESSMENT

INTERIM REPORT 6:
RESTORATION AND CONSERVATION ACTIONS

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
San Francisco District
San Francisco, California

and

SONOMA COUNTY WATER AGENCY
Santa Rosa, California

Prepared by:

ENTRIX, INC.
Walnut Creek, California

May 11, 2001

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Page

Page

The Sonoma County Water Agency (SCWA), the U.S. Army Corps of Engineers (USACE), and the Mendocino County Russian River Flood Control and Water Conservation Improvement District (MCRRFCD) are undertaking a Section 7 Consultation under the federal Endangered Species Act (ESA) with the National Marine Fisheries Service (NMFS) to evaluate effects of operations and maintenance activities on listed species and their critical habitat. The Russian River watershed is designated as critical habitat for threatened stocks of coho salmon, chinook salmon and steelhead. SCWA, USACE and MCRRFCD operate and maintain facilities and conduct activities related to flood control, channel maintenance, water diversion and storage, hydroelectric power generation, and fish production and passage.

Federal agencies such as USACE are required under the ESA to consult with the Secretary of Commerce to insure that their actions are not likely to jeopardize the continued existence of listed species or adversely modify or destroy critical habitat. As part of the Section 7 Consultation, USACE and SCWA will submit to NMFS a biological assessment (BA) that will provide the basis for NMFS to prepare a biological opinion (BO) that will evaluate current and alternative project operations. The BA will integrate interim reports on current project operations.

This report assesses restoration and conservation actions in the Russian River Watershed that SCWA has either funded or implemented with staff time and materials, or with a combination of SCWA funding and other resources, to benefit listed species and their critical habitat in the Russian River basin. These efforts include the general categories of restoration projects (riparian and aquatic habitat protection, restoration and enhancement, fish passage), watershed management, and water conservation and reuse.

Potential effects on protected coho salmon, steelhead, and chinook salmon and their critical habitat were evaluated. Restoration and conservation actions have a beneficial effect on the habitat of the protected species. There may be effects to individual fish during construction activities, but there is no risk to protected populations. This section provides key findings.

Funding and Priorities

SCWA commits substantial funds, staff and equipment to restoration projects. The SCWA spends approximately $800,000 per year on its Natural Resources program, about 30 to 40% on monitoring at the Mirabel and Wohler diversion facilities (which has yielded valuable information about how listed fish species use the watershed), about 50% on FEP projects, and about 10% on meetings. Additionally, in-kind contributions of staff and equipment were committed to restoration projects. For example, the in-kind contribution for restoration work on Big Austin Creek was $7,000 and on Copeland Creek was $31,000. An additional $471,000 in grants was secured in the year 2000, and additional grant money will be pursued in the future.

To maximize the effectiveness of the dollars invested, SCWA develops project priorities on a basin-wide level and in cooperation with CDFG and other agencies and private interests in the watershed. When the CDFG Draft Basin Restoration Plan for the Russian River Basin is released (spring of 2001), SCWA will work to implement priorities and recommendations formally outlined by CDFG. Partnerships with other stakeholders in the watershed have been instrumental to the success of SCWA restoration projects and programs. SCWA expands the indirect beneficial effects of restoration projects by utilizing all available opportunities for public education.

Restoration Actions and Fish Passage Projects

Restoration projects are designed to increase the quantity and quality of salmonid habitat. Instream habitat improvements are structures or alterations within the streambed that improve or create spawning and rearing habitat. Riparian restoration activities reduce streambank erosion and reestablish native riparian vegetation that restore the natural functions of the riverine ecosystem. Projects to control rural road erosion reduce sediment runoff into valuable spawning and rearing habitat, and often help to reestablish riparian vegetation.

Typically, larger projects provide more biological benefits than smaller projects. Conservation and restoration actions were evaluated quantitatively by assessing their *biological benefit*. The biological benefit score was based on the project size (length of stream affected), the timeframe for expected benefits, habitat elements affected and their relative importance to listed fish species, stream inventory and/or population data, the cost vs. benefits of the project, and the educational value of the project. It should be noted that projects may have effects beyond the immediate project area. For example, a series of small instream structures can beneficially change the habitat unit ratios of an entire reach (pool/run/riffle ratio). Reductions of sediment input to a stream may benefit a long stream reach downstream of the project. The habitat value was qualitatively assessed by considering the duration and timeframe to development, effects to canopy cover, instream cover, sediment and bank erosion. The importance of the project for improving a limiting factor was considered. A biological benefit score of 5 represents a project that has a very high potential to benefit listed fish species. A score of 3 represents a project that while useful, has small, localized benefits or is located in an area that has less value for salmonid spawning or rearing. If a project uses limited financial resources that would be better spend elsewhere, it is scored a 2 and if it results in long-term degradation of habitat, it is scored a 1.

Table E-1 summarizes information about past, current and proposed actions, the biological benefit scores, and where known, indicates the listed fish species the action is likely to affect. Steelhead are the most abundant species in many of these areas, but as coho salmon or chinook salmon populations are recovered, utilization of these streams by these species is likely to increase. All projects listed are likely to improve habitat for spawning, rearing and migration of protected salmonids. Restoration actions that are part of the proposed actions and have been implemented since the time the MOU was signed (December 31, 1997) represent an improvement to baseline conditions and do not require a take authorization. Actions that require take are projects that will be implemented and may have direct effects on listed species during construction. They are usually projects that require instream work while listed fish species may be present. Best management practices to minimize adverse effects are generally outlined during the permitting process.

Table E-1 Summary of Restoration and Conservation Actions

The size of the project is the actual length of stream affected. A "+" indicates projects that have effects that may extend well beyond the immediate project area.

Creek	Type of Project	Size of Project	Species Affected[1]	Biological Benefit Score[2]
BASELINE PROJECTS				
Instream Habitat Improvements				
Green Valley	Contiguous structures and fencing	~ 1 mile	Co, St	5
Freezeout	3 non-contiguous structures		Co, St	4
Riparian Restoration				
Green Valley (streambank stabilization)	Erosion control	2 small projects	Co, St	Co – 3 St - 4
Green Valley (livestock exclusion)	Fencing	> 1 mile	Co, St	5
Freezeout	Fencing	3,000 ft	St	4
Little Briggs	Fencing	> 1 mile	St	5
Porter	Willow walls & mattresses	~300 ft	St	3
Matanzas	Willow wall, revegetation	~20 ft	St	3
PART OF THE PROPOSED ACTIONS (NO TAKE STATEMENT REQUIRED)				
Instream Habitat Improvements				
Mill	14 sets instream habitat structures	~ 2 miles	St	5
Felta	14 sets instream habitat structures	~ 2 miles	Co, St	5
Riparian Restoration				
Copeland	Fencing, grading, riparian planting	6,000 ft	St	4
Howell	Fencing	4,000 ft	St	4
Turtle	Willow walls & mattresses	500 ft	Co, St	3
Turtle	Irrigation	> 1 mile	Co, St	5
Felta	Willow walls	3 projects	St	3
Russell Irrigation site on Turtle Creek	Fencing, cattle removal	> 1 mile	Co, St	5
Unnamed - Huff property	Willow wall		Co, St	3

Table E-1 Summary of Restoration and Conservation Actions –Continued–

Creek	Type of Project	Size of Project	Species Affected[1]	Biological Benefit Score[2]
PART OF THE PROPOSED ACTIONS (NO TAKE STATEMENT REQUIRED) –CONT'D–				
Instream and Riparian Restoration				
Brush	Streambed and bank regrading, instream structures, revegetation	1,200 ft +	St	5
Big Austin	Reconstruct channel	1,300 ft	Co, St	5
Big Austin	13 erosion control/riparian structures – willow baffles, willow wall, slide repair	0.5 mi. +	Co, St	5
Palmer	Instream habitat structures	3,000 ft	St	5
Rural Road Erosion Control				
Palmer	Erosion control, instream structures	1.5 +	Co, St	5
Santa Rosa (Hood Mt.)	Road and landslide erosion control	100 yds +	Co, St	5
Fish Passage				
Santa Rosa (Hood Mt.)	Rock weirs, not completed	10 miles upstream habitat	Co, St	5
PROJECTS THAT REQUIRE TAKE				
Instream Habitat Improvements				
Palmer	Instream habitat structures		St	5
Instream and Riparian Restoration				
Santa Rosa Creek	Restore channelized creek to more natural form and function	12.8	St	5
Fish Passage				
Matanzas	Passage through box culvert, not completed	5 miles upstream habitat	St	5
Mumford Dam	Rock weirs, not completed	~600 ft of channel & 10 miles upstream habitat	St, Ch, Co	5
Crocker Creek Dam	Series of weirs. Regrade, stabilize, and replant stream banks.	4.5 miles	St	5

[1]Co = Coho, St = Steelhead, Ch = Chinook
[2]A score of 5 is the highest biological benefit

The primary benefit of fish passage projects is that additional spawning and rearing habitat becomes available to anadromous salmonids. Matanzas Creek Fishway will provide access for steelhead to approximately five miles of habitat upstream of the mouth of Matanzas Creek. The Mumford Dam modification project will provide unrestricted access to approximately 10 miles of spawning and rearing habitat in the main stem Russian River primarily for steelhead and chinook salmon and possibly coho salmon. This project also improves about 600 feet of habitat directly below Mumford Dam. The improvements in Santa Rosa Creek in the Hood Mountain region improve access to about 10 miles of quality upstream habitat. The Crocker Creek Dam fish passage project will provide access to approximately 4.5 miles of spawning and rearing habitat, as well as improved habitat resulting from stabilized and revegetated stream banks upstream of the dam site.

Fish passage projects have the potential to increase predation on protected salmonids. There is no increased risk of predation at the Mumford Dam, Crocker Creek Dam or Santa Rosa Creek sites. However, by concentrating adult steelhead at the entrance to the culvert, the Matanzas project has the potential to expose fish to poaching. Limited access to the site during high flows (when upstream migration occurs) is likely to keep that risk low.

Effects from construction of these restoration and passage projects are minimized by the use of effective BMPs as specified during the permitting process. Construction activities are timed to occur when flows are low or channels are dry. When work does occur in a wetted channel, only rearing salmonids are expected to be present. Fish rescue is generally provided. Instream and upslope sediment control measures will minimize sediment input to the stream channel. Where appropriate, native vegetation will be planted to reduce long-term erosion and increase the habitat value of the project area.

Water Conservation and Reuse

Water reuse and conservation will reduce peak water demand on the order of 3-5%. This would typically occur during the dry season in mid-summer. Water conservation is expected to help meet future, growing, water demands and may help to reduce the amount of water diverted from streams.

Watershed Management Projects

Scientific research efforts, information dissemination, and regional coordination of management efforts are important components of the restoration and conservation of protected species and their critical habitat. Table E-2 summarizes watershed management projects and their relative value in terms of the geographic area they are likely to affect and the biological benefit they may provide for listed fish species. Basin-wide applicability (score 5) addresses most or all of the watershed that is likely to be important to protected species. Isolated project/stream information is likely to be useful in a localized area, such as a particular stream or stream reach. A SCWA-funded review of the North Coast Regional Water Quality Control Board (RWQCB) Russian River Basin Plan water quality requirements may lead to changes in regulatory standards that increase protection for listed fish species, affecting management of the Russian River watershed and the entire ESU of each listed fish species. Data on population trends and habitat use will help focus conservation actions where they will have the greatest effect. By sharing information and coordinating restoration actions with other groups, limited resources and beneficial effects are maximized.

Table E-2 Information Value Scores

Project	Range of Applicability	Information Value Score
DATA COLLECTION		
Stream habitat surveys	Basin-wide: SCWA focus on Mark West and Santa Rosa Creek watersheds	5
Temperature	Major tributary watersheds	5
Water quality sampling	Austin, Maacama, Mainstem Mark West, Santa Rosa, Green Valley, Mill, Ackerman, Robinson, Dutch Bill, Hulbert, Fife, Franz, Porter, Redwood	4
Coho and steelhead population monitoring	Basin-wide	5
Genetic studies on coho, steelhead and chinook	Basin-wide	5
Arundo mapping and research	Basin-wide	5
Laguna de Santa Rosa sedimentation study	Regional application - lower Russian River floodplain	4
DEMONSTRATION PROJECTS		
Pierce's Disease Control Study	Maacama Creek site, with potential application to other vineyards	5
Fish Friendly Farming	Vineyards, the dominant agricultural industry in the watershed	5
Palmer Road Erosion Control	Demonstration project helpful for other work in areas with road erosion problems	3
INFORMATION COORDINATION AND DISSEMINATION		
KRIS/GIS Database	Basin-wide	5
Restoration Project Database	Basin-wide	5
Information dissemination: Workshops, newsletters, library, training programs, school projects	Regional applications	4
RWQCB Russian River Basin Plan Review	Basin-wide, and application to entire evolutionarily significant units of listed fish species	5
Watershed Management Plan	Regional applications	4
NBWA participation	Regional applications	4
Clean-up days	Target specific streams	3

Synthesis of Effects

SCWA commits substantial funds, staff and equipment to restoration projects. SCWA's success with grant writing has been, and will continue to be, used to supplement this effort. The value of this commitment is maximized by prioritizing projects on a basin-wide level, through cooperation with other stakeholders, and by utilizing opportunities for public education.

Restoration and conservation actions are likely to benefit protected species and their critical habitat. Restoration projects restore habitat for protected salmonids. Fish passage projects increase access to valuable spawning and rearing habitat. BMPs are outlined during the permitting process and are used during construction and maintenance activities to minimize direct injury to fish and to minimize sediment input to the stream. While construction activities related to the fish passage projects may have short-term effects on rearing salmonids in the area, rescue efforts and judicious timing of the construction are expected to minimize these effects. Watershed management actions, including funding of review of the RWQCB Russian River Basin Plan, data collection, information dissemination, and coordination of stakeholder activities, are expected to help to make appropriate management decisions, target the use of limited resources, and coordinate conservation and restoration actions on local and regional levels. The benefits of water reuse and conservation are likely to help reduce shortages during peak water demand, and may not directly affect protected species and their habitat.

Restoration and conservation actions are likely to adversely affect the listed fish species because there may be effects to individual fish during construction activities. The effects are limited to short-term effects during construction activities, during fish rescue efforts or during the placement or removal of construction isolation structures in the stream. This may present a small risk to individual fish, but no risk to protected populations. Restoration and conservation actions are not likely to adversely modify the designated critical habitat of the listed fish species. The restoration and conservation actions have a beneficial effect on the habitat of the protected species.

It may seem to the reader that it is contradictory to state that there is no risk of adverse effects to protected populations, along with the statement that the proposed project is likely to adversely affect the listed species. However, the first statement is a general assessment of the risk to the larger population of the protected fish species, while the second statement reflects the possibility that one or more fish might be harmed by certain activities. These conclusions will assist NMFS with preparing a BO which may include an incidental take statement (with regard to the individual fish that may be harmed by the proposed action), as well as a determination of whether the proposed action is likely to jeopardize the continued existence of the species.

1.1 SECTION 7 CONSULTATION

The Sonoma County Water Agency (SCWA), the U.S. Army Corps of Engineers (USACE), and the Mendocino County Russian River Flood Control and Water Conservation Improvement District (MCRRFCD) are undertaking a Section 7 Consultation under the federal Endangered Species Act (ESA) with the National Marine Fisheries Service (NMFS) to evaluate effects of operations and maintenance activities. The activities of the USACE, SCWA, and MCRRFCD span the Russian River watershed from Coyote Valley Dam and Warm Springs Dam to the estuary, as well as some tributaries. The Russian River watershed is designated as critical habitat for threatened stocks of coho salmon, chinook salmon and steelhead. The SCWA, USACE, and MCRRFCD operate and maintain facilities and conduct activities related to flood control, water diversion and storage, hydroelectric power generation, and fish production and passage. The SCWA, USACE, and MCRRFCD also are participants in a number of institutional agreements related to the fulfillment of their respective responsibilities.

Federal agencies such as the USACE are required under the ESA to consult with the Secretary of Commerce to insure that their actions are not likely to jeopardize the continued existence of listed species or adversely modify or destroy critical habitat. The USACE, SCWA, and NMFS have entered into a Memorandum of Understanding (MOU) which establishes a framework for the consultation and conference required by the ESA with respect to the activities of the USACE, SCWA and MCRRFCD that may directly or indirectly affect coho salmon, chinook salmon and steelhead in the Russian River. The MOU acknowledges the involvement of other agencies including: the California Department of Fish and Game (CDFG), the U.S. Fish and Wildlife Service (USFWS), the State Water Resources Control Board (SWRCB), the North Coast Regional Water Quality Control Board (RWQCB), the State Coastal Conservancy, and the Mendocino County Inland Water and Power Commission (MCIWPC).

1.2 SCOPE OF THE BIOLOGICAL ASSESSMENT

As part of the Section 7 Consultation, the USACE and SCWA will submit to NMFS a biological assessment (BA) that provides a description of the actions subject to consultation, including the facilities, operations, maintenance and existing conservation actions. The BA will describe existing conditions including information on hydrology, water quality, habitat conditions, and fish populations. The BA will provide the basis for NMFS to prepare a biological opinion (BO) that will evaluate the project, including conservation actions.

This document presents an analysis of the potential for adverse impacts to the Russian River populations of coho salmon, steelhead, and chinook salmon as a result of certain activities. Because the ESA prohibits take of any individuals, the document will come to a conclusion of “likely to adversely affect” if any individual fish could be harmed by the proposed action, even if the overall risk of adverse impact to the overall population is low. Such a conclusion would mean that one or more listed fish might be harmed by the proposed action. Once a BA containing this determination is submitted to NMFS, formal consultation under the ESA will be initiated. During the formal consultation process, NMFS will make an assessment of whether the proposed action is likely to jeopardize the continued existence of the species. NMFS will present this conclusion in the form of a BO.

The BA will integrate a number of Interim Reports:

Report 1	Flood Control Operations
Report 2	Fish Facility Operations
Report 3	Instream Flow Requirements
Report 4	Water Supply and Diversion Facilities
Report 5	Channel Maintenance
Report 6	Restoration and Conservation Actions
Report 7	Hydroelectric Projects Operations
Report 8	Estuary Management Plan

This interim report evaluates the effects of restoration and conservation actions in the Russian River Watershed, focusing on projects which SCWA has either funded or implemented with staff time and materials, or with a combination of SCWA funding and other resources.

1.3 STATUS OF COHO SALMON, STEELHEAD AND CHINOOK SALMON, IN THE RUSSIAN RIVER

The primary biological resources of concern within the project area are coho salmon, steelhead and chinook salmon. These species are each listed as threatened under the ESA. The pertinent Federal Register notices for these species are provided in Table 1-1. Coho salmon and steelhead are native Russian River species, although there have been many plantings from other river systems (CDFG 1991). It is uncertain whether chinook salmon used the Russian River historically (NMFS 1999). They have been stocked in the past, were not stocked in the last two years, but continue to reproduce in the watershed. The Central California Coast Coho Salmon Evolutionarily Significant Unit (ESU), which contains the Russian River, extends from Punta Gorda in northern California south to and including the San Lorenzo River in central California, and includes tributaries to San Francisco Bay, excluding the Sacramento-San Joaquin River system. The Russian River is the largest drainage included in the Central California Coast Steelhead ESU, which extends from the Russian River down the coast to Soquel Creek near Santa Cruz, California. The chinook salmon listing defined the population unit that contains the Russian River as the California Coastal ESU. This ESU encompasses the region from Redwood Creek in Humboldt County to the Russian River (Sonoma County).

Critical habitat for each of these species within the Russian River is designated as the current estuarine and freshwater range of the species including "all waterways, substrate, and adjacent riparian zones...." For each species, NMFS has specifically excluded areas above Warm Springs and Coyote Valley dams and within tribal lands.

Table 1-1 Federal Register Notices for the Salmonids of the Russian River

Species	Listing	Take Prohibitions	Critical Habitat
Coho Salmon	Vol. 61, No. 212, Pgs. 56138-56147 Oct. 31, 1996	Vol. 61, No. 212, Pgs. 56138-56147 Oct. 31, 1996	Vol. 64, No. 86, Pgs. 24049-24062 May 5, 1999
Steelhead	Vol. 62, No. 159, Pgs. 43937-43954 Aug. 18, 1997	Vol. 65, No. 132, Pgs. 42422-42481 July 10, 2000	Vol. 65, No. 32, Pgs. 7764-7787 February 16, 2000
Chinook Salmon	Vol. 64, No. 179, Pgs. 50394-50415 Sept. 16, 1999	Not yet issued	Vol. 65, No. 32, Pgs. 7764-7787 February 16, 2000

Life history descriptions for these species are provided in sections 1.3.1 through 1.3.3 so that effects from project operations can be evaluated. All three species are anadromous, but steelhead may also exhibit a life history type that spends its entire life cycle in freshwater. These species migrate upstream from the ocean as adults and spawn in gravel substrate. Their eggs incubate for a short period, depending on water temperature, and generally hatch in the winter and spring. Juveniles spend varying amounts of time rearing in the streams and then migrate out to the ocean, completing the cycle. Details on life history, timing and habitat requirements are provided for each species.

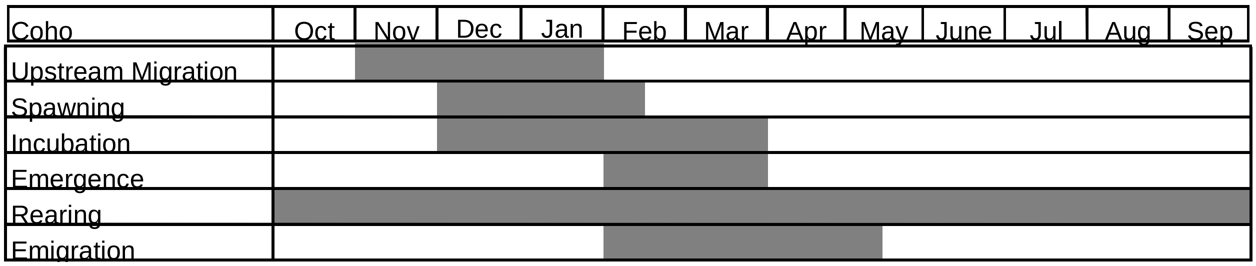
1.3.1 Coho Salmon

Coho salmon are much less abundant than steelhead in the Russian River basin. Spawning occurs in approximately 20 tributaries of the lower Russian River, including Dry Creek. In wet years, coho salmon have been seen as far upstream as Ukiah. The Don Clausen Fish Hatchery produced and released an average of about 70,000 age 1+ coho salmon each year (1980-1998). However, no coho have been produced in the last two years.

1.3.1.1 Life History

The coho salmon life history is quite rigid, with a relatively fixed three-year life cycle. The best available information suggests that life history stages occur during times outlined in Figure 1-1 (EIP Assoc. 1993, SCWA 1996, SWRCB 1997, RMI 1997, S. White, SCWA, pers. comm. 1999). Most coho enter the Russian River in November and December and spawn in December and January. Spawning and rearing occur in tributaries to the lower Russian River. The most upstream tributaries with coho salmon populations include Forsythe, Mariposa, Rocky, Fisher, and Corral creeks. The mainstem below Cloverdale serves primarily as a passage corridor between the ocean and the tributary habitat.

After hatching, young coho will spend about one year in freshwater before becoming smolts and migrating to the ocean. Freshwater habitat requirements for coho rearing include adequate cover, food supply, and water temperatures. Primary habitat for coho includes pools with extensive cover. Outmigration takes place in late winter and spring. Coho salmon live in the ocean for about a year and a half, return as three-year-olds to spawn, and then die. The factors most limiting to juvenile coho production are high summer water temperatures, poor summer and winter habitat quality, and predation.



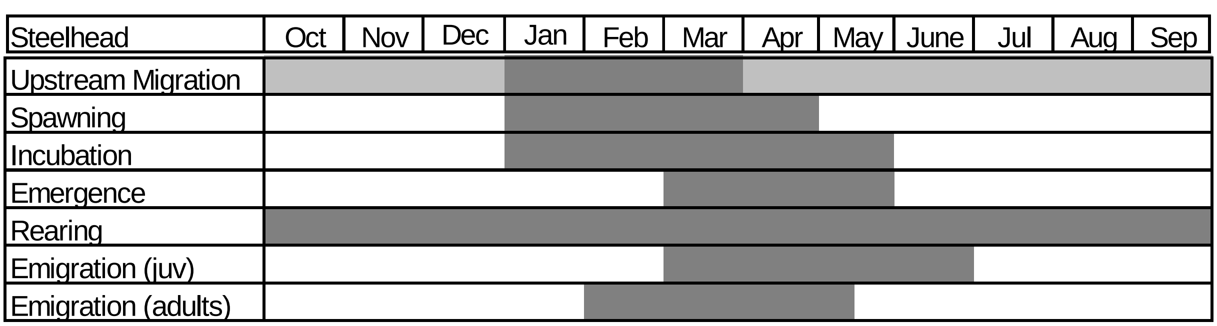
(EIP Assoc. 1993, SCWA 1996, SWRCB 1997, RMI 1997, S. White, SCWA, pers. comm. 1999).

Figure 1-1 Phenology of Coho Salmon in the Russian River Basin

1.3.2 STEELHEAD

There have been no recent efforts to quantify steelhead populations in the Russian River, but there is general agreement that the population has declined in the last 30 years (CDFG 1984, 1991). SCWA, CDFG and NMFS are currently developing programs to monitor trends in salmonid populations within the designated critical habitat boundaries for the basin. There has been substantial planting of hatchery reared steelhead within the basin, which may have affected the genetic constitution of the remaining natural population. Almost all steelhead planted prior to 1980 were from out-of-basin stocks (Steiner 1996). Since 1982, stocking of hatchery reared steelhead has been limited to progeny of fish returning to the Don Clausen Fish Hatchery and the Coyote Valley Fish Facility.

Steelhead occupy all of the major tributaries and most of the smaller ones in the Russian River Watershed. Many of the minor tributaries may provide spawning or rearing habitat under specific hydrologic conditions. Steelhead use the lower and middle mainstem Russian River primarily for migration to and from spawning and nursery areas in the tributaries and the mainstem above Cloverdale. The majority of spawning and rearing habitat for steelhead occurs in the tributaries. However, it is possible that juvenile rearing may occur in the mainstem before smolt outmigration.



(EIP Assoc. 1993, SCWA 1996, SWRCB 1997, RMI 1997, S. White, SCWA, pers. comm. 1999).
Note: Peak upstream migration occurs January through March, but adults have been observed in all months.

Figure 1-2 Phenology of Steelhead in the Russian River Basin

1.3.2.1 Life History

Adult steelhead generally begin returning to the Russian River in November or December, with the first heavy rains of the season, and continue to migrate upstream into March or April. Adults have been observed in the Russian River during all months (S. White, SCWA pers. comm. 1999). However, the peak migration period tends to be January through March (Figure 1-2). Flow conditions are suitable for upstream migration in most of the Russian River and larger tributaries during the majority of the spawning period in most years. Sandbars blocking the river mouth in some years may delay entry into the river. However, during the times the sand barrier is closed, the flow is probably too low and water temperature is too high to provide suitable conditions for migrating adults further up the river (CDFG 1991).

Most spawning takes place from January through April, depending on the time of freshwater entry (Figure 1-2). Steelhead spawn and rear in tributaries from Jenner Creek near the mouth, to upper basin streams including Forsythe, Mariposa, Rocky, Fisher and Corral creeks. Steelhead usually spawn in the tributaries, where fish ascend as high as flows allow (USACE 1982). Gravel and streamflow conditions suitable for spawning are prevalent in the Russian River mainstem and tributaries (Winzler and Kelly Consulting Engineers 1978), although gravel mining and sedimentation have diminished gravel quality and quantity in many areas of the mainstem. In the lower and middle mainstem (below Cloverdale) and the lower reaches of tributaries, water temperatures exceed 55°F by April in some years (Winzler and Kelly Consulting Engineers 1978), which may limit the survival of eggs and fry in these areas.

After hatching, steelhead spend from one to four years in freshwater. Fry and juvenile steelhead are extremely adaptable in their habitat selection. Requirements for steelhead rearing include adequate cover, food supply, and water temperatures. The mainstem above Cloverdale and upper reaches of the tributaries provide the most suitable habitat, as these areas generally have excellent cover, adequate food supply, and suitable water temperatures for fry and juvenile rearing. The lower sections of the tributaries provide less cover, as the streams are often wide and shallow and have little riparian vegetation, and water temperatures are often too warm to support steelhead. In the summer, these areas can dry up completely. Available cover has been reduced in much of the mainstem and many tributaries because of loss of riparian vegetation and changes in stream morphology.

Emigration usually occurs between February and June, depending on flow and water temperatures (Figure 1-2). Sufficient flow is required to cue smolt downstream migration. Excessively high water temperatures in late spring may inhibit smoltification in late migrants.

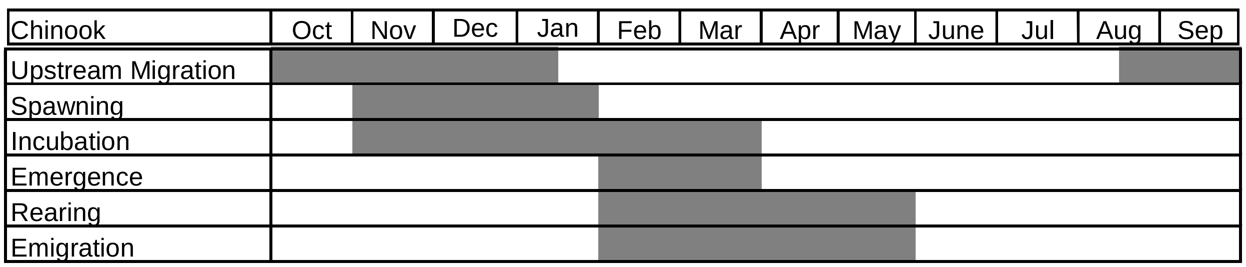
1.3.3 CHINOOK SALMON

The historic extent of naturally occurring chinook salmon in the Russian River is debated (NMFS 1999). Whether or not chinook were present historically, the total run of chinook salmon today, hatchery and natural combined, is small. Historic spawning distribution is unknown, but suitable habitat formerly existed in the upper mainstem and in low gradient tributaries. Chinook currently spawn in the mainstem and larger tributaries, including Dry Creek. Chinook tissue samples were collected this year by the SCWA, CDFG and NMFS from the mainstem, Forsythe, Feliz and Dry creeks, and there were anecdotal reports of chinook in the Big Sulphur system.

1.3.3.1 Life History

Adult chinook salmon begin returning to the Russian River as early as August, with most spawning occurring after Thanksgiving. Chinook may continue to enter the river and spawn into January (Figure 1-3) (S. White, SCWA, pers. comm., 1999).

Unlike steelhead and coho, the young chinook begin their outmigration soon after emerging from the gravel. Freshwater residence, including outmigration, usually ranges from two to four months, but occasionally chinook juveniles will spend one year in fresh water. Chinook move downstream from February through May (Figure 1-3). Ocean residence can be from one to seven years, but most chinook return to the Russian River as two to four-year-old adults. Like coho salmon, chinook die soon after spawning.



(EIP Assoc. 1993, SCWA 1996, SWRCB 1997, RMI 1997, S. White, SCWA, pers. comm. 1999).

Figure 1-3 Phenology of Chinook Salmon in the Russian River Basin

1.4 PROJECT DESCRIPTION

1.4.1 INTRODUCTION

The Sonoma County Water Agency (SCWA) has implemented many projects over the last several years that are designed to contribute to the conservation of natural resources in the Russian River watershed, particularly species listed under the Endangered Species Act (ESA). This report focuses on projects that SCWA has either funded or implemented with staff time and materials, or with a combination of SCWA funding and other resources. These efforts include the general categories of watershed management; riparian and aquatic habitat protection, restoration, and enhancement; construction of the Matanzas Creek Fishway; and Water Conservation and Recycled Water. Further details on these subjects are provided in the sections below.

1.4.2 WATERSHED MANAGEMENT

SCWA has historically been involved with watershed management activities in the Russian River watershed. Recently, SCWA has taken a more proactive role with regard to restoration and enhancement projects, and stewardship of the watershed. Several specific projects related to

SCWA's contributions to watershed management efforts in the Russian River basin are described below.

In March of 1995, and October of 1996, SCWA conducted two public workshops before its Board of Directors on watershed management activities, and specifically, SCWA's role in those activities. In August of 1996, SCWA published the report, *The Russian River: An Assessment of Its Condition and Governmental Oversight*. In January of 1997, SCWA began publishing the *Russian River Bulletin*, an interagency publication circulated among government agencies and other interested parties to describe new programs, legislation affecting or involving the Russian River, and the status of ongoing projects. In addition, SCWA has created a library, available to the public and other agencies, containing reports, documents, and other information pertinent to the Russian River watershed.

<u>Russian River Symposium</u>

In 1998, SCWA participated in the sponsorship of a three-day Russian River Symposium, at which agencies involved in studies and projects affecting the Russian River presented the results of their efforts. The symposium offered participants the opportunity to gain understanding of current issues in the Russian River, and a chance to build communication, cooperation, and coordination with other entities in the Russian River watershed. Invited participants included landowners, state and federal regulators, city and county planners, decision makers, farmers, activists, members of watershed groups, industry representatives, recreationists, environmental professionals, water and recycled water specialists, public health officials, and teachers and students. The Russian River Symposium is intended to be a one or two-day event occurring every two years.

<u>Russian River Basin Plan Review</u>

SCWA is providing funding for the North Coast Regional Water Quality Control Board (RWQCB) to conduct a review of their Russian River Basin Plan (Basin Plan) to determine whether the requirements of the Basin Plan are sufficient to protect fish species in the Russian River. This information will assist ongoing efforts in the Russian River watershed for watershed management and protection of threatened fish species by providing more information on the requirements of these species and an assessment of the adequacy of existing regulatory requirements in protecting these species. The review may lead to changes in regulatory standards.

<u>Resource Conservation District Assistance</u>

SCWA has contributed funding for Resource Conservation Districts in the Russian River watershed to develop and implement a Watershed Management Plan. This plan is intended to be a voluntary, watershed-based, locally-driven program to assist the agricultural and grazing community in complying with federal and state endangered species and water quality laws, including the protection of threatened fish species and their habitat. The watershed planning efforts will address soil and water conservation, including the improvement of farm irrigation and land drainage; erosion control and flood prevention; and coordination with community watershed groups. The plan will conform with city and county general plans that are applicable to the Russian River watershed area. In addition, the plan will incorporate the watershed planning needs identified by NMFS in notices associated with the listing of coho salmon, steelhead, and chinook salmon. For example, the listing notice for coho salmon stated that NMFS will work with federal, state, and local agencies, including the California Association of Resource Conservation Districts, to develop and implement planning efforts, and that both technical and financial assistance will be made available to farmers in high-priority watersheds.

One particular program that SCWA has assisted the Sotoyome RCD with implementing is the "Fish Friendly Farming" program. This program is a voluntary, incentive-based certification program to address recovery efforts of the listed fish species. A technical advisory committee that consisted of grapegrowers, vintners, farming organizations, environmental organizations, and government officials worked together to develop a certifiable set of best management practices (BMPs) aimed at restoring and enhancing the fish habitat in the Russian River watershed. The BMPs focus on conserving soil and restoring and sustaining fish habitat on the agricultural property. Participants in the program use a workbook to evaluate and assess their property, current growing practices, and to create a conservation plan for their property. The concept is that once the assessment and a farm conservation plan are completed and the BMPs are implemented, the grower will receive certification as a "fish friendly" grower.

North Bay Watershed Association

SCWA is also participating in the North Bay Watershed Association (NBWA), which has been created to bring together government agencies within the North Bay watershed to discuss issues of common interest and concern. Such issues include Total Maximum Daily Load (TMDL) regulations, ESA compliance, habitat restoration, recycled water use, NPDES permits and studies, pollution prevention, source water protection, public education, and others. The NBWA will be a forum to allow local entities to:

- Work cooperatively and effectively with other agencies on watershed-based regulations and issues;
- Explore coordinated efforts on projects in order to leverage limited funding and resources; decreasing their costs and increasing the impacts of projects;
- Maximize success in securing state and federal grant funding for new watershed initiative programs; and
- Efficiently share information about projects, regulations, and technical issues.

The NBWA can serve as a forum to find ways to increase the effectiveness of habitat restoration projects implemented by the participants. A watershed group, such as the NBWA, can seek opportunities to jointly develop habitat restoration projects to reduce costs and increase the ecological benefits to protected areas.

Russian River Watershed Council

SCWA has also contributed to a watershed community council within the Russian River watershed region that has been established by the California Resources Agency and the USACE. SCWA has provided a meeting place and refreshments, staff time, and other miscellaneous contributions, and has published updates in the *Russian River Bulletin*. The mission of the

Russian River Watershed Council is to protect, restore, and enhance the environmental and economic values of the Russian River watershed.

<u>KRIS/GIS Database</u>

SCWA is contributing to the North Coast Watershed Assessment Program (NCWAP) by developing Klamath Resource Information System (KRIS) coverages and developing selected Geographical Information System (GIS) layers for several watersheds on the North Coast, including the Russian River watershed. This KRIS/GIS system will develop management tools for the National Marine Fisheries Service (NMFS) and California Department of Fish and Game (CDFG) that facilitate salmon and steelhead conservation and recovery planning in NMFS's North-Central California Coast Recovery Planning Domain (planning domain).

KRIS is a Windows©-based or Internet-based computer program that allows easy access to data tables, charts, photographs, and bibliographic materials relevant to fisheries, water quality, and watershed management. The KRIS system can be adapted to any watershed to track factors that affect fish production and water quality over time and across watershed locations. ArcView GIS projects are an integral part of the KRIS program. GIS provides spatially referenced information that is displayed graphically and can be overlaid in conjunction with other spatial or temporal information. GIS "layers" are used in KRIS to develop overlays and facilitate analysis of factors potentially limiting salmon and steelhead conservation and recovery.

The North Bay KRIS/GIS will provide an organized and easily-accessible computer-based collection of technical information that can be utilized by NFMS and CDFG as well as other groups working in the region to assist in the definition, implementation, monitoring, evaluation, and adaptive management of measures intended to increase the numbers of naturally-reproducing salmon and steelhead in the planning domain. The project will incorporate existing GIS data layers pertinent to salmon and steelhead recovery as well as develop new layers to augment the recovery planning process. Existing digital and non-digital databases, relevant watershed literature, and bibliographic reviews will be reviewed and compiled to identify pertinent data that need to be digitized and/or incorporated into the KRIS information management tools. Data layers identified as necessary for evaluating salmon and steelhead restoration, conservation, and recovery planning efforts will be digitized and incorporated into the KRIS projects based on priorities established by CDFG, NMFS, the Regional Water Quality Control Board (RWQCB), and other applicable state and local organizations in the planning domain. The project will be coordinated with other ongoing GIS and KRIS efforts in the planning domain to avoid duplication of effort.

SCWA is providing funding for the KRIS/GIS project, while the RWQCB will be responsible for managing the program in coordination with California Resources Agency watershed assessment methods and needs. By filling the gaps in drainage coverage and developing a unified platform for data review, analysis and manipulation, consistent with other similar projects in Northern California, the North Bay KRIS/GIS will facilitate salmon and steelhead conservation and recovery planning by NMFS and CDFG.

Restoration Project Database

SCWA is funding a project for the RWQCB to develop a database of potential restoration projects in the Russian River watershed. The database is intended to identify specific projects which will enhance the quality of surface waters with the Russian River watershed to benefit listed and unlisted aquatic and terrestrial species.

In cooperation with local agencies, watershed groups, and stakeholders, including but not limited to CDFG and the Sotoyome RCD, the RWQCB determines what mitigation, enhancement, or water quality improvement projects are currently being proposed, are under development, or may be needed to increase recovery and protection of the listed and unlisted species in the Russian River watershed. The RWQCB inventories and prioritizes these projects in the *Russian River Watershed Restoration Potential Projects Database* for use by local agencies in determining which projects will protect and speed the recovery of the species. Development of this database will aid in coordinating project implementation on a watershed or sub-watershed basis, with the goal of improving water quality and habitat conditions in the most timely and efficient manner. RWQCB began development of this database in 1999. The database is intended to be functional and updatable for all users.

Invasive Plant Species Management

SCWA is funding studies to evaluate the status and control of invasive plant species in the Russian River watershed. These studies will inform other projects and assist with watershed-level planning efforts to control invasive species. SCWA's Invasive Plants Species study has focused on the exotic plants *Arundo donax* and *Vinca major*, which have been spreading rapidly and are threatening the integrity of the Russian River's riparian community.

When nonnative plant species replace native species, the riparian ecosystem that salmonids depend on can be altered. The purpose of the Invasive Plant Species study is to: 1) determine the influence of two exotic plant species, *Arundo donax* (the Giant Reed) and *Vinca major* (Periwinkle), on the composition of native riparian vegetation and invertebrates along the Russian River, 2) evaluate the response of aquatic insects to native and nonnative plant litter deposited in the mainstem and tributaries, 3) identify the most effective methods for eradicating *Arundo*, 4) develop techniques for restoring vegetation in previously invaded riparian areas, 5) map the distribution of *Arundo* in tributary streams, and 6) educate the public about *Arundo* and coordinate and train volunteers for *Arundo* removal and follow-up restoration projects.

The control and restoration of areas invaded by *Arundo* will be the focus of two projects. In the Alexander Valley, *Arundo* has been removed from test plots by herbicide and mechanical methods. The recovery of exotic and native plants within the plots will be evaluated. In another location, the success of revegetation techniques after *Arundo* removal will be evaluated.

In 1998, SCWA funded Circuit Rider Productions, Inc. and Sonoma State University efforts to map the extent of *Arundo* along the mainstem Russian River. The 1999 project will extend the mapping effort to the Russian River tributaries. The extent of the *Arundo* infestation will be delineated using standard aerial photographs and ground-truthing techniques. Information collected during these surveys will be entered into a computer database (combining GIS and

ArcView software) to generate high-quality maps illustrating the extent of *Arundo* along salmonid bearing tributaries.

1.4.3 Riparian and Aquatic Habitat Protection, Restoration, and Enhancement

SCWA began implementation of the Fisheries Enhancement Plan (FEP) in 1996. SCWA's Board of Directors has directed SCWA to develop the FEP for the tributaries of the Russian River watershed. Since 1996, SCWA has issued an annual Request for Proposals (RFP) for fisheries enhancement work within the Russian River watershed. Projects funded to date have included both on-the-ground restoration and research efforts.

Since 1996, SCWA has granted funds to various entities each year to provide habitat restoration and research on listed fish species in the Russian River watershed. For example, SCWA has provided funding to non-profit groups, private landowners, and public agencies through the FEP program. In addition, SCWA has contributed staff time and materials to many of these projects. Table 1-2 summarizes many of the projects that have been funded and implemented under the FEP. The numbers next to the projects correspond to the numbers on the map shown in Figure 1-4 and to numbered descriptions of the project.

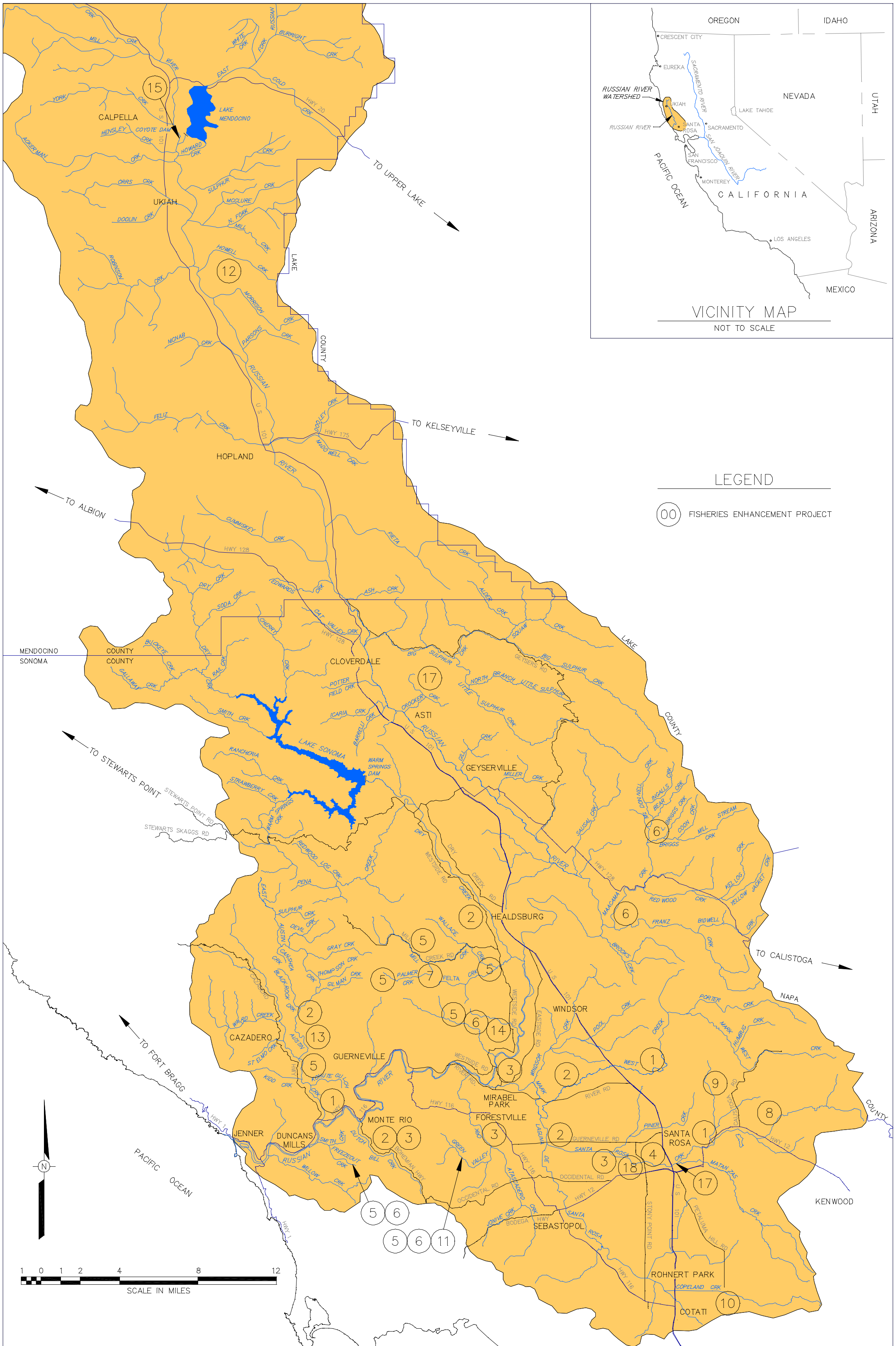
In addition to the FEP projects, SCWA has provided funding and staff for research that will facilitate restoration and protection of listed fish species in the Russian River. An important example is SCWA's funding of a project for Bodega Marine Labs to conduct genetic studies of tissue samples from coho salmon captured in the Russian River watershed. These studies have been used to identify the closest relation of the Russian River salmonids to known population stocks of coho and chinook. These studies also have the potential to be used to conduct genetic analyses of adult salmonids returning to the hatcheries at Warm Springs Dam and Coyote Valley Dam.

1.4.3.1 Fisheries Enhancement Program Project Descriptions

Several specific projects designed to benefit coho salmon, steelhead, and chinook salmon are described below. In addition to these specific projects, SCWA has funded and/or implemented numerous projects that indirectly benefit coho salmon, steelhead, and chinook salmon. For example, SCWA has provided funding, staff, and equipment for clean-up efforts on the Russian River and its tributaries. Those efforts have resulted in the removal of garbage and other materials that could have degraded water quality and habitat quality. These clean up efforts have also increased community participation in restoration of the Russian River.

Table 1-2 Summary of Fisheries Enhancement Plan Projects

No.	Project Name	Issue Addressed						Species Affected			SCWA Grants	SCWA Projects	Timetable
		Fish Habitat	Water Quality	Bank Stabiliz.	Fish Passage	Riparian Veg.	Exotic Species	Coho Salmon	Steelhead	Chinook Salmon			
1	Stream Habitat Surveys	✓		✓	✓	✓		✓	✓			✓	96-00
2	Temperature Data Collection		✓					✓	✓	✓	✓	✓	96-00
3	Water Quality Sampling		✓					✓	✓		✓	✓	96-99
4	Population Monitoring							✓	✓			✓	99-00
5	Instream Habitat Improvements	✓		✓	✓	✓		✓	✓		✓	✓	96-99
6	Riparian Restoration	✓		✓		✓	✓	✓	✓		✓	✓	96-00
7	Rural Road Erosion Control	✓	✓					✓	✓		✓	✓	97-98
8	Hood Mountain		✓	✓	✓				✓		✓		98-00
9	Brush Creek	✓	✓	✓		✓			✓		✓		98-99
10	Copeland Creek	✓	✓	✓		✓			✓			✓	98-00
11	Green Valley Creek	✓		✓	✓	✓		✓	✓		✓		96-00
12	Howell Creek					✓			✓		✓		99-00
13	Big Austin Creek	✓	✓	✓		✓		✓	✓			✓	97-00
14	Russell Irrigation Site		✓			✓					✓		98-99
15	Mumford Dam Modification	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	00-01
16	Matanzas Creek Fishway	✓			✓				✓			✓	01-02
17	Crocker Dam Modification	✓	✓	✓	✓	✓			✓				00-01
18	Laguna de Santa Rosa	✓	✓						✓				00-01
19	Santa Rosa Creek	✓	✓	✓		✓			✓				01-02



SONOMA COUNTY WATER AGENCY
2150 West College Avenue
Santa Rosa, CA. 95401

FIGURE 1–4
RESTORATION AND CONSERVATION MEASURES IN THE RUSSIAN RIVER

SCWA has provided funding and production support for the publication and distribution of a native riparian plant handbook to assist landowners, schools, and community groups with the planning and implementation of native plant revegetation projects within the Russian River watershed. These efforts reduce streambank erosion and reduce the risk of exotic, invasive plant species, which compete with native species, being introduced to the riparian habitat. SCWA has provided staff and materials to conduct parcel ownership research in the Russian River watershed to provide the CDFG and SCWA with contact information for landowners to contact to gain stream access for habitat surveys and water quality data collection. SCWA provided staff and materials for a training session on instream habitat structure construction in 1996. The training was offered to individuals in the community interested in working on habitat improvement projects, and created a pool of trained individuals to work with SCWA and CDFG on future habitat improvement projects.

1. Stream Habitat Surveys

Stream habitat surveys have been conducted in cooperation with CDFG each year of the FEP since 1996, and are intended to assess the habitat conditions of streams that are potentially viable for salmonid production. The surveys are used to identify streams that are in need of enhancement or restoration. The goal for this project is to conduct habitat surveys on every stream within the Russian River watershed. Surveys are conducted according to the CDFG Habitat Restoration Manual. All data gathered is entered into CDFG's computer program to prioritize stream restoration projects. SCWA has allocated staff and materials for this project.

2. Temperature Data Collection

Water temperature monitoring has been conducted each year of the FEP since 1996, and is intended to identify streams that provide suitable summer thermal conditions for salmonid juvenile rearing. Because environmental conditions vary annually, an accurate depiction of stream temperature requires data collection in multiple years. Data loggers (*i.e.*, equipment to monitor and record water quality measurements at specific intervals) are removed annually from each stream during the fall and deployed again the following spring. Temperature data has been collected in the Mark West Creek, Maacama Creek, Austin Creek, East Austin Creek, Santa Rosa Creek, Dutch Bill Creek, Hulbert Creek, Dry Creek, Brush Creek, Matanzas Creek, and Big Sulphur watersheds. SCWA has allocated staff and equipment for this project.

In 2000, SCWA began coordinating its temperature monitoring efforts with the North Coast Regional Water Quality Control Board (RWQCB) and other entities conducting water quality monitoring in the Russian River watershed, including the City of Santa Rosa, CDFG, and Mendocino County. These groups met several times to coordinate placement of temperature monitoring equipment, standardization of techniques, sharing of equipment, and exchange of information. This coordination will allow for more effective monitoring of temperatures in the basin by applying the collective efforts in a more efficient manner, as well as allowing for better comparison of results through standardization of techniques and reporting formats.

3. Water Quality Sampling

This project includes collecting and identifying invertebrates from several streams in the Russian River watershed and analyzing the samples as indicators of water quality. Analysis of the data has entailed sampling of reference streams identified by CDFG for a minimum of two years to establish a baseline reference condition. Other streams sampled are compared to those reference streams to determine relative water quality status. This project has been implemented each year since 1996. SCWA contributes staff and materials for the project. Additionally, SCWA provided funding for analysis of samples. Streams assessed include Austin Creek tributaries, Maacama Creek tributaries, the Russian River mainstem, Mark West Creek, Santa Rosa Creek, Green Valley Creek, Mill Creek, Ackerman Creek, Robinson Creek, Dutch Bill Creek, Hulbert Creek, Fife Creek, Franz Creek, Porter Creek, and Redwood Creek.

4. Russian River Basin Coho and Steelhead Population Monitoring

Coho and steelhead populations in the Russian River basin have decreased dramatically over the last 100 years. However, comprehensive population surveys have never been conducted in the basin, making it difficult to document the decline or accurately track recent population trends. In conjunction with CDFG and NMFS, SCWA is planning a basin-wide monitoring program to determine long term trends in salmonid abundance. Streams throughout the watershed will be sampled annually using a variety of methods including direct observation (snorkeling), trapping, and electrofishing. While the program will generate indices of abundance for all salmonid life stages (*e.g.* juveniles, smolts, and adults), SCWA will focus primarily on obtaining population estimates for juveniles during late summer and fall. Consistent environmental conditions during this portion of the year allow access to a large number of sites and increase the repeatability of annual surveys. SCWA funded a project to develop a study plan for the population monitoring project, and has completed the first year of a pilot study to evaluate methods and sampling sites in the field. Following the second year of the pilot study, SCWA will adopt a final plan in consultation with CDFG and NMFS.

5. Instream Habitat Improvements

SCWA has funded and/or implemented projects from 1996-1999 to improve habitat in stream channels. Streams were identified as candidates for instream habitat improvements, including Green Valley Creek, Freezeout Creek, Mill Creek, Austin Creek, Turtle Creek, and Felta Creek. Instream habitat structures have that have been placed consisted of large woody debris, such as rootwads, that provide protective cover from predators and that promote development of pools. Sites lacking in riparian cover have been planted with trees. A section of Big Austin Creek was reconstructed to convert a braided, intermittent channel to a single thread, perennial stream, with 13,000 square feet of reconstructed spawning area. Additionally, bank stabilization and riparian planting were implemented along Big Austin Creek (see #13 for additional details on Big Austin Creek). SCWA provided matching funds and staff support for these projects.

6. Riparian Restoration

SCWA has funded and/or implemented projects on Little Briggs Creek, Green Valley Creek, Freezeout Creek, and Howell Creek to exclude livestock from the riparian zone adjacent to the stream, and to replant degraded areas with native vegetation. These projects were intended to allow riparian vegetation to re-establish, stabilize stream banks, and decrease animal waste entering the stream. On Green Valley Creek, SCWA has also worked with Trout Unlimited and the landowners to provide temporary water supplies to restored riparian areas to increase the survival of newly planted trees. On Porter Creek and Matanzas Creek, SCWA has implemented projects to enhance riparian habitat and stabilize stream banks. These projects consisted of placement of bioengineered erosion structures, such as willow mattresses and baffles, planting of native riparian trees in upslope areas, and educating landowners on ways to prevent erosion and the value of riparian vegetation along stream banks on their property. SCWA has provided funding, staff, and materials for these projects. On Maacama Creek, SCWA is providing funding for a study to investigate methods of controlling Pierce's Disease through removal of nonnative plants that are serving as hosts. In areas where vegetation has been removed, native trees will be planted to provide vegetative cover for wildlife, and shade and structure for aquatic biota.

7. Rural Road Erosion Control Project

SCWA provided funding and materials for a project to decrease sediment runoff from one mile of steeply-graded rural roadway adjacent to Palmer Creek. The project consisted of measures to reshape, grade, and excavate runoff ditches in the existing roadway and resurface it with high-quality crushed blue shale. Undersized culverts were replaced to minimize erosion. A series of rolling dips was graded into the roadbed in an effort to properly drain the road and reduce erosion during heavy rains. In addition, decreasing the sediment load enhanced instream habitat structures, also funded by SCWA, on the same stretch of Palmer Creek.

8. Hood Mountain Regional Park

This project is intended to reduce delivery of fine sediment to Santa Rosa Creek from an eroding road adjacent to the stream. The portion of Santa Rosa Creek within Hood Mountain Regional Park provides valuable spawning and rearing habitat for steelhead trout. During the winter of 1996-97, a landslide on Hood Mountain Trail, adjacent to Santa Rosa Creek, displaced over 300 cubic yards of material. In 1999, the site remained unstable and continued to deliver fine sediment to the stream. SCWA granted FEP funds to Sonoma County Regional Parks in 1998 for the development of engineering plans to stabilize the slide. The project was implemented during the 1999-2000 FEP and provided a comprehensive repair to the cut slope, modified the road surface, and filled gullies.

During 1998 and 1999, SCWA provided staff support, materials, and funding for other components of the Hood Mountain project, including: construction of a fish ladder to assist salmonid migration over a stream crossing; removal of litter (e.g., chain link fence, 55-gallon drums); and development of a water quality monitoring program to be run by LandPaths staff and local high school students.

9. Brush Creek

This project was designed to maintain the flood conveyance capacity of Brush creek while improving aquatic and riparian habitats. The completed project will enhance available habitat for steelhead and other native fish, amphibians, songbirds, and small mammals along Brush

Creek. Brush Creek previously underwent channel modifications to allow conveyance of 100-year flow events and provide flood protection for local homeowners. The project will widen the cross-sectional area of Brush Creek to permit the stream to both convey streamflow during a 100-year flood event and provide the area necessary to increase habitat diversity along 1,200 linear feet of the stream. Overall, approximately 4,500 cubic yards of material will be removed from the streambed and banks. After the streambed and banks are graded, a series of restoration and enhancement activities will be instituted to provide aquatic and riparian habitat throughout the project area. Instream structures such as weirs, deflectors, and suitable substrate material will be placed in the river to promote the development of pool and riffle habitats, as well as providing bank stability. Stream banks denuded of vegetation during the sediment removal and grading phase of the project will be replanted with native vegetation. SCWA is contributing funding to the project.

10. Copeland Creek

This project will involve construction of cattle exclosure and monument fencing, recontouring heavily eroded stream banks, and revegetation with native riparian species on Copeland Creek. The project site is located on approximately 6,000 feet of Copeland Creek between Roberts/Pressley Road and Petaluma Hill Road. Historically, the project site has been grazed by cattle and horses. Grazing pressures have limited vegetation establishment to nonnative grasses and forbs, with tree cover limited to a stand of nonnative Eucalyptus, some scattered oaks (*Quercus* sp.), and California buckeye (*Aesculus californicus*). Numerous cattle paths cross the channel, and trampling has exacerbated erosion of the banks. Restoration of this section of stream will decrease sediment load and improve fish habitat. Fencing will be installed to prevent livestock access to the riparian zone. Riparian vegetation will be reestablished along the stream banks to provide stability and shade. Before plantings are conducted, banks will be recontoured to a more stable profile. Project implementation will be phased over a 3 to 4-year period. SCWA is providing staff support, materials, and funding for this project.

11. Green Valley Creek Restoration

Two restoration projects have been proposed to improve habitat conditions for steelhead trout and coho salmon in Green Valley Creek. Both projects are designed to reduce stream bank erosion. Green Valley Creek is one of the few tributaries in the Russian River watershed that still supports a self-sustaining, although diminished, population of threatened coho salmon. The Green Valley Creek watershed is held entirely in private ownership and efforts aimed at improving habitat conditions for species recovery require the voluntary participation of landowners. Trout Unlimited and CDFG constructed two stream bank stabilization projects in 1996. Both projects were not performing as intended. One failed in 1998 and another is in danger of failing. The sites deliver substantial amounts of fine sediment to the stream. Dragonfly Stream Enhancement, in conjunction with two private landowners, repaired both projects and arrested accelerated erosion at both sites. The site improvements will include sloping and armoring of an eroding bank, planting of native vegetation to stabilize the sites, and removal of nonnative vegetation. SCWA provided funding for the project.

12. Howell Creek Livestock Exclusion Fencing and Riparian Enhancement

This project is intended to exclude cattle from the riparian zone along 4,000 feet of Howell Creek, a tributary of the Russian River, in Mendocino County. A 1998 stream inventory conducted by CDFG indicated that riparian vegetation and stream channel conditions were degraded due to unrestricted cattle grazing in a 4,000 foot reach of Howell Creek. This section of stream currently provides only marginal habitat for steelhead trout. Healthy riparian vegetation is necessary to improve the condition of the stream banks and bed in this reach. As part of the project, barbed wire fence will be installed, and off-stream water sources will be developed to eliminate the intrusion of cattle into the riparian zone. Native riparian vegetation will be planted in the project site to facilitate recovery. SCWA is providing funding for this project.

13. Big Austin Creek

The purpose of this project was to reconstruct 1,300 feet of braided, intermittent channel to single-thread channel, perennial stream with 13,000 square feet of reconstructed spawning area. The project also included bank stabilization and riparian vegetation planting along sections of the stream channel. Prior to the project, a series of shifting channels flowed through an area known as “King’s Flat.” Large amounts of bedload from old mining tailings located upstream of the project area caused excessive aggradation, resulting in a braided multi-channel stream. By restoring the stream to a single channel, fish habitat is being greatly improved. Stream sections with highly eroded banks were stabilized with rock, rootwads, and live trees. Riparian vegetation was re-established along the banks to increase cover and help reduce water temperature. Work completed under the 1997-98 FEP Plan included bank stabilization, placement of instream cover, and construction of willow baffles. Work conducted under the 1999-00 FEP Plan included additional stream bank stabilization and riparian vegetation planting.

14. Russell Irrigation Site on Turtle Creek

The purpose of this project was to facilitate development of a mature riparian forest, stable stream banks, and improved aquatic and terrestrial habitats. This was accomplished through providing an alternative drinking source for livestock which previously used the stream as a watering source. The landowner for this site previously participated in a voluntary fencing project to exclude the cattle from Turtle Creek. To provide the alternative drinking source for the livestock, a well was removed and repaired, and 2,100 feet of pipe were installed to deliver the water to the cattle. SCWA provided the funding for this project.

15. Mumford Dam Modification Project

This project is intended to improve passage of anadromous fish above Mumford Dam (dam) on the West Fork Russian River. The existing flashboard dam has been used to impound water to provide frost protection and irrigation for landowners adjacent to the river. Downcutting has occurred below the dam to the point where upstream passage of anadromous fish is difficult or impossible during most flow conditions.

As part of this project, the Agency is assisting with design and funding of the construction of a series of large rock weirs. These weirs will assist with maintaining the thalweg of the river near the center of the channel, thereby reducing bank erosion on both sides of the channel. The series of weirs will create a more gradual slope from upstream to downstream of the dam, which will facilitate fish passage upstream, as well as helping to stabilize the channel bed and improve instream habitat. In addition, the project will include streambank stabilization measures including planting with native riparian plant species.

The project will have a direct effect on approximately 600 feet of channel in the vicinity of the dam. An important indirect effect of the channel modification project is that it will allow anadromous fish access to 10 miles of high quality habitat upstream of the dam.

16. Matanzas Creek Fishway

Matanzas Creek is a tributary of Santa Rosa Creek, and both streams flow from the southern end of Santa Rosa in a north to northwestern direction. The confluence of the two streams is in downtown Santa Rosa near the intersection of Santa Rosa and Sonoma avenues.

Historically, Matanzas Creek supported a self-sustaining steelhead population. However, flood control structures funded by the Soil Conservation Service that were constructed in downtown Santa Rosa during the early 1960s created an impassable migration barrier for anadromous salmonids at the mouth of Matanzas Creek. While the adjacent Santa Rosa Creek flood control project included a fishway, the Matanzas Creek flood control project did not. Fish passage through the 1400-linear-foot box culvert is currently prohibited by high water velocities in winter when depth of flow is not a problem or shallow depth of flow during summer low flow periods. The feasibility of installing a fishway inside the culvert at the mouth of Matanzas Creek was studied in the spring of 1996. SCWA has designed the Matanzas Creek Fishway project, to be located in the box culvert upstream of the confluence with Santa Rosa Creek (Figure 1-4).

The Matanzas Creek fishway would consist of installing eight to ten inflatable bladders across the bottom of the culvert to create a series of small weirs inside the culvert (Figures 1-5 and 1-6). The purpose of the weirs is to raise water levels and decrease velocities throughout the structure, enabling fish to pass through the culvert. During high winter storm flows, the bladders would automatically deflate to retain maximum flood flow capacity within the culvert. A trench would be excavated into the splash apron on the downstream side of the culvert to provide access to the fishway from Santa Rosa Creek. Fish would pass the inflated bladders by swimming or leaping over them and then continue upstream out of the culvert and into Matanzas Creek.

The proposed project would allow fish passage through the culvert and into five miles of spawning and rearing habitat for salmonids upstream of the culvert. Evaluations of the suitability of that habitat, including habitat typing and temperature monitoring, indicated that the habitat would be suitable for use by salmonid fish species. Additionally, resident juvenile steelhead/rainbow trout have been found upstream of the culvert, further demonstrating the suitability of the habitat for anadromous steelhead.

Construction of the trench on the splash apron downstream of the culvert would be combined with the City of Santa Rosa's Prince Memorial Greenway (PMG) portion of the Santa Rosa Creek Project. The PMG portion of the project would provide for protection, restoration and

Figure 1-5 Matanzas Creek Fishway – Photo of Entrance

Figure 1-6 Matanzas Creek Fishway – Rendition of Proposed Modification to Culvert

enhancement of Santa Rosa Creek, and would be implemented prior to the Matanzas Creek Fishway portion of the project. Combining the construction of the exterior parts of the Matanzas Creek culvert with the PMG project would improve construction efficiency and avoid disruption of the enhanced habitat in Santa Rosa Creek with later construction activities. Although construction of the PMG project will begin in 1999, the portion of the project affecting the Matanzas Creek Fishway project will not begin until 2001. The improvements to the Matanzas Creek flood control structure are anticipated to begin in 2002.

BMPs during construction will be implemented to minimize water quality effects (sediment input) to downstream areas and minimize injury to protected species. The stream will be blocked off on the upstream end with a method that leaves no aggregate particles in the stream. Isolation of the construction site will keep water from the river from entering the construction area, contain sediments loosened during construction, and prevent fish from entering the construction area once it has been isolated. The method is yet to be determined, but it is likely that an inflatable water structure or sandbags may be used, since the area involved is small. Water structures, manufactured by Water Structures Unlimited, function like portable dams or barriers that are positioned wherever needed to contain or divert the movement of water. After the construction area has been isolated SCWA will conduct a fish rescue within the construction area. Since the flow in the whole channel will be blocked during construction, water would be re-routed downstream of the project.

17. Crocker Dam Modification Project

Crocker Creek is a tributary to the Russian River located approximately 2 miles southeast of the City of Cloverdale. Crocker Creek enters the Russian from the east, and is approximately 5 miles long. The Crocker Creek watershed is typical of east-side tributaries in northern Sonoma and Mendocino Counties supporting mostly oak woodland and chaparral habitats. While oak dominant habitats are generally not considered “optimal” for anadromous salmonids, field investigations by the CDFG and SCWA indicate that these type of tributaries are very important for steelhead in the Russian River Watershed.

The Crocker Creek Dam is located approximately 0.5 mile upstream from the creek’s confluence with the Russian River. The final configuration of the Crocker Creek Dam was a concrete buttress dam approximately 30 feet high and 100 feet wide with two concrete spillways (one used and one abandoned) approximately 150 feet long. The dam began to show signs of impending structural failure as early as 1974, however, major structural failures did not occur until 1995. In 1995, the entire northern side of the dam, with the exception of the original base, collapsed. Further failure of the dam occurred in 1997. The impact to Crocker Creek as a result of the failures has been significant. The creek downstream of the dam has become inundated with the sediment that was trapped behind the structure. The creek upstream of the dam has experienced major erosion and collapsing banks as a result of the acute loss of a major grade control structure. Currently, all that remains of the Crocker Creek dam is the abutments on either side, both spillways, the original base, and a massive pile of concrete and other structural debris directly below the base of the dam. While the elevation of the base is significantly lower than the previous top of the dam, the structure and associated debris pile remains an impassible barrier to anadromous salmonids.

CDFG and SCWA biologists and SCWA engineers have examined the site and developed a proposed technique for stabilizing the dam and impacted creek area as well as allowing passage of anadromous salmonids. Juvenile steelhead were observed directly below the dam by CDFG and SCWA biologists during field visits in 1998. In addition, habitat crews supervised by CDFG biologist Bob Coey habitat typed the Crocker Creek watershed during the summer of 1998.

The proposed project includes many tasks: topographical survey of the project site; engineering and design; permitting and environmental compliance; and several phases of construction. The main tasks involved with the construction of the project include:

1. Stabilize the North Abutment: The north abutment of the concrete dam is anchored in what appears to be earth fill. With the failure of the dam and the resulting erosion, this earth fill has become unstable and is subject to collapse. As part of this project SCWA will recommend removing as much of the earth fill as possible. This will be accomplished by "laying back" the slope to match existing grades. In addition, it will be necessary to provide some slope protection at both the toe and up the side of the resulting slope

2. Demolish the Remaining Concrete Structures: The remains of the north abutment, the south abutment, and the two spillways will be demolished. The north abutment concrete remains will have to be removed as part of the stabilization. The south abutment and the spillways will be demolished using jackhammers and heavy equipment.

3. Construct Fish Ladder Foundation and Fish Ladder: The material created by demolishing the remains of the dam would be used as fill and for the foundation of the fish ladder. Material will be placed using an excavator or similar heavy equipment. Once the foundation is in place, the rest of the fish ladder will be constructed using imported rock.

4. Revegetation above the Dam: The 210 feet of eroded left bank upstream from the dam face will be sloped to approximate a 2:1 slope utilizing aggregate from the adjoining floodplain, and sloping the top of the bank to meet the grade. A live willow brush mattress with a quarried boulder toe will be installed at bankfull elevation height. Replacement of the existing concrete block deflectors with boulders and addition of a series of 3 parallel boulder wing deflectors will complete the transition of the eroded bank to the upper streambank. There is about 400 feet of eroded right bank upstream of the dam face. Treatment on this bank will consist of the same treatment for the first 150 feet upstream of the dam, and for the remaining 250 feet a series of 10 willow baffles, 25 feet long and 5 feet wide each with a boulder cluster deflector (a total of 10) at the toe of the bank. The reshaped banks will require a 3-foot deep trench to be excavated at the toe of the bank, with all disturbed areas mulched and inter-planted with willows. Size of the rock from the toe trench up to the high water mark will be of a size that will withstand normal high flows.

18. Laguna de Santa Rosa

The USACE is conducting a feasibility study to investigate the extent and causes of sedimentation in the Laguna de Santa Rosa (Laguna). The Laguna area is defined as a large, gently sloping basin. The local community is interested in protecting and restoring the natural flood retention capability and historic wetland attributes of the Laguna. Local interests contend that municipal development in the surrounding area, as well as certain agricultural practices, are filling the Laguna with excess sediment, threatening the Laguna's attributes and flood retention capability. The community is concerned that the effects of human development have accelerated habitat changes in the Laguna and have modified hydraulic and hydrologic conditions.

The Laguna drains a basin of 250 square miles (160,000 acres) that includes the adjacent cities of Cotati, Rohnert Park, Santa Rosa, and Sebastopol. The Laguna transports rainfall runoff from the watershed to the Russian River, and as the water surface elevation in the Russian River rises with increasing runoff flows, water flows back into the Laguna from the Russian River. The Laguna is considered to be an important factor in lowering the water surface elevation in the lower Russian River floodplain.

The results of the initial sedimentation studies would determine which, if any, alternatives are investigated for the possibility of management and restoration measures. The measures to reduce adverse effects of sedimentation on flood damage and habitat could include the following:

- Watershed management measures: identify sediment reduction alternatives; conduct a topographic survey of the Laguna to use as a comparison to past data and as a baseline for future studies; inventory stream channels, analyze air photos, and use historic and current information to determine local sources of sediment affecting the Laguna.
- Channel restoration measures: identify and characterize flood control channels within the Laguna; identify and evaluate structural flood detention alternatives; identify and evaluate flood protection within the Laguna.
- Habitat restoration measures: identify and characterize opportunities to restore historic wetlands for optimum diversity and long-term sustainability.

19. Santa Rosa Creek

The USACE, SCWA, City of Santa Rosa, and Sonoma County are undertaking a project to restore Santa Rosa Creek by returning the channelized creek reaches to more natural geomorphic and ecological form and function and improving water quality, while maintaining existing levels of flood protection. The restoration is also intended to benefit steelhead and other aquatic life. The project will be consistent with the Santa Rosa Creek Master Plan which was signed on September 21, 1993 by the City of Santa Rosa, the County of Sonoma, and the Sonoma County Water Agency.

In the City of Santa Rosa Master Plan, the 12.8 mile-long project has been divided into seven reaches, distinguished by vegetation, hydrology, adjacent land use, ownership, channel morphology, and access. Reaches A and B, which are between Highway 12 near Los Alamos Road and E Street, are characterized as natural channel. The vegetation represents a mature, native riparian community. This area is in private property ownership with limited access. Commercial, residential, and undeveloped land uses are located adjacent to the creek. Reaches C, D and E, are between E Street and Piner Creek west of Fulton Road. They are characterized by a relatively steep, trapezoidal-shaped channel with grouted rock in Reach C and rip-rap in Reaches D and E. There is very little riparian vegetation. SCWA owns the two maintenance roads on either side. Adjacent land use is commercial, residential, and industrial. The Rural Reaches F and G are between Piner Creek and Laguna de Santa Rosa. These reaches are characterized by a wider and shallower channel with more sediment bars, less rip-rap (none in Reach G), and some riparian vegetation. There are levees in Reach F and maintenance roads along both sides of the creek in both reaches. The adjacent land use is agriculture and floodplain. The boundaries of the proposed restoration project include part of Reach C (Pierson Street to Dutten Street) and all of Reach D through Reach G. No action is proposed for Reaches A or B except a proposed fish passageway enhancement project, which would be located on Matanzas Creek in the area generally located between Reach B and Reach C (described above as a separate project).

The project is currently in the planning and permitting phase. Several alternatives are being considered, which are discussed below. The selected alternatives will be implemented in the project area. It is expected that flooding will continue at the same frequency and intensity as it has in the past in areas around Santa Rosa Creek. Habitat values would remain the same. The action alternatives include restoring habitat and improving water quality by implementing one or more of the following measures in the various reaches of Santa Rosa Creek:

- Measure 1: Enlarge channel capacity by removing existing grouted rip-rap, replacing the southern bank with a steeper, engineered wall system which will allow for vegetative growth, and by stepping the north bank with a series of retaining walls which will allow for multiple use, pedestrian and maintenance paths. A soft, naturalized creek bottom will be vegetated with native riparian grasses, sedges and shrubs. This restoration measure is proposed for sections of Santa Rosa Creek between Santa Rosa Avenue and Pierson Street.
- Measure 2: Enlarge the channel capacity by removing the existing rip-rap, laying back the southern bank to a more stable angle, and terracing the northern bank to allow for path installation. The newly constructed channel will be vegetated using native riparian species. The creek bottom will provide a soft, meandering low-flow channel, which will be shaded and will feature rocks and anchored logs for fish habitat. This restoration measure is proposed for sections of Santa Rosa Creek between Pierson Street and Piner Creek.
- Measure 3: Enlarge channel capacity and expand the existing cross sectional area of the creek by removing existing rip rap, laying back one bank, and excavating the other bank to create vegetated terraces on which paths would be placed. The entire creek channel will be revegetated with native riparian plant materials. This restoration measure is proposed for limited sections of Santa Rosa Creek between Stony Point Road and Piner Creek.
- Measure 4: Increase the channel width by relocating one or both levees away from the creek a total of not more than 100 feet. The creek channel would be re-contoured to create a naturalized meander pattern with riparian plantings throughout. This restoration

measure is proposed for sections of Santa Rosa Creek between Piner Creek and Willowside Road.

- Measure 5: The area of riparian vegetation would be expanded by 100 feet or less between Willowside Road and Laguna de Santa Rosa to enhance the riparian vegetation and to allow the development of a meandering low flow channel.

In Measures 1 through 5, rocks would be placed in the creek to create pools, riffles, runs and define the low-flow channel. In addition, anchored logs with root wads exposed to the creek will be installed. These features will enhance the structural diversity of the channel bottom and improve fish habitat.

1.4.3.2 Best Management Practices for Restoration Projects

BMPs used are site-specific, but in general, SCWA follows the procedures outlined in the CDFG Fisheries Habitat Restoration Program. With few exceptions, SCWA projects are not built on "live" streams. Most can be constructed during a period when the stream is dry. In most cases, if not all, work in a wet stream channel would require a permit from the USACE, and the terms and conditions of that permit would dictate the practices used to minimize impacts. For example, on Austin Creek reconstruction of the toe of the bank was necessary, and the BMPs used were those stipulated by the USACE permit. A combination of detention basins, hay bales, and filter fabrics were used, and no sediment problems were identified. On Adobe Creek (not in the Russian River Basin), SCWA built a fish passage (with a series of boulders) in an active stream, and fish rescues were conducted to move as many fish as possible out of the project area.

SCWA strives to avoid any effects to the streams or protected species while implementing restoration projects. Details for specific projects to be constructed have been provided where they are known.

1.4.4 Water Conservation and Recycled Water

SCWA has completed a preliminary assessment of urban water re-use to evaluate the feasibility of recycled water projects. The assessment addressed the following elements of water conservation and recycled water use:

- The potential reduction in peak demands on the water supply system that could be realized through the expanded use of tertiary-treated recycled water for irrigation;
- The potential reduction in annual water supply demands from expanded use of tertiary-treated recycled water; and
- Order of magnitude costs (within -30% to +50% to actual cost) for construction and operation of recycled water distribution systems in urban areas.

In addition to the feasibility assessment for recycled water projects, SCWA is participating in the development of a storage and distribution system for the agricultural use of recycled water from the Geysers Recharge Project. This project would provide recycled water to the northern portion of Sonoma County, in Alexander Valley, to agricultural users for irrigation. The water source would be recycled water produced by the City of Santa Rosa that is in excess of the amount that has been committed to the Geysers Recharge Project and other existing irrigation uses within Sonoma County.

1.4.4.1 Recycled Water Feasibility Study

1.4.4.1.1 *Background*

SCWA provides a wholesale potable water supply for eight water contractors which consist of the City of Cotati (Cotati), City of Petaluma (Petaluma), City of Rohnert Park (Rohnert Park), City of Santa Rosa (Santa Rosa) and City of Sonoma (Sonoma) and the Forestville Water District (Forestville), North Marin Water District (North Marin), and the Valley of the Moon Water District (VMWD).

Pursuant to Section 2.5 of the Tenth Amended Agreement for Water Supply and Construction of the Russian River-Cotati Intertie Project, SCWA may undertake cost-effective water conservation measures that will reduce demands on SCWA's water transmission system. The use of recycled water for irrigation in urban areas has the potential to reduce the peak summer demands on SCWA's water supply system. During the peak water demand periods, SCWA's water supply system is currently operating at capacity. If water demands continue to increase, SCWA's water supply system may be unable to meet peak demands for sustained periods.

1.4.4.1.2 *Scope of Assessment*

A preliminary assessment of urban reuse was performed primarily using existing sources of information provided by SCWA's water contractors. These sources of information included the following:

- Existing water reuse studies
- Potable water use records
- Maps of existing and proposed recycled water distribution systems
- Agency construction-cost data

Urban water reuse studies have been conducted by several of SCWA's water contractors. Based on the review of these reports, the methodologies used to size and estimate construction costs for water reuse projects varied considerably between the water contractors. For the purposes of this report, SCWA staff compiled and/or generated the necessary project components for the urban reuse projects and applied consistent cost estimates to each project. The cost estimates presented in the assessment represent order of magnitude estimates and are intended to allow comparisons of the costs and benefits of the various projects.

While these cost estimates can be used for preliminary planning purposes, a second-phase feasibility study of potential water reuse would provide a more accurate representation of the necessary components of urban water reuse systems and the associated costs. This additional evaluation should include, but not be limited to, computer modeling of the pipeline systems, field surveys of potential pipeline routes, environmental concerns, and evaluation of the existing recycled water irrigation systems.

1.4.4.1.3 *Water Reuse Regulations*

Opportunities for reducing potable water demands include the use of tertiary-treated recycled water for urban irrigation. Allowable uses of tertiary-treated recycled water are specified in the California Code of Regulations (CCR), Title 22. The definition of tertiary-treated recycled water is also presented in these regulations. Specifically, tertiary treatment is defined as a treatment process for wastewater that includes biological treatment, settling or clarification, coagulation, filtration and disinfection.

Allowable uses of recycled water are specified in CCR Title 22, Section 60303. According to CCR Title 22, disinfected tertiary recycled water can be used for irrigation of the following:

- Food crops where the recycled water comes into contact with the edible portion of the crop, which includes all edible root crops
- Parks and playgrounds
- School yards
- Residential landscaping
- Unrestricted access golf courses
- Recreational impoundments
- Flushing toilets and urinals
- Decorative fountains
- Commercial laundries
- Any other irrigation use not specified in this section and not prohibited by other sections of the California Water Code

Irrigation area requirements for tertiary recycled water are also specified in CCR Title 22 and include the following:

- No irrigation with disinfected tertiary recycled water shall take place within 50 feet of any domestic water supply well.
- No impoundment of disinfected tertiary recycled water shall take place within 100 feet of any domestic water supply well.
- Any use of recycled water shall comply with the following: (1) Any irrigation runoff shall be confined to the recycled water use area unless otherwise authorized by the regulatory agency; (2) Spray, mist, or runoff shall not enter a dwelling or a food handling facility; (3) Drinking water fountains and designated outdoor eating areas shall be protected against contact with recycled water spray, mist, or runoff.
- All areas where recycled water is used and that are accessible to the public shall be posted with conspicuous signs, in a size no less than 4 inches high by 8 inches wide, that include the following wording: "RECYCLED WATER - DO NOT DRINK."

- Except as allowed under Section 7604 of Title 17, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.
- The recycled water system shall not include any hose bibbs. Quick couplers that are different from that used on the potable water system may be used.

1.4.4.1.4 *Water Supply Agreement*

SCWA provides water to its water contractors in accordance with the terms and conditions presented in the Tenth Amended Agreement for Water Supply and Construction of the Russian River-Cotati Intertie Project. This agreement describes the obligations of SCWA to provide water supply or supplemental water supply to the water contractors and the obligations of the water contractors to pay for the delivered water and for a water conservation program. This agreement also specifies the delivery entitlements of the water contractors. These entitlements are defined as average flow expressed in million gallons per day (mgd) during a month and are as follows:

Contractor	**Average Monthly Flow**
Santa Rosa	50.0 mgd
Petaluma	17.0 mgd
North Marin	11.2 mgd
Valley of the Moon	4.7 mgd
Sonoma	3.3 mgd
Contractor	**Average Monthly Flow**
Cotati	1.7 mgd
Forestville	1.5 mgd
Rohnert Park	1.0 mgd

Based on the results of a reconnaissance-level study, it appears that the expanded use of recycled water use for irrigation within SCWA's service area could reduce both annual and peak potable water demands. It is estimated that: (1) 2,300 acre-feet (AF) of water could be saved on an annual basis and (2) the peak average month flow would decrease by about 5 mgd. A summary of the estimated capital and operation and maintenance (O&M) costs is presented below.

Water Contractor	**Annual Recycled Water Use (AF)**	**Estimated Capital Cost**	**Estimated O&M Cost**
City of Cotati	30	$400,000	$100
Forestville Water District	50	600,000	75
North Marin Water District	650	8,800,000	100
City of Petaluma	640	5,800,000	80
City of Rohnert Park	90	800,000	80
City of Santa Rosa	440	3,600,000	80
City of Sonoma	135	1,100,000	80
Valley of the Moon Water District	275	3,100,000	90
Total	**2,310**	**$24,200,000**	**$90**

The total annual cost for providing recycled water to the sites described can be estimated assuming that: (1) construction of the improvements were financed through 20-year revenue bonds at an interest rate of 6.0 percent, and (2) the average estimated O&M costs. Based on these assumptions, the construction and operation of the urban water reuse system described would cost approximately $1,000 per AF.

As indicated previously, the demand on SCWA's water supply system can exceed its capacity during peak water use periods in the summer months. As the baseline demand for water increases, the number and duration of periods in which SCWA's water supply system is unable to meet peak demands will increase. The use of recycled water appears to be a feasible alternative for reducing demands on SCWA's water supply and transmission system.

The full development of a water reuse program could reduce the water contractor's demand on the SCWA system by about 3% annually and 5% during the peak average months. While cost for recycled water is greater than the cost of water produced by SCWA's existing water supply and transmission system, SCWA's existing system and water right limitations may limit the amount of such water that is currently available. Therefore, the increased use of recycled water is necessary to allow SCWA to meet the future needs of its water contractors.

The recycled water use program would reduce potable water demands by about 2,300 AF and would cost on the order of $24,200,000 ($10,500 per AF) to construct. Based on the importance of this recycled water use program to maintain available potable water supplies for the water contractors and other water users, SCWA has indicated that this program could be supported through capital improvement funding in the amount of $10,000 per AF of potable water offset. This program would be phased in over a period of 5 years with full funding of $2,000,000 per year available on the 5th through 15th year of implementation.

1.4.4.2 Agricultural Use of Recycled Water in the Alexander Valley

The City of Santa Rosa, the Coalition for Sustainable Agriculture, and SCWA are jointly participating in the development of a storage and distribution system for the agricultural use of recycled water that is in excess of the amount that has been committed to the Geysers Recharge Project and other existing uses. The proposed project will require the negotiation of agreements between the parties for project design, water delivery, and project financing.

The City of Santa Rosa treats water to a tertiary level and supplies the water during the summer months for irrigation of public and private lands within Sonoma County. Water in excess of these irrigation demands is either discharged to the Russian River during the winter, or is stored for irrigation the following year. The proposed project would allow for reuse of recycled water in addition to the City of Santa Rosa's currently available methods. It is estimated that the amount of water potentially available for agricultural reuse could range from 1,985 million gallons (mg) (6,092 acre-feet) to 8,344 mg (25,607 acre-feet) per water year. This additional reuse of recycled water would improve the reliability of the water supply for agricultural purposes in the Alexander Valley. The project would also assist SCWA with the development of solutions to address water supply, environmental, and regulatory concerns.

Habitat conservation and restoration projects, fish passage projects, water reuse and recycling, and watershed management actions may have direct and indirect effects on protected species and critical habitat. Some effects may occur during implementation of projects, others after projects are completed. Research and public information activities that support watershed management actions may have unquantifiable indirect effects.

This section defines restoration and conservation actions, and identifies issues of concern and potential effects from these activities. Evaluation criteria based upon peer-reviewed literature and generally accepted guidelines are developed to assess the potential effects on salmonids and their habitat. The issues of concern include:

- Biological benefits of restoration projects – effects to critical habitat
- Adult spawning migration through fish passage projects
- Predation on listed fish species in fish passage structures
- Short-term effects from construction, including sediment input, injury to fish, and vegetation removal and restoration
- Effects of water reuse and recycling
- Effects of watershed management projects, including studies and information dissemination

2.1 RESTORATION AND CONSERVATION ACTIONS

Restoration and conservation measures include actions to protect, restore, improve or enhance aquatic habitat, riparian systems and stream and river channels, reduce the input of fine sediments to the stream corridors and reduce water use. These actions could include preservation, restoration or enhancement of riparian or aquatic habitat conditions and may have direct or indirect benefits to the coho salmon, steelhead and chinook salmon life history stages in the Russian River system.

Direct actions are those that have an immediate response and utilization by a target species for one or more life history stages. For example, actions that would have a direct benefit would include the addition of spawning gravel or the physical improvement of pool quality. The addition of spawning gravel would result in improved spawning conditions or increased spawning opportunities, and may increase recruitment to young-of-the-year life history stages. Improving pool quality could directly benefit several life history stages for coho salmon and steelhead, including juvenile rearing, winter habitat conditions for juveniles, and summer low flow refuge habitat. It could also improve adult holding habitat for all three species. Fish populations could show a rapid response to these actions because they involve direct improvements to the physical habitat in the stream.

An indirect action would require some time before it would be reflected in the fish population. For instance, implementing a sediment control plan in a tributary watershed may require many years before an improvement can be detected in the receiving waters, and it may be many more years before these improvements result in a response in the fish population. Reduction in fine sediment could affect habitat quality for invertebrates, alter the local temperature regime and/or eventually improve spawning habitat quality. All these actions would result in indirect changes to habitat conditions supporting fish. Typically indirect benefits are realized in incremental changes over time compared to direct benefits.

2.1.1 Types of Restoration Projects

Improved land management that enables natural recovery of riparian zones and aquatic resources should be the first step in stream and river restoration projects (NRC 1992). This management action would be taken when high or good quality habitat is identified and protected through direct purchase of the reach of stream or through the implementation of a conservation agreement. Any other management actions made within purchased lands or conservation easements for the purpose of improving on existing conditions would be scored separately on their own merit.

Riparian restoration involves active or passive revegetation of riparian zones with native riparian plants, and typically focuses on re-establishing alders, willows, sycamores or cottonwood trees along stream banks. These projects can be quickly implemented, but require variable timeframes to become fully functional, on the order of 2 to over 20 years.

Aquatic habitat restoration includes construction activities designed to physically alter aquatic habitat. Such activities may include the reconstruction of pools or riffles or the redesign and construction of other channel features specifically to function as fish habitat.

Aquatic habitat enhancement includes the installation of structures within the stream channel or the addition of features that would augment the aquatic habitat to levels higher than would normally be continually supported by the stream. These actions may require a one or two year timeframe to fully mature and become functional.

Geomorphic restoration includes actions that are designed to work with the fluvial processes of the channel to recover some of the riverine processes. The actions are not specifically designed to improve fish habitat, but may result in doing so. These actions require construction activities followed by sufficient flows that work with the channel features to improve sediment transport, sediment deposition, or create pool and riffle forming features in the stream. The timeframe for this type of project to develop and function fully as fish habitat can vary.

Bank erosion control activities include bank stabilization projects designed to retard the incorporation of fine sediment into the channel. To become fully functional, these construction projects often require the growth and establishment of riparian vegetation, so the timeframes are usually on the order of 2 to 4 years.

Upslope erosion control projects would involve regrading, hydro-seeding, soil treatments or other activities designed to reduce the amount of soil erosion. There are usually immediate reductions to soil loss, but because of background levels in the stream, it may take several years before any improvements are noted in the stream.

Road treatments would involve outsloping roads, installing rolling dips and surfacing roads with materials to reduce surface erosion. These actions would immediately reduce the release of fine sediments, but because of the nature of sediment impacts, it may be years before any noticeable changes are seen in aquatic systems.

2.1.2 Evaluation Criteria for Restoration Projects

Evaluation criteria for effects from construction of restoration projects are presented in Section 2-3. Evaluation of the biological benefit for these projects are outlined here.

Planning and prioritization of restoration opportunities is an important component in an effective conservation program. Because financial resources are finite, it is important to maximize the biological benefit of conservation and restoration projects. This can be done by developing and utilizing information about the watershed, coordinating efforts on a basin-wide level, developing partnerships with other stakeholders, and seeking opportunities to bring additional financial or in-kind resources to the program.

An assessment of the biological value of specific SCWA restoration projects is made based on the size of the project, whether habitat or population data suggest the area is important or has the potential to be important for spawning or rearing, and the timeframe for the expected benefit. A qualitative assessment of the biological benefit score is given to each project based on several factors as outlined in Table 2-1. Each project is evaluated for each of the target species, and for spawning/incubation, rearing or migration life history stages.

Typically larger projects provide more benefits than smaller projects. The size limit is often constrained by funding sources, permitting issues, and the amount of work that can be accomplished in a single working season.

The conservation action is also qualitatively assessed based on the expected duration of the action and the timeframe to full development. The importance of short duration actions are considered to be lower than those with a 1-3 year life span, and both are lower than actions that endure for greater than 3 years. An additional timeframe to consider in evaluating the project is the time it takes the project to become fully functional at an ecological level. How long a project takes to become fully functional depends on the type of project. For example, the addition of spawning gravel to a system where spawning sites are limited can have an immediate and dramatic benefit. In contrast, it may take 10 to 20 years for the effects of a riparian restoration program to mature to the point where it begins to benefit the target species. Construction actions are typically evaluated without regard to full development timeframes. However, if riparian vegetation growth and development is required prior to full development, timeframes are typically on the order of decades. Projects with rapid start up times may have a greater beneficial effect.

A qualitative assessment is made of project effects on critical habitat, including elements such as canopy cover, instream cover, sediment effects, and bank erosion. Since changes in these elements are difficult to quantify, actual scoring criteria have not been developed for them. If the project addresses a known limiting factor it would be considered more important. Any stream assessments or population data that have been collected are used to evaluate the current or potential use of the project area by salmonids.

A project that has an educational component or can serve as a demonstration project may have indirect beneficial effects. Because so much of the Russian River watershed is privately owned, landowner cooperation is essential. Demonstration projects serve to educate the public about the advantages of a restoration action and may help alleviate concerns related to work involving endangered or threatened species on private property.

Components considered in determining the biological benefit of restoration projects are summarized in Table 2-1.

Table 2-1 Components Considered in Determining the Biological Benefit of a Restoration Project

Component	Description
Size	Length of stream affected. Downstream or upstream habitat may also be affected. For example stream bank erosion control is likely to reduce sedimentation of downstream habitat, or installation of fish passage may result in access to miles of upstream spawning and rearing habitat.
Time	The timeframe for expected benefits. Projects with rapid start up times may have a greater beneficial effect. Some projects may take some time before benefits are fully realized, but if they are of long duration or permanent in nature, substantial benefits can be realize for protected fish species.
Habitat Elements	A qualitative assessment of the habitat elements affected and their relative importance to protected fish species.
Habitat or Population Data	If data are available on population abundance or stream assessments, they are used to assess the relative importance of the project to protected fish species. For example, a fish passage project that provides access to several miles of high quality spawning and rearing habitat may have more value than instream habitat improvements in an area that is likely to have limited rearing or spawning habitat. If a known limiting factor is addressed, the project is considered to have a higher benefit.
Cost	Limited public and private funds are available for restoration actions. Projects that can deliver the most benefit for these dollars are preferred alternatives.
Education	A project that has an educational component or can serve as a demonstration project may have indirect beneficial effects.

A restoration project may improve the quantity and/or quality of the habitat or it may produce no change. If a conservation action is expected to improve habitat for protected species, it is scored 3 or better (Table 2-2). A project that has a very high potential to benefit would be one that improves a large portion of valuable or potentially valuable habitat, preferably with effects that are likely to occur soon and for an extended period of time. Intermediate or small-sized projects may also have high potential to benefit, and are scored a 4. Some projects, while useful, have small, localized benefits but may be located in areas that have less value for salmonid spawning or rearing and are rated a 3. While a particular project may not have a direct benefit within its footprint, it may provide upstream benefits (such as access to spawning habitat) or downstream benefits (such as an improvement in water quality). If a project has little or no benefit but uses limited public financial resources that may be better spent elsewhere, it is scored a 2. A project that is poorly planned or implemented, results in long term degradation of habitat, or wastes limited financial resources is scored a 1. For example, a large streambank stabilization project that places rip rap along a streambank or redistributes gravel bars to protect a landowners property, but that degrades salmonid habitat, would receive a lower score than a bank stabilization project designed to improve riparian and instream habitat for salmonids.

Table 2-2 Biological Benefit Evaluation Criteria for Restoration Actions

Category Score*	Evaluation Criteria Category
5	Very high potential to benefit
4	High potential to benefit
3	Moderate potential to benefit
2	No benefit and utilizes scarce resources
1	Poorly planned or implemented, degrades habitat

*A high score of 5 is given to a beneficial action, a low score of 1 to very detrimental action.

2.2 FISH PASSAGE

2.2.1 FISH PASSAGE DESIGN

Fish passage structures are usually required when anthropogenic structures block spawning runs. Effects on salmonids can occur during construction, operation, and maintenance activities related to the fish passage structure. Fish passage structures also have the potential to increase predation on protected species by concentrating predators and prey.

Fish passage may not have been considered during original culvert design or installation. At high flows, high water velocities can prevent the upstream passage of fish, and at low flows, low water depth can prevent upstream or downstream passage of fish. For fish to swim through a culvert, a flow depth at least equal to the body depth of the maximum sized fish is required (Bell 1990). The length of the culvert at various slopes, and the site-specific water velocities, affect the ability of fish to swim upstream through the culvert. Erosion at the outflow of the culvert can create a drop that blocks access to the entrance of the culvert. If a splash apron is constructed to reduce erosion, it may also become a barrier to passage.

Dams may restrict fish passage in more than one way. One way is to block passage directly. Another is to change the channel in such a way as to restrict fish passage. An example is Mumford Dam. This flashboard dam has caused downcutting below the dam to the point where upstream passage for anadromous fish is difficult or impossible over most flow conditions.

2.2.1.1 Evaluation Criteria for Fish Passage Design

2.2.1.1.1 *Criteria*

Successful fish passage depends on several factors, including the species and life history stage to be passed, fishway entrance design, the style of fish passage used, and flow in the fishway. To provide successful fish passage the fishway must be carefully engineered for width and depth relationships to provide the low velocity flows required in its design. At the same time, the design must make it easy for fish to find the entrance with minimal or no delay. There must be enough water flowing through the fishway at the range of flows for which it is designed so that fish can find the entrance of the passage structure (attraction flow) and pass upstream with minimal delays.

There are several commonly used fish passage designs, but they do contain some common design considerations. General design considerations for adult salmonid upstream passage are summarized below (Bell 1990). These design criteria are appropriate for traditional fish passage designs, but some may not always apply to fish passage that is designed to mimic natural conditions within a creek. However, they serve as a starting point to outline general fish passage design issues and present general guidelines to assess them.

- Resting areas with velocities of 0.1 feet per second (fps) in pools, or a tenth of the normal swimming speed.
- Maximum drop of 12 inches between pools.
- Average maximum velocities over weirs or through orifices of 8 fps.
- Entrance velocities of 4 to 8 fps.
- Travel time through fishway 2.5 to 4 minutes per pool.
- Space for fish in pool equivalent to 0.2 cubic foot per pound of fish.
- Entrance eddies: recommended that cross velocity not exceed 2 fps at zero fishway discharge.

Adult passage evaluation criteria are presented in two components. First, the fish passage should be built to pass fish by using effective design features. Secondly, the passage should have enough attraction flow for fish to find the entrance and pass upstream.

Although upstream migrants may not move during the highest river flows, migrations are induced by freshets and therefore fish passage during moderate flood events should be provided. The range of flows in which a fish passage structure operates should be wide enough to prevent significant migration delays. Several design flow criteria have been developed. Gebhards (1972, cited in Bates 2000) suggests an allowable migration delay of up to six consecutive days for salmon and trout. Dryden (1975, cited in Bates 2000) recommends that a seven day migration delay should not be exceeded more than once in 50 years and a three day migration delay should not be exceeded during the average annual flood. The CDFG suggests that passage should be provided during at least 90% of the flows that will be encountered for the target species during its migration period (Bates 1988).

Table 2-3 provides scoring categories for the effectiveness of the passage design to pass fish. High scores are given to fish passage facilities that meet basic design criteria and pass fish with minimal or no delay. A fish passage project that removes a passage impediment or restores the geomorphology of a stream channel in a way that reestablishes good fish passage conditions would receive a high score.

Table 2-3 Adult Fish Passage Evaluation Criteria Based on Fish Ladder Design and Operation

Category Score	Evaluation Categories
5	Fish passage passes adult salmonids without delay
4	Fish passage passes adult salmonids with acceptable delay
3	Fish passage passes all target species after extended delay
2	Fish passage does not pass all target species of adult salmonids
1	Passage provided but does not appear to pass any adult salmonids, or passage not provided

Sufficient attraction conditions are particularly important during adult spawning runs that occur during high winter flows. One of the factors affecting attraction conditions is attraction flows. Insufficient attraction flows could make it difficult for adult fish to find the entrance to the fishway thereby creating migration delays. As a general rule of thumb attraction flow is sufficient if the amount of water provided for the fishway and bypass system (exits at the fishway entrance) is 10 percent or more of the total flow. However, designing for 10 percent of river flow through the fishway can be impractical at very high flows, and therefore other factors affecting attraction condition can be addressed.

Achieving a good attraction condition is a function of many factors, including fish behavior, river size, attraction flow strength, fishway entrance location and flexibility of spillway operation. As river flows change the relative importance of each component changes.

Site-specific conditions, especially tailwater hydraulics and channel width, determine entrance flow requirements. Fish will migrate along the channel banks during high flows to take advantage of lower flow velocities. Migrating fish will search laterally in combination with short fall backs when confronted by a barrier. Low flow entrances can be located close to the base of dams and should also be located beneath the nappe of the spillway when it separates a substantial distance from the dam. The location of the entrance should be at the upstream-most point of fish passage, and the location must take into account the locations where fish hold before attempting to pass the barrier. The entrance flow should be high enough to compete with spillway flow for fish attraction.

The jet of water leaving the fishway entrance is an extension of the fishway into the tailwater and it guides fish to the entrance. The greater the momentum of the jet, the further it reaches into the tailwater and the more successfully it can guide fish to the entrance. When a low-flow entrance is aligned perpendicular to the channel alignment, parallel to the barrier, or oriented at a small angle, the entrance jet penetrates the tailwater to a greater extent than if aligned perpendicular to the flow in the tailrace. When a high flow entrance is placed a low angle (30 degree angle), the protrusion into the stream of an angled entrance provides an abutment and velocity shadow behind which fish move upstream, and then passage is blocked by the abutment and high water velocities upstream of the entrance.

Table 2-4 provides scoring categories based on the general rule of thumb that at least 10% of flow stream flow should be provided for attraction flows. High scores are given to fish passage structures that provide at least 10% of total stream flow for fish attractions flows during most or all of the spawning migration period. If the fish passage improvement project passes the entire stream flow, this score would be a 5.

Table 2-4 Fish Passage Evaluation Criteria Based on Attraction Flow

Category Score	Evaluation Categories
5	At least 10% of total streamflow is provided for fish attraction continuously during migration
4	At least 10% of streamflow is provided for fish attraction 75-99% of time during migration
3	At least 10% of streamflow is provided for fish attraction 50-74% of time during migration
2	At least 10% of streamflow is provided for fish attraction 25-49% of time during migration
1	At least 10% of streamflow is provided for fish attraction 0-24% of time during migration

Most published criteria address upstream spawning migrations, but some of these criteria may also apply to juvenile downstream migration. Downstream migrant smolts need a minimum of 6 inches depth of water (Flosi *et al*. 1998). Furthermore, if a barrier significantly decreases water velocity upstream, downstream passage through the fishway may be delayed or impeded entirely. Juvenile downstream migrants had a finite amount of time to complete the physiological change (smoltification) that enables them to survive in a marine environment. A substantial delay in migration may result in smolts reverting to a resident form, and they may spend an additional year in freshwater.

Fish passage projects that improve both upstream and downstream passage for all life history stages of salmonids, as well as for other species, are likely to restore some of the natural functions inherent in an interconnected riverine ecosystem. Therefore, fish passage projects that restore the geomorphology of the stream are likely to have a greater benefit than fishways that are designed primarily to pass adult salmonids.

2.2.2 PREDATION

By concentrating predators and prey, or by introducing predators into salmonid habitat they have not previously had access to, fish passage structures have the potential to increase predation on protected species. Of particular concern are nonnative largemouth bass and smallmouth bass, green sunfish and native Sacramento pikeminnow. There are currently self-sustaining populations of these warmwater species in the Russian River. In stream areas that are easily accessible to people, fish passage structures may provide increased poaching opportunities.

Structures that concentrate prey increase the potential for predation on protected species. If there are holding areas that favor predators near structures that concentrate salmonids, and if predators are actually present near those structures, protected species may be adversely affected. Only structures that provide predators access to areas that they have not historically reached would affect the level of predation. Furthermore, water temperatures favorable to predators would be needed.

2.2.2.1 Evaluation Criteria for Predation

To evaluate the risk of increased predation on protected species, three components were developed for predation evaluation criteria: structural criteria, access criteria, and habitat criteria (Table 2-5). Structural criteria assess whether the structure concentrates predators and prey. Access criteria assess passage opportunities for predators and whether predators are given access to areas they have not historically been. Predator habitat criteria are based on water temperatures favorable to warmwater predators, especially centrarchids and Sacramento pikeminnow. The optimum temperature for Sacramento pikeminnow is 26.3°C (Knight 1985). Warm water temperatures favor these predatory fish at the same time that they negatively affect protected salmonids and their ability to avoid predation.

Table 2-5 Predation Evaluation Criteria

Category Score	Evaluation Criteria
	Component 1: Structural Criteria
5	No features that concentrate salmonids or provide cover for predators, concentrations of predators not found.
4	No features that concentrate salmonids, predator cover near, predators in low abundance locally.
3	Features that concentrate salmonids, no predator cover nearby, predators in medium to low abundance locally.
2	Features that concentrate salmonids, predator cover nearby, predators in medium to low abundance locally.
1	Features that highly concentrate salmonids, predators abundant locally.
	Component 2: Access Criteria
5	Structure does not allow passage of predators, predators not present near structure.
4	Structure does not allow passage of predators, predators present near structure.
3	Structure provides limited passage of predators, or limited passage to areas they are already well established, predators not present near structure.
2	Structure provides limited passage of predators to areas they have historically not been found or have been found in limited numbers, predators present in limited numbers near structure.
1	Structure provides passage of predators to areas they have historically not been found or found in limited numbers, predators present or migrate to structure.

Table 2-5 Predation Evaluation Criteria -continued-

	Component 3: Warmwater Species Temperature Criteria
5	Water temperatures < $13^{O}C$
4	Water temperatures 13 - $18^{O}C$
3	Water temperatures 18 - $20^{O}C$
2	Water temperatures 20 - $22^{O}C$
1	Water temperatures 22 - $24^{O}C$
0	Water temperatures >= $24^{O}C$

2.3 Construction, Maintenance and Operation Activities

2.3.1 Sediment Input and Injury to Fish

Potential effects of construction, maintenance and operation of fish passage structures include sediment input to the stream, short-term increased turbidity, and direct fish mortality. There could also be temporary or permanent loss of habitat. Other restoration projects may also have short-term construction effects, but are less likely to have operation or maintenance effects because they are designed to operate passively once they have been completed.

Increased Fine Sediment and Turbidity

Fine sediments can potentially decrease the survival of salmonid eggs (Bell 1990). They can reduce primary productivity and the production of aquatic invertebrates (Cordone and Kelley 1961, Lloyd *et al*. 1987), and thus affect the availability of food for salmonids. When an excess of silt is deposited after spawning, eggs can be “smothered” when silt settles into the spaces between the gravel particles, blocking the flow of water, and therefore oxygen, through the redd (egg nest). Increased sedimentation also reduces the abundance of invertebrates on which juveniles feed. Many invertebrates reside within the spaces between the substrate. As these spaces are filled with fine sediment, there is less physical space for the invertebrates, and the flow of water, oxygen, nutrients and light are also decreased. This leads to the loss of production.

Turbidity is measured by the amount of light that penetrates the water and is measured in nephelometric turbidity units (NTUs) or Jackson turbidity units (JTUs). Turbidity is affected by a number of factors including microorganisms, organic debris, minerals, clays and silts, pigments from vegetation and others. These factors reduce the amount of light that can penetrate the water and cause light within the water column to scatter, reducing visibility.

Most streams and rivers have some level of natural turbidity that varies seasonally. During the summer months, turbidity and erosion are usually lower than during the winter and spring months when storms produce runoff that increases turbidity. Turbidity can affect fish and aquatic life both positively and negatively. Aquatic ecosystems have some resistance to short term exposures to increased turbidity or suspended sediments, as these increases are part of the natural cycle of streams and rivers.

Increased turbidity levels can cause stress (Newcombe and MacDonald 1991), impede migration (Cordone and Kelley 1961, cited in Bjornn and Reiser 1991), reduce growth of fry (Sigler *et al.* 1984), interfere with feeding and growth (Berg and Northcote 1985) and cause avoidance reactions (Bisson and Bilby 1982, Lloyd *et al.* 1987). However, moderate levels of turbidity may give juveniles protection from predators (Gregory 1993), and chinook salmon are known to occupy turbid rivers for a significant portion of their early life. In general, high, sustained levels of turbidity can negatively affect salmonids.

Fish Mortality

Work in a streambed may result in direct mortality or injury to fish or incubating eggs. This effect can be minimized by timing work to avoid critical life history stages, working in a dry stream, establishing a bypass during construction, or excluding fish from the streambed.

Loss of Habitat

As specified within the critical habitat designations prepared by NMFS, critical habitat within the Russian River for all three salmonid species is defined as “all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers.” (NMFS 1999, 2000). Critical habitat would be considered to be adversely affected if it were “altered or destroyed by the proposed activities to the extent that the survival and recovery of the affected species would be appreciably reduced” (USFWS and NMFS 1998). This alteration or loss is most significant if it is permanent in nature or occurs at a time of year when this habitat is being used, especially if the habitat were used for a critical life history stage, such as spawning.

2.3.1.1 Evaluation Criteria

Direct construction or maintenance effects on fish mortality and sediment input are evaluated by evaluation criteria for *Opportunity for Injury* (Table 2-6) and *Sediment Containment* (Table 2-7).

Immediate, effects from construction or maintenance activities are scored according to the opportunity for injury to protected species (Table 2-6). BMPs are generally implemented to reduce the risk of injury to fish and may include scheduling the work when protected species are not present or when the stream channel is dry, conducting a biological survey of the project area to assess appropriate BMPs, isolating the project area from stream flow, and providing escape or rescue for fish that may be present. Site-specific factors dictate appropriate BMPs. For example, isolating a construction or maintenance area from streamflow may be a preferred alternative for some projects, but may result in an unacceptable disruption of habitat for other activities, such as one that take place in a long reach of stream but involves minimal instream work. While a fish rescue may reduce the risk of injury, it has risks associated with it, and there may be times when providing escape is a preferred alternative.

High evaluation scores are associated with activities that have a low risk of injury, such as those that do not take place in the channel, or take place in a dry channel. Some activities require almost no interaction with the stream channel or water in the stream. If activities take place when no fish species are present, then no direct injury to fish would be expected. The greater the interaction with the stream, the higher the risk of direct mortality to fish and effects associated with increased turbidity and sedimentation of aquatic habitat. Occasionally, a project may require equipment in the flowing channel. Appropriate BMPs, such as project area surveys by a qualified biologist, isolation of the project area from flow, and fish rescue or escape, reduce the injury from equipment or stranding.

The lowest scores are given to activities that occur in a wetted channel where appropriate BMPs are not applied or applied in a limited way. There may be site-specific considerations that limit the ability of staff to apply appropriate BMPs. For example, emergency work after a landslide may restrict the ability of staff to implement all practices that might be desirable.

Table 2-6 Opportunity for Injury Evaluation Criteria

Category Score	Evaluation Criteria Category
5	Project area is not within flood plain or below maximum water surface elevation (WSEL), and requires no isolation from flow.
4	Project area is in within dry part of channel, or construction and maintenance activity scheduled when species of concern is not present.
3	Appropriate BMPs are applied; *e.g.* project area survey, escape or rescue provided, project area isolated from flow (if appropriate).
2	Limited ability to apply appropriate BMPs.
1	Appropriate BMPs are not applied.

If there are biological or habitat conditions in a particular area that suggest there may be a more significant risk to protected fish species, the risk to protected fish species may be greater. For example, if an activity is scheduled in the late summer in the upper mainstem Russian River, where important rearing habitat is known to occur, the effects may be more significant than if the work were performed in the Mirabel area where high summer water temperatures are likely to limit the number of listed fish species that are present. The level of risk is qualitatively assessed, based on general knowledge of the tributary or river where the work is done.

Evaluation criteria for sediment control address two components, instream and upslope sediment control (Table 2-7). For component 1, instream sediment control, a high score indicates instream work practices with the highest degree of sediment containment, and a low score indicates poor or no sediment containment measures. Working in a stream that is dry receives a score of 5. A clean bypass is routing streamflow around the construction activity so that continuity of flow and water quality is maintained downstream. A clean bypass isolates the work area from the wetted stream channel. Rerouting streamflow from the construction area into a clean bypass, or other method that reroutes streamflow, isolates the construction area and prevents sediment input to the stream, therefore, these options are given higher scores. For instream work in a wetted channel, a gravel berm is typically established to filter turbid waters and reduce potential sedimentation. Limited sediment control is a measure that is only partially effective, and that may allow significant sediment loads to the stream.

Component 2, upslope sediment control, evaluates the potential for upslope work to increase sediment input to the stream or to affect bank erosion. Up-slope work generally means the streambank, but in some cases could include a hillside that can contribute sediment to the stream.

This component evaluates the amount of disturbance, the effectiveness of erosion control measures, and whether bank stabilization is improved or degraded.

Table 2-7 Sediment Containment Evaluation Criteria

Category Score	Evaluation Criteria Category
	Component 1: Instream sediment control
5	Project area does not require rerouting streamflow
4	Clean bypass or similar method used
3	Effective instream sediment control (*e.g.* berm/fence)
2	Limited sediment control
1	No instream sediment control
	Component 2: Up-slope sediment control
5	No upslope disturbance, or an increase in up-slope stability
4	Limited disturbance with effective erosion control measures
3	Moderate to high level of disturbance with effective erosion control measures
2	Action likely to result in increase in sediment input into stream
1	Action likely to result in slope failure, bank erosion, an uncontrolled sediment input to the channel or major changes in channel morphology

2.3.2 Riparian Vegetation

Riparian vegetation has several important functions for the quality of fish habitat (Meehan 1991). Water quality, including temperature and suspended sediment concentrations, may be influenced. Riparian vegetation, especially trees, provides canopy cover and shade, and removal may increase solar input and result in higher water temperatures in the summer (Hall and Lantz 1969). Since salmonids occupy a wide variety of habitat types during various life history stages, it is important to have quality habitat in small and large streams. On small streams, grasses and shrubs may be sufficient to provide beneficial effects, while on larger streams, shrubs and trees are more effective.

Riparian vegetation has an effect on bank strength. Bank erosion and lateral channel migration contributes sediments to the stream if protective vegetation and root systems are removed.

Riparian vegetation is essential for building and maintaining stream structure and for buffering the stream from incoming sediments and pollutants. When vegetation is reduced, flood events are more likely to damage channel morphology by widening the stream and decreasing bedform roughness, potentially filling pools with sediments and reducing quality of spawning gravels. Trees provide streambank stability with their root systems, and when older trees fall into a stream, they create high-quality pools and riffles, as well as controlling the slope and stability of the channel (Beschta and Platts 1986). Streambank stability is also maintained by flexible vegetation such as willows and grasses. During floods, water transports large amount of sediment in the stream. Vegetation mats on the streambank reduce water velocity, causing sediment to settle out and become part of the bank, increasing nutrients so important to productive riparian vegetation.

Riparian vegetation provides cover, an important determinant of fish biomass. Additionally, well-sodded banks gradually erode, creating undercuts important as refuge habitat. Root systems of grasses and other plants can trap sediment to help rebuild damaged banks. Riparian vegetation provides the basis for food production. Plant matter provides organic material to the stream, essential for production of aquatic insects. Vegetation also provides habitat for terrestrial insects, which are an important food for salmonids.

Vegetation removal can be beneficial if it involves the removal of nonnative species. Replacement of nonnative species with native species generally will help restore a naturally functioning, native, riparian ecosystem.

2.3.2.1 Evaluation Criteria for Vegetation Removal

Restoration actions are designed to restore native riparian corridor on eroded banks and in areas dominated by nonnative species. Evaluation criteria were developed for vegetation removal based on the direct effects of removal. Replanting activities are rated with the biological benefit criteria based upon their potential direct and indirect effects on fish and their habitat. As long-term effects are not directly quantifiable, they are evaluated on a qualitative basis (see Section 2.1.2.1).

Vegetation removal is usually accomplished by one or several methods including hand clearing, mechanized methods, and herbicides. An indirect method of vegetation control is to plant desirable native riparian vegetation that will exclude the establishment of nonnative or undesired vegetation.

Hand clearing generally disturbs the streambank or streambed less than mechanized methods, particularly if heavy equipment is used. Vegetation removal activities may increase sediment input into the stream, result in direct injury to fish, and may degrade water quality. For example, a direct effect may involve introduction of pollutants such as herbicides. An indirect effect may be a decrease in dissolved oxygen levels after excessive amounts of decaying vegetation are introduced into the stream. For some plants, such as the highly invasive nonnative weed *Arundo donax* (Giant Reed), a combination of mechanical/hand clearing and herbicide use is more effective than the use of only one. A commonly used herbicide used near aquatic areas is glyphosate (Rodeo®). Glyphosate, when used according to directions, is practically nontoxic to fish and may be slightly toxic to aquatic invertebrates (EXTOXNET 1996). The 96-hour LC50 is 86 mg/L in rainbow trout (Weed Science Society of America 1994).

The vegetation control evaluation criteria (Table 2-8) assesses the amount and quality of chemicals released into the aquatic environment when herbicides are used. Higher scores are associated with practices that use only an aquatic contact herbicide, and limit herbicide use to smaller, targeted areas. Herbicide application can be limited with the use of an individual backpack unit as opposed to being broadcast over a wider area, or it can be applied over a large area with aerial spraying. Moderate to heavy herbicide use is associated with large-scale vegetation removal activities, for example, if a large infestation of *Arundo* had to be removed.

Table 2-8 Evaluation Criteria for Vegetation Control Associated with Herbicide Use

Category Score	Evaluation Criteria Category
5	No chemical release
4	Limited use of herbicide approved for aquatic use in riparian zones or over water
3	Moderate to heavy use of herbicide approved for aquatic use in riparian zones or over water
2	Use of herbicide not consistent with instructions
1	Use of herbicide not approved for aquatic use in riparian zones or over water

2.4 WATER REUSE AND RECYCLED WATER

Full implementation of the water reuse and recycling program could reduce peak demand by 3 to 5% and reduce discharges of treated water to the river. An estimated 2,300 AF of potable water could be saved annually and peak average month flow would decrease by about 5 mgd. Water reuse will have one of two effects.

There will be a nominal reduction in peak potable water demand on the order of 3 to 5%. This typically occurs during warm spells in mid-summer, when there is limited use by target species in the Wohler and Mirabel diversions area or at downstream locations. Therefore, substantial improvements to target fish habitat conditions are not expected to be realized from this effort.

Water reuse may also reduce the discharge of treated water to streams of the Russian River basin. This could have a positive effect if the discharge is of poor quality, or it could have a negative effect if the discharge maintains the streamflow. For water reuse programs affecting the discharge from the Sonoma, Novato, Valley of the Moon and North Marin Water Districts, benefits to the receiving waters are not expected, since all four districts would discharge to waters outside of the Russian River basin in absence of the water reuse program.

2.5 WATERSHED MANAGEMENT PROJECTS

Watershed management projects include three general categories of projects, 1) data collection, 2) demonstration projects and 3) information coordination and dissemination. Studies that collect data on salmonids and their habitat have indirect effects that may not be quantifiable, but are potentially significant. When conservation activities are coordinated with other agencies, a greater benefit may accrue to protected species and their habitat. Demonstration projects gather and utilize information on effect methods to meet specific goals and make that information available for application on a wider scale than the immediate project area, possibly on a watershed scale. Public information and public involvement activities may also have unquantifiable but important effects on listed species and their habitat.

2.5.1 DATA COLLECTION

In the absence of data, it would be very difficult protect listed species and their habitat. Studies funded, coordinated, or implemented by SCWA to produce information that is essential for effective and cost-efficient restoration and conservation activities.

2.5.1.1 Habitat Data

Information that can potentially benefit critical habitat include stream habitat surveys, water quality data, and temperature data. To identify and prioritize streams that are in need of restoration, stream habitat surveys are to be conducted on every stream in the watershed. Water temperature monitoring since 1996 will help identify streams that may provide the best thermal conditions for salmonid rearing. Finally, a baseline reference for water quality has been established in selected streams, and this will be used to determine relative water quality status in other streams.

2.5.1.2 Fish Population Data

Insufficient data exist to assess salmonid population trends in the Russian River. A comprehensive population monitoring program developed by SCWA in conjunction with CDFG and NMFS will assess the current status of steelhead and coho, particularly juvenile abundance. Furthermore, the Rubber Dam/Wohler Pool fish sampling program is producing information on smolt emigration in the late spring, of particular value has been information about chinook salmon juveniles.

Historically, coho salmon, steelhead, and chinook salmon from distant watersheds have been planted in the Russian River. Hatchery broodstock, has, until recently, included out-of-basin stocks. Potential genetic effects of out-of-basin transfers are outlined in *Interim Report 2: Fish Facility Operations.* It is probable that many tributaries of the Russian River contain a mixture of native and nonnative stocks. Genetic information is being collected to determine which streams contain relatively native genetic strains so that they can be targeted for conservation.

2.5.1.3 Invasive Plant Species

Nonnative plants can alter the riverine ecosystem. When invasive plant species replace native riparian vegetation, alterations can occur to the food web, riparian and instream cover, and general habitat characteristics of the stream. Two nonnative species on the Russian River are *Arundo donax* (the Giant Reed) and *Vinca major* (Periwinkle).

Arundo is potentially a serious problem for the Russian River's ecosystem. It is a perennial grass believed to be native to eastern Asia that was introduced to California in the 1800s. It has already established itself in extensive portions of wetland and riparian habitats, especially in southern California. *Arundo* forms tall, dense stands. It propagates vegetatively more so than by seed, and it has deep roots. It quickly invades new areas, particularly where the ground is cleared, when floods break up clumps of *Arundo* and transport rhizomes downstream. Because it outcompetes native species, it may jeopardize riparian restoration projects.

Arundo changes the stream channel by retaining sediments and constricting flow. Root masses that can be more than a meter thick stabilize streambanks and alter flow regimes. *Arundo* provides less canopy cover that native species do, so stream temperatures are increased (Dunne and Leopold 1978, cited in Bell 1997). It changes the quality and timing of organic debris that forms the base of the riparian food chain. It does not seem to provide food or habitat for native species of wildlife, including salmonids. It is highly flammable, and when riparian corridors are changed from flood-defined to fire-defined communities, diverse ecosystems are converted to pure stands of *Arundo* (Bell 1997).

Because *Arundo* has not yet established itself to the devastating degree that it has in southern California, a proactive removal program may still be effective and affordable. It is effectively removed with a combination of manual or mechanical means and herbicide use. Additional treatments may be needed to prevent it from reestablishing itself. As *Arundo* spreads in a downstream direction, eradication has to be coordinated in the watershed. Furthermore, a public information campaign is required, as *Arundo* is sold in nurseries.

While some information about *Arundo* and its control has been developed in southern California, insufficient data exist for northern California streams. Its biology and ecology is not well studied. The mechanisms with which it overtakes native riparian communities are not well understood, particularly in cooler northern climates. It is not known what factors may prevent infestation. Distribution and abundance data are lacking. More information is needed to develop effective *Arundo* eradication and prevention programs.

Vinca major, in addition to invading large areas of native riparian corridors, is a host to sharpshooters, a vector for Pierce's Disease.

2.5.2 DEMONSTRATION PROJECTS

Three demonstration projects provide information that can be applied throughout the Russian River watershed to improve conditions for salmonids and their habitat. They include Pierce's Disease control, fish friendly farming, and the Palmer Road Erosion control.

2.5.2.1 Pierce's Disease Control

Pierce's Disease (PD) is caused by a bacterium (*Xylella fastidiosa*) that kills grapevines. It is spread by zylem feeding insects in the sharpshooter family, particularly the glassy-winged sharpshooter. There is no known control for PD. Management focuses on control of the sharpshooter and removal of diseased plants. The most susceptible vines are on the outskirts of grape-growing areas next to pastures or riparian areas.

In the Russian River watershed, vineyards are often located adjacent to riparian zones where the vegetation is prime habitat for sharpshooters. When vineyard owners indiscriminately clear riparian vegetation, valuable riparian corridors can be destroyed. By removing only host plants that attract sharpshooters and leaving others, the insects' abundance can be dramatically reduced. Plants that sharpshooters favor include wild grape, Himalayan blackberry, French broom and periwinkle. Plants that are not likely to attract sharpshooters include oaks, California bay laurel, alder, maple, ash and red willows (University of California at Davis, 1999).

2.5.2.2 Fish Friendly Farming

Many streams in the Russian River watershed run through agricultural land, particularly vineyards. The success of this voluntary education and certification program depends on the level of participation and implementation by growers. Therefore, incentives that increase participation are important to the success of the program.

2.5.2.3 Palmer Road Erosion Control

Roads can cause degradation of streams by modifying natural drainage and accelerating erosion processes, altering channel morphology and by changing the runoff characteristics of watersheds. (Furniss *et al*. 1999). The resulting sedimentation of streams can be dramatic. Improperly designed roads can affect migration of salmonids. There are guidelines for road siting, building and maintenance that can help reduce adverse effects and minimize sedimentation of streams (Furniss *et al*. 1999, WDFW 1999, NMFS 2000). A properly designed rural road can provide a demonstration of principles that should be applied throughout the watershed.

2.5.3 Evaluation Criteria for Information Value

Some research data may have localized usefulness, such as water quality sampling conducted in specific streams. Other research may be useful to many areas of the river watershed, such as development of effective *Arundo* eradication methods. Evaluation criteria for information gathering or dissemination assess how wide a geographic area the information has the potential to be used in, and a qualitative assessment is made on the relative biological benefit to listed species or designated critical habitat (Table 2-9).

Table 2-9 Information Value Evaluation Criteria

Category Score	Evaluation Criteria Category
5	Basin-wide applicability
4	A region or “type” of habitat (*i.e.* small tributaries, or lower mainstem)
3	Isolated project/stream information
2	Information not useful to protected species or critical habitat
1	Incorrect or misleading information

2.5.4 Information Coordination and Dissemination

The Russian River basin will be subjected to increasing demands on its resources. If it is to be protected and restored to the fullest extent possible, coordination among stakeholders is essential. By coordinating with agencies, government entities, and various organizations or watershed groups, limited resources can be put to maximum use. By providing information and training to the public, additional conservation actions can be implemented and future problems can be avoided. Furthermore, some activities, such as *Arundo* control or development and implementation of water quality standards, must be coordinated on a watershed level to be fully effective.

While the benefits of these activities are not always quantifiable, they are potentially significant. By taking a proactive role, SCWA can realize significant indirect benefits to protected species and their critical habitat.

This section assesses the effects of restoration and conservation actions on protected species and their critical habitat. First an overview is given of the level of SCWA's restoration and conservation actions within a given year and a description of how priorities are set. Then an overview of the Russian River Watershed is given so that specific restoration actions may be put in context. Evaluation criteria developed in Section 2 are applied. A qualitative assessment of the biological benefit of past, current and proposed projects for affected life history stages of listed salmonids is made. Effects due to construction and maintenance practices of the projects are assessed.

Some restoration projects were completed prior to the time that the MOU was signed, others have been or will be completed since then. For assessment in this BA, restoration projects fall into one of the following categories:

1. *Baseline Projects*: These are recent conservation projects that were approved and completed at the time the MOU was signed (December 31, 1997). They represent improvements, but are considered part of the baseline condition and do not require assessment in this BA or a statement of take in the BO.

2. *Part of the Proposed Actions*: These are conservation projects that have been completed, are underway, or may be implemented in the future, but are not likely to result in direct injury to protected fish species and therefore do not require a take statement.

3. *Projects that Require Take Authorization*: These are conservation projects that require assessment in this BA and require an incidental take statement. They generally involve instream work, and therefore have the potential to harm salmonids during construction activities.

3.1 PROGRAM OVERVIEW

3.1.1 FUNDING AND PRIORITIES

SCWA has increased its budget and level of efforts for restoration and conservation actions within the last three years, and the current budget will be maintained in future years. Out of approximately $800,000 spent on the Natural Resources program in the year 2000, about 30 to 40% was spent on monitoring at the Mirabel and Wohler diversion facilities (which has yielded valuable information about how listed species use the watershed), about 50% on FEP projects, and about 10% on meetings. Additionally, in-kind contributions of staff from other SCWA departments and equipment have been committed to stream restoration projects. For example, $31,000 was committed for a large project on Copeland Creek and $7,000 for Austin Creek.

Two years ago, SCWA began to apply for grant money to supplement this budget. For example, $400,000 of Proposition 13 funds was secured to implement *Arund*o eradication in the Russian River Watershed. SCWA developed a successful grant application by designing a comprehensive approach to *Arundo* eradication, rather than a program of less effective spot treatments. This approach includes mapping the entire watershed, developing a disposal and compost facility, and conducting eradication from the most upstream location to downstream areas. The mapping stage has been completed, and *Arundo* removal will begin soon. In some cases, grant money has been used to jump-start projects by local organizations that match grants. In the year 2000, SCWA secured $471,000 in grants, and grant-funded projects are booked solidly through the summer 2002 season. If a landowner were to be willing to team up for an aggressive project, SCWA would pursue a grant for that project. Given past successes, SCWA expects to secure additional grant funding in the future.

To maximize the effectiveness of the dollars invested, SCWA develops project priorities on a basin-wide level. Stream habitat inventories coordinated by the CDFG have identified restoration opportunities, and SCWA and CDFG have had a successful track record in working on multiple projects and efforts throughout the watershed. When the CDFG Basin Restoration Plan for the Russian River Basin is released, SCWA will work to implement priorities and recommendations formally outlined by CDFG. The contribution of funding and implementation efforts from private landowners, agencies such as CDFG, NMFS, the Sotoyome Resource Conservation District, and the RWQCB, and various entities and groups that have been partners on these projects have been instrumental to the success of restoration programs.

A decision is made to proceed on a project based on several considerations as outlined below.

1. *Projects that have known benefits*. These sites are chosen for a restoration action because the need has presented itself and the project is one that has the potential to do the most good. A site may be chosen in consultation with CDFG after it has been identified as a priority during a habitat survey. Relevant information is reviewed, including formal or anecdotal information from SCWA or CDFG staff or others, whether a limiting factor is affected, and potential effects to the population of a listed species (with a priority focus on coho salmon). For example, some streams have adequate spawning habitat, but large woody debris is needed to provide adequate rearing habitat. If a project has a small footprint but affects a large area, (for example 700 feet of work that provides fish passage past Mumford Dam affects 50 miles of stream) more value from the project can be realized. If a project has educational value as a demonstration project, it is considered more valuable.

2. *Opportunity based projects (willing landowner)*. Occasionally a project is requested by a local landowner and approved by CDFG. Because so much of the watershed is in private ownership, landowner cooperation is important. Publicity about SCWA programs and demonstration projects that have already been implemented may increase the number of these opportunities in the future.

3. *Third party cooperation*. As information about SCWA programs spreads, individuals or organizations seek opportunities to develop cooperative projects.

If SCWA sees a restoration opportunity that may be handled more effectively by another organization, it will contact that organization. For example, SCWA is well equipped for dam removal projects, but there may be a large fencing project that may be more appropriately handled by the California Conservation Corps (CCC) office in Ukiah.

In summary, SCWA commits substantial funds, staff and equipment to restoration projects. The value of this commitment is maximized by prioritizing projects on a basin-wide level, through cooperation with many other stakeholders, and by utilizing opportunities for public education and outreach. Furthermore, SCWA's success with grant writing has been, and will continue to be, used to supplement this effort.

3.1.2 Salmonid Habitat in the Russian River Basin Relative to SCWA Restoration and Conservation Actions

An analysis of the effects of restoration and conservation actions on the populations of coho salmon, steelhead, and chinook salmon requires an understanding of the importance of various geographic areas to the various life history stages of these species. Activities within a particular geographic area can then be assessed for their overall effect on populations of listed species.

Figure 3-1 is a CDFG map of the steelhead and coho salmon streams within the Russian River watershed. Coho salmon distribution is more restricted than steelhead, and the population is much smaller. In general, the western side of the valley is cooler, is subject to coastal fog in the summer, and supports coniferous forest. Primary coho salmon spawning and rearing habitat is most likely to occur in these tributaries. In contrast, the eastern side of the valley is warmer and drier and is characterized by oak woodland habitat. Good quality salmonid habitat can occur in these tributaries. Steelhead occupy all of the major tributaries and most of the smaller ones in the Russian River Watershed. Less is known about chinook habitat, but spawning habitat is most likely to occur in Dry Creek and in the mainstem of the Russian River above Asti. Good quality coho salmon and steelhead habitat also occurs in the upper portion of the Russian River Watershed. High water temperatures limit salmonid rearing in the lower mainstem in the late summer. All three species utilize Dry Creek and the lower mainstem of the Russian River for passage. The Russian River Estuary is likely also important for steelhead and chinook rearing.

Much of the watershed area is privately owned, and agricultural industries (particularly vineyards) predominate. Restoration actions can be limited by a lack of willing landowners, so public outreach and demonstration projects are an important component of a restoration program. The most urbanized portion of the watershed is in Santa Rosa and the Cotati-Rohnert Park areas. These areas contain most of the constructed flood control channels. Natural streams and constructed channels in the Rohnert Park area are generally low gradient and run through a valley plain to the foothills. Poor summer water quality and low summer flows limit rearing habitat. However, the Laguna de Santa Rosa has important wetland and flood control functions for this part of the watershed.

Santa Rosa Creek also drains to the Laguna de Santa Rosa which in turn drains to Mark West Creek. This part of the Mark West Creek Watershed, including the Santa Rosa Creek watershed, contains good coho and steelhead rearing and spawning habitat. Much attention has been given in recent years to restoration opportunities in this area.

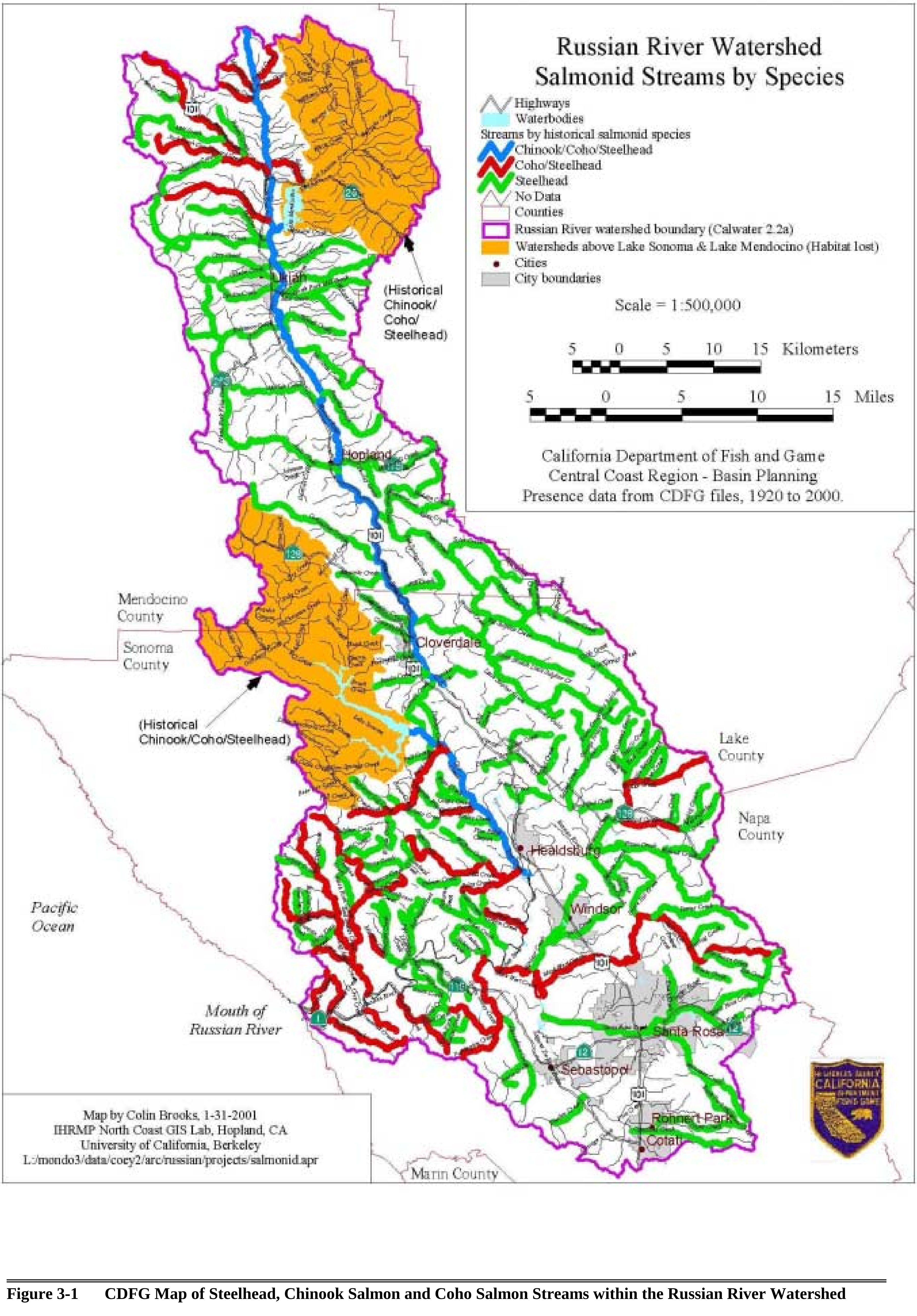


Figure 3-1 CDFG Map of Steelhead, Chinook Salmon and Coho Salmon Streams within the Russian River Watershed

SCWA cooperates with CDFG to conduct stream habitat surveys. Surveys for approximately 60% of the watershed and 100% of the coho streams have been completed, and the remaining surveys will be completed by the end of the summer of 2002 (B. Coey, CDFG, pers. comm. 2001). The CDFG Draft Basin Restoration Plan for the Russian River will be released sometime in the spring of 2001 and will list priorities for restoration based on stream inventory data. Streams that can support coho salmon are given first priority.

Many of the streams in the developed or urbanized portion of the watershed, particularly in the Santa Rosa plain, are in poor shape. About 45 to 60% percent of the watershed may be characterized as moderately degraded, and about 25% as severely degraded (S. White, SCWA, pers. comm. 2001). About 25% of the watershed can be characterized as good, primarily the west or upper end of the watershed upstream of Healdsburg, where only isolated problems exist. The Western portion of the county can be generally characterized as good.

3.2 INSTREAM HABITAT IMPROVEMENTS

Instream habitat structures consisting of large woody debris, such as rootwads, have been installed to give fish protective cover from predators and to create pools. Bank stabilization and riparian planting has been implemented. Trees have been planted where riparian cover was lacking. Other types of structures such as boulder or log weirs, or some other combination of structures (as outlined in the California Salmonid Stream Habitat Restoration Manual of the CDFG) may be implemented. A channel may be reconstructed; for example, a section of Big Austin Creek was reconstructed to convert a braided, intermittent channel to a single thread, perennial stream with a reconstructed spawning area. Other activities could include placement of spawning gravels, removal of obstructions, culvert improvements, or slide removal.

An individual project may be small in scale, but may make beneficial changes to a larger habitat unit, or to the proportion of habitat unit types in a reach (pool/run/riffle ratio). For example, on Mill Creek there are 14 sets of instream habitat structures, and while each structure is short, collectively they change a long section of stream from primarily riffle habitat to a better combination of pool/riffle habitat.

By providing improved and/or additional rearing habitat, instream habitat improvements address an important factor for coho salmon and steelhead in the Russian River Watershed. When riparian cover is planted along streambanks, water temperature is reduced, additional cover is provided, streambanks are stabilized, erosion is reduced, and additional plant material becomes available to provide food and cover for insects upon which juvenile fish feed. Fish passage is also improved.

Instream habitat improvements funded or implemented by SCWA include projects in Green Valley, Freezeout, Mill, Turtle and Felta creeks. (Instream habitat improvements on Big Austin and Brush creeks are addressed in Section 3.4.) These projects greatly improve the habitat value of significant stretches of these streams for rearing salmonids. Table 3-1 summarizes information about these projects and assigns a biological benefit score.

The CDFG has recommended that these creeks should be managed as anadromous, natural production streams, and SWCA has targeted these creeks for their importance to coho salmon and steelhead recovery. Where coho or steelhead are known to be present in a particular stream, it is noted. However, improvements to habitat are likely to increase fish abundance in streams, and it may be possible for coho salmon to begin to utilize a stream that they currently have not been found in, especially if there is a change in the pool/riffle/run ratio. CDFG surveys in the spring of 1995 in Mill Creek documented many 0+ steelhead, indicating successful spawning, but the presence of few yearling fish, indicating poor holding conditions. The instream habitat project will provide additional rearing habitat. The Freezeout Creek project has a score of 3 because it is much smaller in scale than the other projects. The Green Valley, Freezeout and Felta creek projects are particularly important because coho salmon are known to use them.

Table 3-1 Instream Habitat Improvement Projects

Creek	Size of Projects	Type of Project	Species* Affected	Biological Benefit	Project Completion Year
Green Valley	~ 1 mile	Contiguous structures and fencing	Co, St	5	1996
Freezeout		3 non-contiguous structures	Co, St	4	1997
Mill	~ 2 miles	14 sets of instream habitat structures	St	5	1998
Felta	~ 2 miles	14 sets of instream habitat structures	Co, St	5	1998

*Co = Coho, St = Steelhead

Instream habitat improvement projects are likely to result in short-term increases in turbidity during construction if the work is done in a wetted stream, and during the first high-flow event of the following rainy season. Work in a wetted stream also has the potential to injure fish that may be in the area during construction. These potential effects are assessed in Section 3.7 *Construction, Maintenance and Operation Activities on Restoration Projects*. Construction of instream habitat improvement projects may require take authorization.

3.3 RIPARIAN RESTORATION

Riparian restoration projects include projects that exclude livestock from riparian zones, replant degraded areas with native vegetation, provide temporary water supplies to increase survival of newly planted trees, or place bioengineered erosion structures such as willow mattresses and baffles, and planting of native riparian trees in upslope areas.

Several general effects can be realized from riparian restoration. When riparian cover planted along streambanks has matured, water temperature is reduced, additional cover is provided, stream banks are stabilized, erosion is reduced, and additional plant material becomes available to provide food and cover for insects upon which juvenile fish feed. This is particularly beneficial for juvenile coho salmon and steelhead rearing, but there may also be water quality benefits for adult spawners. Furthermore, riparian cover can moderate temperatures for egg incubation. Passage conditions for juvenile fish may also be improved.

Riparian vegetation stabilizes or intercepts fine sediments that can smother eggs in the project area or in areas downstream. Sediment input into the stream reduces the amount of habitat for invertebrates and instream cover available to rearing juvenile fish by filling in areas under and between rocks. Projects that reduce sediment input to the stream often affect long portions of the channel downstream. Even projects of small size can have beneficial water quality effects that extend downstream.

Riparian restoration activities have the potential to affect all life history stages of salmonids. As riparian vegetation takes some time to mature, the benefits of riparian restoration may take several years to be fully realized. Since riparian restoration activities often involve regrading streambanks, there may be some immediate reduction in the amount of sediment input to the stream and bank degradation.

Table 3-2 summarizes information about a number of riparian restoration projects and assigns a biological benefit score. Additional details on effects of specific restoration actions are outlined in the following sections. Where coho or steelhead are known to be present in a particular stream, it is noted. However, improvements to habitat are likely to increase utilization by protected species in the future.

Table 3-2 Riparian Restoration Projects

Creek	Size of Project(s)	Type of Project	Species* Affected	Biological Benefit Score	Project Completion Year
Copeland	6,000 ft.	Fencing, grading, riparian planting	St	4	1999, 2000
Green Valley (streambank stabilization)	2 small projects	Erosion control	Co, St	St - 3 Co - 4	1997
Green Valley (livestock exclusion)	1 mile, 25 ft wide stream	Fencing, water replanted areas	Co, St	5	1997
Howell	4,000 ft.	Fencing	St	4	2000
Freezeout	3,000 ft.	Fencing	St	4	1996
Little Briggs	> 1 mile, 25 ft wide stream	Fencing	St	5	1997
Turtle	500 ft.	Willow walls & mattresses	Co, St	3	1999
Turtle	> 1 mile	Irrigation	Co, St	5	1999
Felta	3 projects	willow walls	St	3 (X3)	1999

Table 3-2 Riparian Restoration Projects –Continued–

Creek	Size of Project(s)	Type of Project	Species* Affected	Biological Benefit Score	Project Completion Year
Porter	~ 300 ft, bankfull width ~ 30 ft	Willow walls & mattresses	St	3	1997
Matanzas	~ 20 ft, bankfull width ~ 30 ft	Willow wall, revegetation	St	3	1997
Russell Irrigation Site on Turtle Creek	> 1 mile	Fencing	Co, St	5	1999
Russell Irrigation Site		Cattle removal	Co, St	3	1999
Unnamed tributary to Mark West (Huff property)		Willow wall	Co, St	3	1998

*Co = Coho, St = Steelhead, Ch = Chinook

3.3.1 COPELAND CREEK

Approximately 6,000 feet of streambank on Copeland Creek will be restored when cattle and horses are excluded, eroded streambanks are recontoured, and native riparian species are planted. The project will be implemented over a period of three to four years. Sediment input to the stream will be reduced when project components are completed, but it may take a few years for effects to be noticeable in the stream and in downstream areas. Once the riparian vegetation has matured, additional and improved rearing habitat will be available during the rainy season.

The project is on a valley floor reach of the stream in the Rohnert Park area, and the watersheds within this area contribute substantial sediment loads to downstream areas. This portion of Copeland Creek goes dry in early summer, as does a downstream reach along Sonoma State University. While the project is likely to have substantial ecological value for other biological resources, there is probably limited value for steelhead rearing in the immediate area. However, this is a project of significant size, and a reduced sediment load to the stream will benefit downstream portions of the watershed. The creek empties to the Laguna de Santa Rosa which has important wetland and flood control functions. Portions of the Laguna de Santa Rosa, particularly areas where tributaries flow into it, may provide important habitat for salmonids. The USACE is conducting a feasibility study to investigate the extent and causes of sedimentation in the Laguna de Santa Rosa. The Copeland Creek project will likely help reduce the sediment load to the Laguna de Santa Rosa. Such a large increase in the riparian zone is also likely to reduce water temperatures. Therefore, the project is rated 4.

3.3.2 Green Valley Creek

Two failing streambank stabilization projects completed in 1996 delivered substantial amounts of fine sediment to the creek. These projects were repaired by sloping and armoring the bank, and by replacing nonnative vegetation with native vegetation. This reduces sediment input directly along the streambank, as well as areas downstream. These are relatively small projects but since a downstream reach will benefit the biological benefit is higher. Because this may be an important coho salmon stream, the biological benefit score is higher for coho. These projects are also expected to improve fish passage.

Preliminary genetic analysis suggests that young-of-the-year coho salmon collected in Green Valley Creek in 1998 may be comprised of a relatively wild stock, rather than having significant hatchery influence. In contrast, the 1997 Green Valley young-of-the-year appeared to most likely be offspring from a hatchery-derived population (Banks *et al.* 1999). These results are preliminary, and more work is needed because strong inferences based on limited data can not be made. As the 1994 year class (which would have produced the 1997 young-of-the-year) is thought to have been extirpated, these 1997 juveniles may have been produced by hatchery strays. Additional genetic research is needed before streams that contain relatively wild genetic strains can be identified. However, this preliminary data suggests restoration actions on Green Valley Creek may be particularly useful for conserving a native strain of coho salmon.

3.3.3 Howell Creek

A 1998 CDFG stream inventory indicated that both riparian vegetation and stream channel conditions are degraded because of unrestricted cattle grazing in an approximately 4,000 foot long reach of Howell Creek, a tributary in Mendocino County. Marginal habitat for steelhead currently exists there. The streambanks and bed of this reach will be improved when cattle are excluded and native riparian species are planted. Development of off-stream water sources will help to eliminate the need for cattle access. Reduction of fine sediment input, reestablishment of the riparian corridor, and reduction of streambed disturbance will increase the habitat value of this and downstream reaches for rearing steelhead. Because this is a relatively large project with beneficial effects that extend downstream, the biological benefit score is 4.

3.3.4 Green Valley, Little Briggs, Freezeout and Mill Creeks Livestock Exclusion

By fencing livestock from the riparian zone adjacent to the stream and replanting degraded areas with native vegetation, streambanks have been stabilized, riparian vegetation has been reestablished, and animal waste entering the stream has been decreased. The biological benefit score for the Green Valley bank stabilization projects is high because although these projects are small, they improve an important coho stream. The sizes of the other projects are substantially larger. Freezeout Creek is a small tributary near the mouth of the Russian River between Willow and Austin creeks. The proximity of this tributary to the ocean and the size of this project make it potentially important for anadromous salmonid habitat.

3.3.5 Russell Irrigation Site

The landowner for this site on Turtle Creek has participated in a voluntary fencing project to exclude cattle from the stream. An alternative drinking source for the livestock was provided.

Water quality has been improved and riparian vegetation has a chance to mature. Fish habitat can be dramatically improved by this kind of conservation action. Over a mile of stream has been fenced, and reduced sediment input will affect downstream reaches as well, therefore a biological benefit score of 5 is given.

3.3.6 Porter and Matanzas Creeks Streambank Stabilization and Riparian Restoration

Porter Creek is in the headwater area of Mark West Creek and Matanzas Creek flows into Santa Rosa Creek. Sediment input to Porter Creek occurs because of poor road maintenance practices, erosion, and agricultural and grazing pressures. An increase in canopy cover in portions of these creeks is likely to reduce stream water temperatures. By placing bioengineered erosion structures such as willow mattresses and baffles, and planting native riparian trees in upslope areas, SCWA has stabilized streambanks and enhanced riparian habitat in these two creeks. Landowners were educated on the importance of riparian vegetation on their stream banks and on ways to prevent erosion. Steelhead rearing habitat is available in these creeks. Because these projects are relatively small, the biological benefit scores are 3 for Porter and Matanzas creeks. However, these two projects occur near one of the more heavily settled portions of the watershed, and therefore have value for public education.

3.4 Instream and Riparian Habitat Restoration

Large projects in Brush, Big Austin, Palmer and Santa Rosa creeks include both instream and riparian habitat improvements. Biological benefit scores for these actions are summarized in Table 3-3.

Table 3-3 Instream and Riparian Restoration Projects

Creek	Size of Project	Type of Project	Species Affected	Biological Benefit Score	Project Completion Year
Brush	1,200 ft.	Streambed and bank regrading, instream structures, revegetation	St	5	1999
Big Austin	1,300 ft.	Reconstructed channel	Co, St	5	1998, 2000
Big Austin	0.5 mile	13 erosion control/riparian structures – willow baffles, willow wall, slide repair	Co, St	5	1998, 2000
Palmer	3,000 ft.	7 instream habitat structures, 1,000 alder trees	Co, St	5	1998
Santa Rosa Creek	12.8 miles	Restore channelized creek to more natural form and function	St	5	2002

*Co = Coho, St = Steelhead, Ch = Chinook

3.4.1 Brush Creek

The channel of Brush Creek was previously modified to handle a 100-year flood event to provide flood protection for local property owners. Spawning habitat has been available, but high summer temperatures have limited rearing habitat. Work is needed to restore salmonid habitat and to lower stream temperatures. After the streambed and banks are graded along about 1,200 linear feet of the stream, restoration and enhancement activities will provide aquatic and riparian habitat. Instream structures will be provided to promote pool and riffle habitats and to provide bank stability. This will provide spawning and rearing habitat for steelhead that will be available when the project is completed. Native vegetation will be planted along the banks that have been regraded. When this vegetation matures, it will provide cover, lower stream temperatures, contribute to the food chain, and reduce run off and bank erosion, which will in turn improve conditions in Santa Rosa Creek. Given the amount of habitat that will be improved, the biological benefit score is 5. The Brush Creek project also occurs in a heavily populated area of the watershed and therefore is useful for public education.

3.4.2 Big Austin Creek

When 1,300 feet of braided, intermittent channel is reconstructed to single-thread perennial stream, fish habitat will be improved. Bank stabilization and riparian revegetation are also planned for sections of the stream. Riparian vegetation will increase cover and reduce water temperature. Work that has already been completed includes bank stabilization, placement of instream cover, and construction of willow baffles. Big Austin Creek is important for coho and steelhead spawning and rearing.

3.4.3 Palmer Creek

Palmer Creek is a tributary to Mill Creek in the Dry Creek watershed. Instream structures, including seven cover/scour structures (logs and boulders) enhance 3,000 feet of coho and steelhead habitat. Also, 1,000 native alder trees were planted. This project was implemented in the summer and fall of 1998.

3.4.4 Santa Rosa Creek

The USACE, SCWA, City of Santa Rosa, and Sonoma County are planning to restore a substantial portion of degraded, channelized creek to a more natural form and function. The project is currently in the planning and permitting phase, and several alternatives are being considered. This is a large project that is likely to result in substantial improvements in water quality and restored habitat for listed fish species. Santa Rosa Creek (including some of the downtown reaches) has been identified as having value as spawning and rearing habitat (CDFG 2001b).

3.5 Rural Road Erosion Control

By decreasing fine sediment input with erosion control, egg incubation and rearing habitat can be improved. Fine sediment can “smother” eggs by decreasing the amount of intergravel dissolved oxygen available to them. The habitat of aquatic insects that juvenile fish feed on can be buried. Primary productivity is reduced in turbid water. As salmonids are “sight feeders” their ability to feed in turbid water can be reduced. Increased sedimentation can bury the interstitial spaces in the substrate used by invertebrates and instream structure available for juvenile fish to use as cover. By reducing erosion from rural roads, both the quantity and quality of juvenile spawning rearing habitat will be improved.

Some erosion control activities, such as regrading banks or soil treatments, have immediate reductions in soil loss, but it may take several years before improvements are noted in the stream. Furthermore, these activities often require the growth and establishment of riparian vegetation, so the timeframe to full development may be on the order of two to four years. However, once they are established, these kinds of conservation actions can have dramatic and long-term effects. Furthermore, immediate and long-term project effects can occur in long distances downstream of the project site.

Two road erosion control projects are addressed. One is a project to decrease the sediment runoff from a road adjacent to Palmer Creek. The other reduces sediment runoff to Santa Rosa Creek in Hood Mountain Regional Park (Table 3-4).

3.5.1 Palmer Creek Road Erosion Control

This project reduced sediment input from one mile of steep rural roadway within the Palmer Creek watershed. By reducing sediment input into the stream, this project enhanced the value of instream habitat structures funded by SCWA within this stretch of Palmer Creek (see Section 3.4.3).

A long portion of Palmer Creek is affected, but there has not been an acute sediment input problem to the stream. While sediment input to the stream was reduced when the project was completed, it may be several years before significant improvement of habitat quality in the stream may become apparent. This project improves rearing habitat for juvenile coho and steelhead by decreasing siltation of cover, reducing turbidity, and improving habitat for aquatic insects. Furthermore, habitat for egg incubation for all three species that may exist at this site or downstream of it will be improved. The biological benefit score is 5.

3.5.2 Hood Mountain Regional Park

An eroding road adjacent to Santa Rosa Creek and a landslide on Hood Mountain Trail deliver fine sediment to the creek. When the project is implemented during 1999-2000, the slide will be stabilized, the road modified, and the slope gullies filled. This project will significantly reduce erosion along about 100 yards of stream bank, as well as reduce sediment input to downstream areas. While sediment input to the stream will be reduced when the project is completed, it may be several years before significant changes are seen in the streambed itself. Because this landslide has been a significant source of fine sediment input to the stream and areas downstream of the site are expected to benefit from this action, the biological benefit score is 5. As the section of Santa Rosa Creek in the park contains valuable spawning and rearing habitat for steelhead and coho salmon, the project is particularly important.

Table 3-4 Road Erosion Control Projects

Creek	Size of Project	Type of Project	Species Affected	Biological Benefit Score	Project Completion Year
Palmer	1.5 miles	Road erosion control, instream structures	Co, St	5	1998 (additional work in 2000, 2001)
Santa Rosa (Hood Mtn.)	~100 yards	Road and landslide erosion control	Co, St	5	2000

*Co = Coho, St = Steelhead

3.6 FISH PASSAGE

Generally, the primary benefit of fish passage is that additional spawning and rearing habitat becomes available to anadromous salmonids. The biological benefit from a fish passage project is proportional to the quality and amount of upstream habitat made available. Scores for specific projects are given in Table 3-5. All of the listed projects are rated 5 because a large quantity of habitat is made accessible. The Santa Rosa and Mumford Dam projects are especially beneficial because they provide access to high quality habitat, provide it for coho salmon as well as steelhead, and in the case of Mumford Dam, for chinook salmon.

Table 3-5 Fish Passage Project

Creek	Upstream habitat affected	Type of Project	Species Affected	Biological Benefit Score	Year Completed
Matanzas	5 miles	Passage through box culvert, not completed. Recontour stream banks	St	5	2003
Santa Rosa (Hood Mtn)	10 miles	Rock weirs, not completed	St, Co	5	1999
Mumford Dam	10 miles	Rock weirs ~ 600 feet of channel, not completed	Co, St, Ch	5	2002
Crocker Dam	4.5 miles	Series of weirs. Regrade, stabilize, and replant stream banks	St	5	2002

*Co = Coho, St = Steelhead, Ch = Chinook

3.6.1 MATANZAS CREEK FISHWAY

Historically, Matanzas Creek supported a self-sustaining steelhead run. Currently the flood control structure at the mouth of Matanzas Creek creates an impassable barrier to migration. Fish passage through this 1,400-foot long box culvert will provide access for anadromous salmonids to about five miles of habitat upstream. Habitat typing and temperature data indicate that this area has suitable habitat for salmonids (CDFG 2001a). Resident juvenile salmonids have been found upstream of the culvert. This project will make a fair amount of rearing habitat, and to a lesser extent, spawning habitat accessible.

3.6.2 Mumford Dam Modification

A series of large rock weirs will maintain the thalweg of the river, stabilize the channel bed, and reduce bank erosion. The series of weirs will greatly improve upstream fish passage, making approximately 10 miles of high quality spawning and rearing habitat available primarily for steelhead and chinook salmon, and possibly coho salmon, on the West Fork Russian River. When native riparian vegetation is planted and established, the streambank will be stabilized even further, and habitat within the 600-foot long project area will be greatly improved. The reduction in bank erosion will also improve water quality in downstream reaches. Because a large amount of habitat will be improved and made available for all three protected species, the biological benefit score is 5.

3.6.3 Santa Rosa Creek

Like the Mumford Dam modification, a series of large rock weirs will stabilize the channel bed and improve upstream fish passage, making approximately 10 miles of quality spawning and rearing habitat available upstream. Therefore, the biological benefit score is 5.

3.6.4 Crocker Creek Dam

When Crocker Creek Dam failed, the impact to Crocker Creek was significant. A large sediment load was released downstream from behind the dam, and the creek upstream of the dam experienced major erosion and collapsing banks. While the elevation of the base of the dam is lower than the previous top of the dam, the structure and debris pile pose an impassable barrier to anadromous salmonids.

The work proposed is significant in extent. The bank on the north abutment of the dam will be regraded to match existing grades, and slope protection at the toe and up the side of the resulting slope will be provided. The remains of the north abutment, south abutment, and the two spillways will be demolished, and the remains of the dam used as fill and for the foundation of the fish ladder. A series of rock weirs will be configured to provide fish passage. The 250 feet of eroded left bank upstream of the dam will be sloped to approximately a 2:1 slope utilizing aggregate from the adjoining floodplain and sloping the top of the bank to meet the grade. The bank will be reconstructed with a quarried boulder toe and the addition of a live willow brush mattress up to the bankfull flow level. Replacement of the existing concrete block deflectors with boulders and addition of a series of three parallel boulder wing deflectors will complete the restoration of the left bank and transition to the non-eroded upstream bank. The treatment for the 400 feet of eroded right bank upstream from the dam face will be the same for the first 150 feet, and for the remaining 250 feet will be a series of ten willow baffles, 25 feet long and 5 feet wide, each with a boulder cluster deflector (10 total) at the toe of the bank. The reshaped banks will require a 3-foot deep trench be excavated at the toe of the bank and all disturbed areas mulched and inter-planted with willows. The rock from the toe trench to the high water mark will be large enough to withstand normal high flows.

When completed, this project will restore access for anadromous fish to the creek, stabilize streambanks in the vicinity of the dam, and reduce sediment input to downstream areas. Because there are benefits for both upstream and downstream habitat, the biological benefit score is high.

3.6.5 Fish Passage Design

The designs of the fish passage projects are evaluated on their effectiveness at passing adult salmonids during upstream spawning migrations. All four projects are expected to pass fish without delay for most flows that would occur during spawning migrations (Table 3-6). Because all flows are passed, sufficient attraction flows are provided (Table 3-7). The Santa Rosa, Mumford Dam, and Crocker Creek projects are designed to operate passively within the channel.

The Matanzas passage would be operational in all but high winter storm flows, when the bladders would self-deflate to maintain maximum flow capacity within the culvert. Fish would pass the inflated bladders by swimming or leaping over them through the culvert. Access to the passage will be provided through a trench excavated into the splash apron on the downstream side of the culvert.

Table 3-6 Fish Passage Scores Based on Fish Ladder Design and Operation

Category Score	Evaluation Criteria Category	Project Score
5	Fish passage passes adult salmonids without delay	Matanzas, Santa Rosa, Mumford Dam, Crocker Creek Dam
4	Fish passage passes adult salmonids with acceptable delay	
3	Fish passage passes all target species after extended delay	
2	Fish passage does not pass all target species of adult salmonids	
1	Passage provided but does not appear to pass any adult salmonids, or passage not provided	

Table 3-7 Fish Passage Scores Based on Attraction Flow

Category Score	Evaluation Criteria Category	Project Score
5	At least 10% of total streamflow is provided for fish attraction continuously during migration	Matanzas, Santa Rosa, Mumford Dam, Crocker Creek Dam
4	At least 10% of streamflow is provided for fish attraction 75-99% of time during migration	
3	At least 10% of streamflow is provided for fish attraction 50-74% during migration	
2	At least 10% of streamflow is provided for fish attraction 25-49% of time during migration	
1	At least 10% of streamflow is provided for fish attraction 0-24% of time during migration	

3.6.6 PREDATION

In general, fish passage projects have the potential to increase predation on protected species. Because these projects do not tend to concentrate juvenile salmonids, and large numbers of predatory fish or birds are not generally present in the three project areas, the risk for predation on juvenile salmonids is low. However, fish passage projects, particularly ones that concentrate fish into a narrow, easily accessible channel, can become ideal poaching sites. This may be an issue in an area where there is access for people to the passage project, such as in the downtown site on Matanzas Creek.

The Mumford Dam, Crocker Creek Dam and Santa Rosa Creek sites do not concentrate predators or salmonids. Component 1 and 2 of the predation criteria are scored 5 for these three sites (Table 3-8). For the Matanzas fish passage project, a component 1 (structural criteria) score of 2 is given because adult steelhead will be concentrated at the entrance to the culvert. However, in the faster flows of that entrance, they are likely to have turbulence in the water as cover, decreasing their vulnerability. As access to the site may be more difficult during higher flows in the spawning season, it may be difficult for poachers to have access to the fish. Therefore a score of 4 is given to the second component. The design of the passage inside the culvert would not concentrate salmonids as much, and access to the inside of a dark culvert is even more limited. While concentration of adult steelhead in the entrance to the fish passage increases the risk of poaching, the risk is likely to be low because access for poachers is limited.

Table 3-8 Predation Evaluation Criteria

Category Score	Evaluation Criteria Category	Project Score
	Component 1: Structural Criteria	
5	No features that concentrate salmonids or provide cover for predators, concentrations of predators not found.	Santa Rosa, Mumford Dam, Crocker Creek Dam
4	No features that concentrate salmonids, predator cover near, predators in low abundance locally.	
3	Features that concentrate salmonids, no predator cover nearby, predators in medium to low abundance locally.	
2	Features that concentrate salmonids, predator cover nearby, predators in medium to low abundance locally.	Matanzas
1	Features that highly concentrate salmonids, predators abundant locally.	
	Component 2: Access Criteria	
5	Structure does not allow passage of predators, predators not present near structure.	Santa Rosa, Mumford Dam, Crocker Creek Dam
4	Structure does not allow passage of predators, predators present near structure.	Matanzas
3	Structure provides limited passage of predators, or limited passage to areas they are already well established, predators not present near structure.	
2	Structure provides limited passage of predators to areas they have historically not been found or have been found in limited numbers, predators present in limited numbers near structure.	
1	Structure provides passage of predators to areas they have historically not been found or found in limited numbers, predators present or migrate to structure.	

3.7 CONSTRUCTION, MAINTENANCE AND OPERATION ACTIVITIES ON RESTORATION PROJECTS

3.7.1 RIPARIAN RESTORATION PROJECTS

Riparian restoration projects are constructed on stream banks, and instream work is not necessary. There is no potential for direct injury to fish during construction activities. Installation of fences and establishment of native riparian vegetation has the potential to create limited to high levels of disturbance on the streambank that has the potential to increase sediment input to the stream. Bank erosion control measures such as detention basins, hay bales and filter fabrics are used as necessary and upslope stability is improved once vegetation is established. Therefore, riparian restoration activities do not require take authorization.

Table 3-9 Sediment Containment Scores for Riparian Restoration Projects

Category Score	Evaluation Criteria Category	Project Scores
5	No upslope disturbance, or an increase in up-slope stability	
4	Limited disturbance with effective erosion control measures	
3	Moderate to high level of disturbance with effective erosion control measures	Revegetation and erosion control projects
2	Action likely to result in increase in sediment input into stream	
1	Action likely to result in slope failure, bank erosion, an uncontrolled sediment input to the channel or major changes in channel morphology	

3.7.2 RESTORATION PROJECTS: INSTREAM AND RURAL ROAD EROSION PROJECTS

Many instream habitat and road erosion projects are constructed during a period when the stream is dry. For those streams, there is no sediment input to the stream and no potential for direct injury to fish during construction activities. There may be an increase in turbidity and sediment input to the stream during the first high-flow event of the rainy season, but these effects would be of short duration and may be indiscernible from turbidity normally associated with these events.

When work is done in a wet stream channel, it is under the terms and conditions of the USACE permit issued for the project. All measures possible are used to reduce effects on the stream. If it is not possible to work in a dry channel, the site is dewatered and a fish rescue is implemented if appropriate. For example, on Austin Creek, reconstruction of the toe of the bank was necessary, and BMPs were stipulated in the permit. A combination of detention basins, hay bales, and filter fabrics were used, and no sediment problems were identified. On Adobe Creek, (not in the Russian River) a series of boulders were placed in an active stream to provide fish passage. Fish rescues were conducted to move as many fish as possible out of the project area. These examples demonstrate a clear commitment on the part of the SCWA to avoid any effects to the aquatic resources and protected species during implementation of restoration projects.

The opportunity for injury is low because most projects are done in a dry channel (Table 3-10). For the few channels that are wetted during construction, fish rescue is performed. Sediment containment measures are implemented in all projects (Table 3-11). While rural road erosion projects would result in short-term, limited to high levels of disturbance to stream banks, effective erosion control measures are in place during construction when work is done near wetted channels. These projects are likely to increase upslope stability in the long-term.

Table 3-10 Opportunity for Injury Scores for Restoration Projects

Category Score	Evaluation Criteria Category	Project Scores
5	Project area is not within flood plain or below maximum water surface elevation (WSEL), and requires no isolation from flow.	
4	Project area is in within dry part of channel, or construction and maintenance activity scheduled when species of concern is not present.	
3	Appropriate BMPs are applied; *e.g.* project area survey, escape or rescue provided, project area isolated from flow (if appropriate).	Instream habitat improvement and rural road erosion projects
2	Limited ability to apply appropriate BMPs.	
1	Appropriate BMPs are not applied.	

Table 3-11 Sediment Containment Scores for Restoration Projects

Category Score	Evaluation Criteria Category	Project Scores
	Component 1: Instream sediment control	
5	Project area does not require rerouting streamflow	Projects in dry channels
4	Clean bypass or similar method used	
3	Effective instream sediment control (*e.g.* berm/fence)	All projects in wetted channels
2	Limited sediment control	
1	No instream sediment control	
	Component 2: Up-slope sediment control	
5	No upslope disturbance, or an increase in up-slope stability	Instream structures
4	Limited disturbance with effective erosion control measures	
3	Moderate to high level of disturbance with effective erosion control measures	Rural road erosion control projects
2	Action likely to result in increase in sediment input into stream	
1	Action likely to result in slope failure, bank erosion, an uncontrolled sediment input to the channel or major changes in channel morphology	

Construction activities are likely to have minimal, if any, short-term effects on protected species or their habitat. These effects include short-term increases in turbidity and sediment input or a slight risk of injury to some individual fish. Therefore instream and rural road erosion projects that are implemented in a wetted stream require a take authorization. As restoration projects act passively after construction is complete, no maintenance or operations effects are anticipated.

3.7.3 FISH PASSAGE

3.7.3.1 Matanzas Fish Passage

Construction of the Matanzas fish passage project will occur in a wetted channel and has the potential to affect protected species and their habitat. Currently anadromous fish do not have access to the culvert or upstream areas. Construction on the splash apron downstream of the culvert will be combined with the City of Santa Rosa's Prince Memorial Greenway portion of the Santa Rosa Creek Project. This will minimize effects to salmonids and their improved habitat downstream of the Matanzas passage project. While construction of internal portions of the fishway will occur later, salmonids currently do not have access to these areas. The Matanzas project also includes a major stream bank recontouring component. This activity has the potential to increase short-term sediment input and cause direct injury to rearing salmonids.

Appropriate BMPs will be implemented to minimize the risk of injury to rearing salmonids (Table 3-12) and minimize water quality effects (sediment input) to downstream areas (Table 3-13) during construction of the fish passage through the culvert. The construction will be isolated to keep water from the river from entering the construction area, contain sediments loosened during construction, and prevent fish from entering the construction area once it has been isolated. The method is yet to be determined, but it is likely that an inflatable water structure or sandbags may be used, since the area involved is small. After the construction area has been isolated, SCWA will conduct a fish rescue within that area. During construction, water will be rerouted to an area downstream of the project. These measures are likely to result in minimal short-term effects on protected species and the habitat they currently have access to. There may be a slight risk to steelhead present while the isolation procedures are put in place or during the fish rescue, but few, if any fish are likely to be affected.

As part of the Matanzas project, a major bank recontouring component will result in a temporary, moderate to heavy upslope disturbance, but effective erosion control measures will limit sediment input. This portion of the project will be implemented in 2002 or 2003, and specific BMPs will be determined during the permitting. The score for component 2: up-slope sediment control, for this portion of the Matanzas project is 3. Long term effects of recontoured and replanted banks will include an increase in up-slope stability and restoration of native riparian cover.

3.7.3.2 Mumford Dam and Santa Rosa Fish Passage

Construction of the Mumford Dam and Santa Rosa fish passage projects will be timed and implemented to minimize disturbance of rearing salmonids. While there is a risk to protected species and their habitat from construction activities, the use of standard BMPs makes the risk low. Fish rescues will be performed if necessary, and this reduces the opportunity for injury to fish (Table 3-12). A gravel berm will be constructed to reduce instream sediment loads from construction activities. Bank erosion control measures will be used when planting native riparian vegetation, and upslope stability will be improved once the vegetation is established (Table 3-13).

3.7.3.3 Crocker Creek Dam Fish Passage and Bank Stabilization

Activities related to construction of the rock weir fish passage and regrading and stabilization of the stream banks are scheduled for a two-month period beginning in the summer of 2002. There is a potential to affect juvenile salmonids, either by direct injury to fish or by increased sediment input from work in the streambed or on the stream bank. The work is timed to minimize disturbance of rearing steelhead, coho salmon and chinook salmon. Because standard BMPs are implemented, the risk is low. Fish rescues will be performed, and this reduces the opportunity for injury to fish. BMPs will be in place to reduce sediment input from instream work, bank regrading activities, and excavation of a trench at the toe of the bank. Design and permitting for this project will occur during 2002, and final site-specific BMPs will be determined during the permitting process. Long-term benefits, including stabilized banks with a native riparian corridor and passage to additional spawning and rearing habitat, outweigh potential short-term risks to individual fish.

Table 3-12 Opportunity for Injury Scores for Fish Passage Projects

Category Score	Evaluation Criteria Category	Project Scores
5	Project area is not within flood plain or below maximum water surface elevation (WSEL), and requires no isolation from flow.	
4	Project area is in within dry part of channel, or construction and maintenance activity scheduled when species of concern is not present.	
3	Appropriate BMPs are applied; *e.g.* project area survey, escape or rescue provided, project area isolated from flow (if appropriate).	Matanzas, Mumford Dam, Crocker Creek Dam
2	Limited ability to apply appropriate BMPs.	
1	Appropriate BMPs are not applied.	

Table 3-13 Sediment Containment Scores for Fish Passage Projects

Category Score	Evaluation Criteria Category	Project Scores
	Component 1: Instream sediment control	
5	Project area does not require rerouting streamflow	
4	Clean bypass or similar method used	
3	Effective instream sediment control (*e.g.* berm/fence)	Matanzas, Mumford Dam, Crocker Creek Dam
2	Limited sediment control	
1	No instream sediment control	
	Component 2: Up-slope sediment control	
5	No upslope disturbance, or an increase in up-slope stability	Mumford Dam
4	Limited disturbance with effective erosion control measures	
3	Moderate to high level of disturbance with effective erosion control measures	Matanzas, Crocker Creek Dam
2	Action likely to result in increase in sediment input into stream	
1	Action likely to result in slope failure, bank erosion, an uncontrolled sediment input to the channel or major changes in channel morphology	

Construction activities are likely to have minimal, if any, short-term effects on protected species or their habitat. These effects include short-term increases in turbidity and sediment input or a slight risk of injury to some individual fish. Therefore construction of fish passage projects generally require a take authorization.

3.8 WATERSHED MANAGEMENT PROJECTS

Evaluation criteria for research, demonstration projects, or information dissemination evaluate how wide a geographic area the information has the potential to be used in, and whether the information is useful for the protection of listed species or critical habitat (Table 3-13). Basin-wide applicability (score 5) addresses most or all of the watershed that is likely to be important to protected species. Isolated project/stream information (score 3) is likely to be useful in a localized area, such as a particular stream or reach of a stream. Scores are assigned for the various projects based on the range of applicability and on a qualitative assessment of the biological benefit that may accrue (Table 3-14). A discussion of the value of the information for some of the key projects follows. Watershed management projects provide information that is needed to restore and protect critical habitat for protected species, and make it possible to apply this information on a watershed level to maximize the effects.

Table 3-14 Information Value Evaluation Criteria

Category Score	Evaluation Criteria Category
5	Basin-wide applicability
4	A region or "type" of habitat (*i.e.* small tributaries, or lower mainstem)
3	Isolated project/stream information
2	Information not useful to protected species or critical habitat
1	Incorrect or misleading information

Table 3-15 Information Value Scores

Project	Range of Applicability	Information Value Score
DATA COLLECTION		
Stream habitat surveys	Basin-wide – SCWA focus on Mark West and Santa Rosa Creek watersheds	5
Temperature	Major tributary watersheds	5
Water quality sampling	Austin, Maacama, Mainstem Mark West, Santa Rosa, Green Valley, Mill, Ackerman, Robinson, Dutch Bill, Hulbert, Fife, Franz, Porter, Redwood	4
Coho and steelhead population monitoring	Basin-wide	5
Genetic studies on coho, steelhead and chinook	Basin-wide	5
Arundo mapping and research	Basin-wide	5
Laguna de Santa Rosa sedimentation study	Regional application - lower Russian River floodplain	4
DEMONSTRATION PROJECTS		
Pierce's Disease Control Study	Maacama Creek site, with potential application to other vineyards	5
Fish Friendly Farming	Vineyards, the dominant agricultural industry in the watershed	5
Palmer Road Erosion Control	Demonstration project helpful for other work in areas with road erosion problems	3

Table 3-15 Information Value Scores –Continued–

Project	Range of Applicability	Information Value Score
INFORMATION COORDINATION AND DISSEMINATION		
KRIS/GIS Database	Basin-wide	5
Restoration Project Database	Basin-wide	5
Information dissemination: Workshops, newsletters, library, training programs, school projects	Regional applications	4
RWQCB Russian River Basin Plan Review	Basin-wide, and application to entire evolutionarily significant units of listed fish species	5
Watershed Management Plan	Regional applications	4
NBWA participation	Regional applications	4
Clean-up days	Target specific streams	3

3.8.1 RWQCB Russian River Basin Plan Review

SCWA is providing funding for the RWQCB to review their Basin Plan to determine whether water quality requirements of the Basin Plan are sufficient to protect fish in the Russian River. This review may have enormous implications if it leads to changes in regulatory standards that increase protection of listed fish species. Changes in these standards would not only affect management of the Russian River watershed, but of the entire ESU of each listed fish species.

3.8.2 Population and Habitat Surveys

A key focus for the SCWA is participation in a comprehensive survey of salmonid populations and their critical habitat throughout the Russian River. This information is critical for effective management and restoration of protected species and their critical habitat. Studies are also underway to determine the genetic stocks in the Russian River so that locally adapted "wild" stocks can be identified and given additional protection.

Population monitoring may result in injury or mortality to some individual fish. However, the benefits of having data to help effectively manage the resource outweighs the potential to harm to some individual fish. Take of listed fish species is addressed in the NMFS fish sampling permitting process.

3.8.3 Temperature Monitoring

The RWQCB, with funding from SCWA, has organized a Temperature Summit to coordinate various organizations to monitor water temperature comprehensively in the watershed. Priority is given to salmonid bearing streams or impaired streams that need improvement. Collectively there are about 300 sample locations in the basin. Some organizations participating in the Temperature Summit have access to privately owned land that other organizations might lack.

Temperature data will be put into the KRIS database and are used in several ways. For streams that have good water temperatures but no salmonids, limiting factors for sensitive life history stages are looked for. Water temperature problems that might affect coho salmon are identified. Areas where water temperatures increase are also identified. If possible, areas that contain subsurface flow for thermal refugia are identified. CDFG monitors individual tributaries for one season. SCWA monitors temperatures over several seasons to document long-term trends. These data are crucial to help identify priority restoration opportunities.

3.8.4 Pierce's Disease Control

If riparian vegetation is indiscriminately removed to prevent the spread of Pierce's Disease, critical habitat for protected species can be degraded. The insects that carry this disease generally favor nonnative vegetation. By leaving native vegetation that the insects do not use, the benefits of a healthy riparian corridor can be maintained. SCWA is providing funding for a study site on Maacama Creek. The information generated from this study could potentially be applied in other riparian corridors that pass through vineyards. Because so much of the watershed is in agricultural land and the need for information on effective control is actively being sought by growers, this information has the potential to significantly decrease the amount of riparian vegetation that is currently being removed from critical habitat.

3.8.5 Fish Friendly Farming

The Fish Friendly Farming program implemented by the Sotoyome Resource Conservation District with assistance from SCWA gives landowners the knowledge and incentive to practice beneficial management practices that protect fish habitat. Participants learn such topics as assessing natural features, evaluation of current practices, riparian corridor restoration and management, roads, soils, slopes and drainage.

When implemented, BMPs outlined in the Fish Friendly Farming Certification Program Farm Conservation Plan Workbook will increase the habitat value of streams for listed fish species by decreasing sedimentation of streams, increasing the quality of the riparian corridor, and improving instream habitat. A marketing component designed to increase the value of wine produced by these growers gives a financial benefit to certified growers and is likely to increase the level of success of this program. Additional financial assistance for restoration efforts will be sought. Because this program targets the region's dominant agricultural industry, wide-scale adoption of this program may result in improvements to fish habitat in a substantial portion of the watershed.

3.8.6 Palmer Road Erosion Control

The Palmer Road erosion control project was described in Section 3.5.1. In addition to reducing sediment input from a mile of steep rural roadway, this project has value as a demonstration project for effective rural road erosion control. Application of these techniques to other rural roads in the watershed could substantially reduce erosion in this basin.

3.8.7 Invasive Plant Species

Nonnative plant species have the potential to seriously impair the natural functions of the Russian River ecosystem. Of particular concern are *Arundo donax* (the Giant Reed) and *Vinca major* (Periwinkle). Information about the influence of these weeds on native riparian vegetation and insects is needed to assess the effects on the aquatic ecosystem that supports coho salmon, steelhead and chinook salmon (see Section 2.5.1.3). By studying and controlling *Arundo donax* while it is still manageable, SCWA is working to prevent the devastating level of infestation that occurs in streams in southern California.

The extent of *Arundo* infestation has been determined and mapped. Many areas in the Alexander Valley are dominated by *Arundo* and *Vinca* (Natural Resources Management Corporation 1999). These populations could serve as source population from which downstream areas are colonized. Identification of areas where *Arundo* has taken hold is an important first step in the effort to control it.

Arundo removal and establishment of native riparian vegetation is an important conservation action that could have significant localized effects throughout the river basin. Therefore, the biological benefit score is 5 (Table 3-16). *Arundo* is generally removed with a combination of mechanical means and application of an herbicide (Rodeo). As eradication efforts target nonnative vegetation, and Rodeo is applied by trained personnel, the benefits of *Arundo* eradication far outweigh minimal risk of short-term effects that may occur from herbicide use (Table 3-17). As *Arundo* is very difficult to eradicate, research that could identify effective methods for restoring *Arundo* patches to native vegetation would be invaluable.

Table 3-16 Biological Benefit Score for Nonnative Vegetation Removal (*Arundo*)

Category Score*	Evaluation Criteria Category	Project Score*
5	Very high potential to benefit	Co, St, Ch
4	High potential to benefit	
3	Moderate potential to benefit	
2	No benefit and utilizes scarce resources	
1	Poorly planned or implemented, degrades habitat	

*Co = Coho salmon, St = Steelhead, Ch = Chinook salmon

Table 3-17 Vegetation Control Score for *Arundo*

Category Score	Evaluation Criteria Category	Project Score
5	No chemical release	
4	Limited use of herbicide approved for aquatic use in riparian zones or over water	
3	Moderate to heavy use of herbicide approved for aquatic use in riparian zones or over water	Co, St, Ch
2	Use of herbicide not consistent with instructions	
1	Use of herbicide not approved for aquatic use in riparian zones or over water	

*Co = Coho salmon, St = Steelhead, Ch = Chinook salmon

Because *Arundo* is available in nurseries, educating the public about *Arundo* and coordinating volunteer efforts for its removal is an important component of an effort to eradicate this invasive weed and prevent its spread or reintroduction. SCWA distributes a native riparian plant handbook to assist individuals and groups, and this information will help control the spread of invasive species. SCWA is taking a watershed approach to the control of nonnative weeds because a basin-wide effort is needed to keep *Arundo* under control.

3.9 WATER CONSERVATION AND RECYCLED WATER

SCWA plans to undertake water conservation measures that will reduce demands on SCWA's water transmission system. This program is designed to reduce peak water demands in the summer. To evaluate the potential benefits of water conservation projects to listed salmonids and their habitat, information on the amount and location of flows is needed. Information on water conservation in Sonoma Creek will be available sometime after the year 2001, and information on other areas will be available at a later date.

The SCWA has implemented, funded, or planned projects designed to benefit listed species and their critical habitat in the Russian River. These efforts include the general categories of restoration projects (riparian and aquatic habitat protection, restoration and enhancement, fish passage), watershed management, and water conservation and reuse.

Potential effects on protected coho salmon, steelhead, and chinook salmon and their critical habitat were evaluated. These projects have a beneficial effect on the habitat of the listed fish species. Some types of restoration and conservation actions are likely to affect individual fish during construction activities, but there is no risk to populations of listed species as a whole. This section provides key findings.

4.1 FUNDING AND PRIORITIES

SCWA commits substantial funds, staff and equipment to restoration projects. The SCWA spends approximately $800,000 per year on its Natural Resources program, about 30 to 40% on monitoring at the Mirabel and Wohler diversion facilities (which has yielded valuable information about how listed fish species use the watershed), about 50% on FEP projects, and about 10% on meetings. Additionally, in-kind contributions of staff and equipment have been committed to restoration projects. For example, the in-kind contribution for restoration work on Big Austin Creek was $7,000 and on Copeland Creek was $31,000. An additional $471,000 in grants was secured in the year 2000, and additional grant money will be pursued in the future.

To maximize the effectiveness of the dollars invested, SCWA develops project priorities on a basin-wide level and in cooperation with CDFG and other agencies and private interests in the watershed. When the CDFG Draft Basin Restoration Plan for the Russian River Basin is released (spring of 2001), SCWA will work to implement priorities and recommendations formally outlined by CDFG. Partnerships with other stakeholders in the watershed have been instrumental to the success of SCWA restoration projects and programs. SCWA expands the indirect beneficial effects of restoration projects by utilizing all available opportunities for public education.

4.2 RESTORATION ACTIONS AND FISH PASSAGE PROJECTS

Restoration projects are designed to increase the quantity and quality of salmonid habitat. Instream habitat improvements are structures or alterations within the streambed that improve or create spawning and rearing habitat. Riparian restoration activities reduce streambank erosion and reestablish native riparian vegetation that restore the natural functions of the riverine ecosystem. Projects to control rural road erosion reduce sediment runoff into valuable spawning and rearing habitat, and often help to reestablish riparian vegetation.

Typically, larger projects provide more biological benefits than smaller projects. Conservation and restoration actions were evaluated quantitatively by assessing their *biological benefit*. The biological benefit score was based on the project size (length of stream affected), the timeframe for expected benefits, habitat elements affected and their relative importance to listed fish species, stream inventory and/or population data, the cost vs. benefits of the project, and the educational value of the project. It should be noted that projects may have effects beyond the immediate project area. For example, a series of small instream structures can beneficially change the habitat unit ratios of an entire reach (pool/run/riffle ratio). Reductions of sediment input to a stream may benefit a long stream reach downstream of the project. The habitat value was qualitatively assessed by considering the duration and timeframe to development, effects to canopy cover, instream cover, sediment and bank erosion. The importance of the project for improving a limiting factor was considered.

Table 4-1 summarizes information about past, current and proposed actions, the biological benefit scores, and where known, indicates the protected species the action is likely to affect. Steelhead are the most abundant species in many of these areas, but as coho salmon or chinook salmon populations are recovered, utilization of these streams by these species is likely to increase. A score of 5 is given to the largest projects with the most substantial biological benefit. All projects listed are likely to improve habitat for spawning, rearing and migration of protected salmonids. Actions that are part of the proposed actions have been implemented and therefore do not require a take authorization. They have been implemented since the time the MOU was signed (December 31, 1997) and represent an improvement to baseline conditions. Actions that require take are projects that will be implemented and may have direct effects on listed species during construction. They are generally projects that require instream work while listed fish species may be present. Best management practices to minimize adverse effects are generally outlined during the permitting process.

Table 4-1 Summary of Restoration and Conservation Actions

The size of the project is the actual length of stream affected. A "+" indicates projects that have effects that may extend well beyond the immediate project area.

Creek	Type of Project	Size of Project	Species Affected[1]	Biological Benefit Score[2]
BASELINE PROJECTS				
Instream Habitat Improvements				
Green Valley	Contiguous structures and fencing	~ 1 mile	Co, St	5
Freezeout	3 non-contiguous structures		Co, St	4
Riparian Restoration				
Green Valley (streambank stabilization)	Erosion control	2 small projects	Co, St	Co - 3 St - 4
Green Valley (livestock exclusion)	Fencing	> 1 mile	Co, St	5
Freezeout	Fencing	3,000 ft	St	4
Little Briggs	Fencing	> 1 mile	St	5

Table 4-1 Summary of Restoration and Conservation Actions –Continued–

Creek	Type of Project	Size of Project	Species Affected[1]	Biological Benefit Score[2]
BASELINE PROJECTS –CONT'D–				
Riparian Restoration -Continued-				
Porter	Willow walls & mattresses	~300 ft	St	3
Matanzas	Willow wall, revegetation	~20 ft	St	3
PART OF THE PROPOSED ACTIONS (NO TAKE STATEMENT REQUIRED)				
Instream Habitat Improvements				
Mill	14 sets instream habitat structures	~ 2 miles	St	5
Felta	14 sets instream habitat structures	~ 2 miles	Co, St	5
Riparian Restoration				
Copeland	Fencing, grading, riparian planting	6,000 ft	St	4
Howell	Fencing	4,000 ft	St	4
Turtle	Willow walls & mattresses	500 ft	Co, St	3
Turtle	Irrigation	> 1 mile	Co, St	5
Felta	Willow walls	3 projects	St	3
Russell Irrigation site on Turtle Creek	Fencing, cattle removal	> 1 mile	Co, St	5
Unnamed - Huff property	Willow wall		Co, St	3
Instream and Riparian Restoration				
Brush	Streambed and bank regrading, instream structures, revegetation	1,200 ft +	St	5
Big Austin	Reconstruct channel	1,300 ft	Co, St	5
Big Austin	13 erosion control/riparian structures – willow baffles, willow wall, slide repair	0.5 mi. +	Co, St	5
Palmer	Instream habitat structures	3,000 ft	St	5
Rural Road Erosion Control				
Palmer	Erosion control, instream structures	1.5 +	Co, St	5

Table 4-1 Summary of Restoration and Conservation Actions –Continued–

Creek	Type of Project	Size of Project	Species Affected[1]	Biological Benefit Score[2]
PART OF THE PROPOSED ACTIONS (NO TAKE STATEMENT REQUIRED) –CONT'D–				
Rural Road Erosion Control –Continued-				
Santa Rosa (Hood Mt.)	Road and landslide erosion control	100 yds +	Co, St	5
Fish Passage				
Santa Rosa (Hood Mt.)	Rock weirs, not completed	10 miles upstream habitat	Co, St	5
PROJECTS THAT REQUIRE TAKE				
Instream Habitat Improvements				
Palmer	Instream habitat structures		St	5
Instream and Riparian Restoration				
Santa Rosa Creek	Restore channelized creek to more natural form and function	12.8	St	5
Fish Passage				
Matanzas	Passage through box culvert, not completed	5 miles upstream habitat	St	5
Mumford Dam	Rock weirs, not completed	~600 ft of channel & 10 miles upstream habitat	St, Ch, Co	5
Crocker Creek Dam	Series of weirs. Regrade, stabilize, and replant stream banks.	4.5 miles	St	5

[1]Co = Coho, St = Steelhead, Ch = Chinook
[2]A score of 5 is the highest biological benefit

The primary benefit of fish passage projects is that additional spawning and rearing habitat becomes available to anadromous salmonids. Matanzas Creek Fishway will provide access for steelhead to approximately five miles of habitat upstream of the mouth of Matanzas Creek. The Mumford Dam modification project will provide unrestricted access to approximately 10 miles of spawning and rearing habitat in the main stem Russian River primarily for steelhead and chinook salmon and possibly coho salmon. This project also improves about 600 feet of habitat directly below Mumford Dam. The improvements in Santa Rosa Creek in the Hood Mountain region improve access to about 10 miles of upstream habitat. The Crocker Creek Dam fish passage project will provide access to approximately 4.5 miles of spawning and rearing habitat, as well as improved habitat resulting from stabilized and revegetated stream banks upstream of the dam site.

Fish passage projects have the potential to increase predation on protected salmonids. There is no increased risk of predation at the Mumford Dam, Crocker Creek Dam or Santa Rosa Creek sites. However, by concentrating adult steelhead at the entrance to the culvert, the Matanzas project has the potential to expose fish to poaching. Limited access to the site during high flows (when upstream migration occurs) is likely to keep that risk low.

Effects from construction of these restoration and passage projects are minimized by the use of effective BMPs as specified during the permitting process. Construction activities are timed to occur when flows are low or channels are dry. When work does occur in a wetted channel, only rearing salmonids are expected to be present. Fish rescue is generally provided. Instream and upslope sediment control measures will minimize sediment input to the stream channel. Where appropriate, native vegetation will be planted to reduce long-term erosion and increase the habitat value of the project area.

4.3 WATER CONSERVATION AND REUSE

Water reuse and conservation will reduce peak water demand on the order of 3 to 5%. This would typically occur during the dry season in mid-summer. Water conservation is expected to help meet future, growing, water demands and may help to reduce the amount of water diverted from streams. Information on water conservation in Sonoma Creek will be available sometime after the year 2001.

4.4 WATERSHED MANAGEMENT PROJECTS

Scientific research efforts, information dissemination, and regional coordination of management efforts are important components of the restoration and conservation of protected species and their critical habitat. Table 4-2 summarizes watershed management projects and their relative value in terms of the geographic area they are likely to affect and the biological benefit they may provide for listed fish species. Basin-wide applicability (score 5) addresses most or all of the watershed that is likely to be important to protected species. Isolated project/stream information is likely to be useful in a localized area, such as a particular stream or stream reach. A SCWA-funded review of the RWQCB Russian River Basin Plan water quality requirements may lead to changes in regulatory standards that increase protection for listed fish species, affecting management of the Russian River watershed and the entire ESU of each listed fish species. Data on population trends and habitat use will help focus conservation actions where they will have the greatest effect. By sharing information and coordinating restoration actions with other groups, limited resources and beneficial effects are maximized.

Table 4-2 Information Value Scores

Project	Range of Applicability	Information Value Score
DATA COLLECTION		
Stream habitat surveys	Basin-wide: SCWA focus on Mark West and Santa Rosa Creek watersheds	5
Temperature	Major tributary watersheds	5
Water quality sampling	Austin, Maacama, Mainstem Mark West, Santa Rosa, Green Valley, Mill, Ackerman, Robinson, Dutch Bill, Hulbert, Fife, Franz, Porter, Redwood	4
Coho and steelhead population monitoring	Basin-wide	5
Genetic studies on coho, steelhead and chinook	Basin-wide	5
Arundo mapping and research	Basin-wide	5
Laguna de Santa Rosa sedimentation study	Regional application - lower Russian River floodplain	4
DEMONSTRATION PROJECTS		
Pierce's Disease Control Study	Maacama Creek site, with potential application to other vineyards	5
Fish Friendly Farming	Vineyards, the dominant agricultural industry in the watershed	5
Palmer Road Erosion Control	Demonstration project helpful for other work in areas with road erosion problems	3
INFORMATION COORDINATION AND DISSEMINATION		
KRIS/GIS Database	Basin-wide	5
Restoration Project Database	Basin-wide	5
Information dissemination: Workshops, newsletters, library, training programs, school projects	Regional applications	4
RWQCB Russian River Basin Plan Review	Basin-wide, and application to entire evolutionarily significant units of listed fish species	5
Watershed Management Plan	Regional applications	4
NBWA participation	Regional applications	4
Clean-up days	Target specific streams	3

4.5 SYNTHESIS OF EFFECTS

SCWA commits substantial funds, staff and equipment to restoration projects. SCWA's success with grant writing has been, and will continue to be, used to supplement this effort. The value of this commitment is maximized by prioritizing projects on a basin-wide level, through cooperation with other stakeholders, and by utilizing opportunities for public education.

Restoration and conservation actions are likely to benefit protected species and their critical habitat. Restoration projects restore habitat for protected salmonids. Fish passage projects increase access to valuable spawning and rearing habitat. BMPs are outlined during the permitting process and are used during construction and maintenance activities to minimize direct injury to fish and to minimize sediment input to the stream. While construction activities related to the fish passage projects may have short-term effects on rearing salmonids in the area, rescue efforts and judicious timing of the construction are expected to minimize these effects. Watershed management actions, including funding of review of the RWQCB Russian River Basin Plan, data collection, information dissemination, and coordination of stakeholder activities, are expected to help to make appropriate management decisions, target the use of limited resources, and coordinate conservation and restoration actions on local and regional levels. The benefits of water reuse and conservation are likely to help reduce shortages during peak water demand, and may not directly affect protected species and their habitat.

Restoration and conservation actions are likely to adversely affect the listed fish species because there may be effects to individual fish during construction activities. The effects are limited to short-term effects during construction activities, during fish rescue efforts or during the placement or removal of construction isolation structures in the stream. This may present a small risk to individual fish, but no risk to protected populations. Restoration and conservation actions are not likely to adversely modify the designated critical habitat of the listed fish species. The restoration and conservation actions have a beneficial effect on the habitat of the protected species.

It may seem to the reader that it is contradictory to state that there is no risk of adverse effects to protected populations, along with the statement that the proposed project is likely to adversely affect the listed species. However, the first statement is a general assessment of the risk to the larger population of the protected fish species, while the second statement reflects the possibility that one or more fish might be harmed by certain activities. These conclusions will assist NMFS with preparing a BO which may include an incidental take statement (with regard to the individual fish that may be harmed by the proposed action), as well as a determination of whether the proposed action is likely to jeopardize the continued existence of the species.

Banks, M., J. Robertson, K. Bucklin, P. Siri and D. Hedgecock. 1999. Population genetics criteria for restoration of coho salmon (*Oncorhynchus kisutch*) in northern California. Produced by Bodega Marine Laboratory, University of California at Davis, Bodega Bay, California. Produced for Sonoma County Water Agency, Santa Rosa, California.

Bates, K. 2000. Fishway guidelines for Washington State, draft. Washington Department of Fish and Wildlife. April 25, 2000. http://www.wa.gov/wdfw/habitat.htm.

Bell, G.P. 1997. Ecology and management of *Arundo donax*, and approaches to riparian habitat restoration in southern California. Pp.103-113. *In* Plant Invasions: Studies from North America and Europe. *Edited by* Brock, J.H., M. Wade, P. Pysek and D. Green. Backhuys Publ., Leiden, The Netherlands.

Bell, M.C. 1990. Fisheries handbook of engineering requirements and biological criteria. U.S. Army Corps of Engineers, North Pacific Division. Portland, Oregon.

Berg, L., and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42: 1410-1417.

Beschta, R.L., and W.S. Platts. 1986. Morphological features of small streams: significance and function. Water Resources Bulletin 22:369-379.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. North American Journal of Fisheries Management 2:371-374.

Bjornn and Reiser. 1991. Habitat requirements of salmonids in streams. *In* Influences of Forest and Rangeland Management. *Edited by* W.R. Meehan, American Fisheries Society Special Publication 19. Bethesda, MD 1991.

California Department of Fish and Game (CDFG). 2001a. California Department of Fish and Game stream inventory report: Matanzas Creek. February 14, 2001.

California Department of Fish and Game (CDFG). 2001b. California Department of Fish and Game stream inventory report: Santa Rosa Creek. February 6, 2001.

CDFG. 1991. Russian River Salmon and Steelhead Trout Restoration Plan. Draft, March 11, 1991.

CDFG. 1984. Report to the California State Water Resources Control Board by the California Department of Fish and Game regarding water applications 12919A, 15736, 15737, and 19351, Russian River and Dry Creek, Mendocino and Sonoma Counties. By P. Baker and W. Cox. California Department of Fish and Game. Sacramento, CA.

Cordone, A.J. and D.W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47: 189-228.

Dunne, T. and L.B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company. New York.

EIP Associates. 1993. Draft Environmental Impact Report and Environmental Impact Statement. Syar Industries, Inc. Mining use permit application, reclamation plan, and Section 404 permit application. SCH #91113040. July 1993. Sacramento, CA

EXTOXNET (Extension Toxicology Network Pesticide Information Profiles). 1996. Glyphosate. http://ace.orst.edu/info/extoxnet/pips/glyphosa.htm

Flosi, G, S. Downie, J. Hopelain, M. Bird, R. Coey, and B Collins. 1998. California salmonid stream habitat restoration manual, third edition. California Department of Fish and Game, Inland Fisheries Division.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. *In* Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. *Edited by* W.R. Meehan. American Fisheries Society Special Publication 19:297-323.

Gregory, R.S. 1993. Effect of turbidity on the predator avoidance behavior of juvenile chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 50:241-246.

Hall, J.D., and R.L. Lantz. 1969. Effects of logging on the habitat of coho salmon and cutthroat trout in coastal streams. Pages 355-375 in Northcote (1969).

Hoshovsky, M. 1986. Element stewardship abstract for *Arundo donax* Giant Reed. The Nature Conservancy. Arlington, Virginia.

Knight, N.J. 1985. Microhabitats and temperature requirements of hardhead (*Mylopharodon conocephalus*) and Sacramento squawfish (*Ptychocheilus grandis*), with notes for some other native California stream fishes. Ph.D. dissertation, University of California Davis. December 1985.

Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. North American Journal of Fisheries Management 4:371-374.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries Management 7:18-33.

Meehan, W.R., editor. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. Bethesda, Maryland.

Natural Resources Management Corporation Zitney & Associates. 1999. Further Fishery Study on the Impact of the DeWitt Project on Steelhead, Coho Salmon, and Chinook Salmon. Prepared for County of Sonoma. July 1999.

Newcombe, C.P. and D.D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 11:72-82.

NMFS (National Marine Fisheries Service). 2000. Guidelines for salmonid passage at stream crossings. NMFS Southwest Region.

NMFS 2000. Designated critical habitat: Critical habitat for 19 evolutionarily significant units of salmon and steelhead in Washington, Oregon, Idaho and California. Federal Register 65(32): 7787.

NMFS. 1999a. Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionarily Significant Units (ESUs). Federal Register 64(179):50394-50415

NMFS 1999b. Designated critical habitat: Central California Coast and Southern Oregon/Northern California Coasts coho salmon. Federal Register 64(86): 24049-24062.

NMFS 1997. Endangered and threatened species: Listing of several evolutionarily significant units (ESUs) of West Coast Steelhead. Federal Register 62(159):43937-43954.

Northcote, T.G., editor. 1969. Symposium on salmon and trout in streams. H.R. MacMillan Lectures in Fisheries. University of British Columbia, Institute of Fisheries. Vancouver.

NRC (National Resources Council). 1992. Restoration of Aquatic Ecosystems; Science, Technology, and Public Policy. National Academy Press. Washington, D.C.

RMI (Resource Management International, Inc. 1997. Healdsburg Summer Dam Fish Ladder Draft EIR. State Clearinghouse No. 96092007. Prepared for the California Department of Fish and Game, Central Coast Region. April 1997.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Sonoma County Water Agency. 1996. Comments on the Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. Dec. 18, 1996. Santa Rosa, CA. Submitted to NMFS, Northwest Region, Portland, OR.

State Water Resources Control Board. 1997. Staff report Russian River Watershed. Proposed actions to be taken by the Division of Water Rights on pending water right applications within the Russian River Watershed. August 15, 1997. Sacramento, CA.

Steiner Environmental Consulting 1996. A History of Salmonid Decline in the Russian River. Steiner Environmental Consulting, Sonoma County Water Agency, California State Coastal Conservancy.

Team Arundo del Norte. 1999. Status and management needs in the CALFED Bay-Delta Watershed. http://ceres.ca.gov/tadn/whitepaper.txt. August 30, 1999.

University of California at Davis. 1999. A new pest transmitting Pierce's disease spreads in California. UC Davis, Agriculture and Natural Resources. http://danr.ucop.edu/news/July-Dec1999/pierces.html.

U.S. Army Corps of Engineers. 1982. Russian River Basin Study Northern California Streams Investigation Final Report. San Francisco District. San Francisco, CA.

USFWS (U.S. Fish and Wildlife Service) and NMFS. 1998. Endangered Species Consultation Handbook, Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act. March 1998.

WDFW (Washington Department of Fish and Wildlife). 1999. Fish passage design at road culverts, a design manual for fish passage at road crossings. WDFW, Habitat and Lands Program, Environmental Engineering Division.

Weed Science Society of America. 1994. Herbicide Handbook, Seventh Edition. Champaign, Illinois. P. 10-59.

Winzler and Kelly Consulting Engineers. 1987. Evaluation of fish habitat and barriers to fish migration. San Francisco, CA. Prepared for the U.S. Army Corps of Engineers, Eureka, CA.

PERSONAL COMMUNICATION

Chase, Shawn. December 14, 1999. Sonoma County Water Agency. Personal communication to Ruth Sundermeyer, ENTRIX, Inc.

Coey, Bob. April 11, 2001. California Department of Fish and Game. Personal communication to Tom Taylor, ENTRIX, Inc.

Cox, William (Bill). January 18, 2000. District Fishery Biologist, California Department of Fish and Game. Personal communication to Ruth Sundermeyer, ENTRIX, Inc.

Cox, William (Bill). April 7, 2000. California Department of Fish and Game. Personal communication to Ruth Sundermeyer, ENTRIX, Inc.

White, Sean. April 10, 2001. Sonoma County Water Agency. Personal communication to Jean Baldrige and Ruth Sundermeyer, ENTRIX, Inc.

White, Sean. December 10, 1999. Sonoma County Water Agency. Personal communication to Tom Taylor and Wayne Lifton, ENTRIX, Inc.