



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

In response refer to:
2006/00892

 31 2006

Lieutenant Colonel Craig W. Kiley
District Engineer
U.S. Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street, 16th floor
San Francisco, California 94103-1398

Dear Colonel Kiley:

This document transmits NOAA's National Marine Fisheries Service's (NMFS) biological opinion (Enclosure) for Stanford University's (Stanford) Steelhead Habitat Enhancement Project (SHEP), which, among other things, proposes modifications to the facilities and operational procedures at the San Francisquito Creek Pump Station in San Francisquito Creek, and the Los Trancos Creek Fish Ladder and Diversion Structure in Los Trancos Creek, on lands under ownership and management by Stanford, on the border of Santa Clara and San Mateo counties, California (File No. 28630S). The biological opinion describes NMFS' analysis of the effects of the construction of the facilities and subsequent operations of these facilities on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and on designated critical habitat for CCC steelhead in accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*)

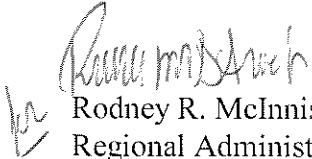
In the enclosed biological opinion, NMFS concludes that this project is not likely to jeopardize the continued existence of threatened CCC steelhead. NMFS has also concluded the proposed project is not likely to result in the destruction or adverse modification of critical habitat for CCC steelhead. However, NMFS anticipates take of CCC steelhead will occur as a result of project construction. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion. Additionally, operation of Stanford's diversion and pumping facilities in Los Trancos and San Francisquito creeks will result in on-going take of CCC steelhead. Stanford, in coordination with NMFS and the California Department of Fish and Game, has developed an operations plan with fish bypass flows for San Francisquito Creek Pump Station and Los Trancos Creek Fish Ladder and Diversion Structure that provides suitable instream flow conditions for threatened CCC steelhead below each facility. This operations plan was submitted to the Corps by Stanford on July 7, 2006, to be incorporated into the project description for the SHEP. The enclosed biological opinion analyzes the potential affects on CCC steelhead and designated critical habitat associated with the on-going operation of the two above listed facilities under Stanford's proposed *Operations and Bypass Procedure*, dated July 6, 2006.



Provided Stanford continues to operate in conformance with the *Operations and Bypass Procedure*, dated July 6, 2006, contained in the project description, the amount or extent of incidental take anticipated in this biological opinion and incidental take statement are not expected to be exceeded. However, if operations change in a manner that causes an adverse effect to listed species or critical habitat that was not considered in the biological opinion, the incidental take statement included with the enclosed biological opinion may no longer apply.

Please contact Mr. Gary Stern at (707) 575-6060 if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,


Rodney R. McInnis
Regional Administrator

Enclosure

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Copy to file (ARN #151422SWR2004SR9240)

BIOLOGICAL OPINION

ACTION AGENCY: U.S. Army Corps of Engineers, San Francisco

ACTION: Stanford University's Steelhead Habitat Enhancement Project at the San Francisquito Creek Pump Station in San Francisquito Creek and the Los Trancos Creek Fish Ladder and Diversion Structure in Los Trancos Creek

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2006/00892

DATE ISSUED: April 21, 2008

I. CONSULTATION HISTORY

At the request of the California Department of Fish and Game (CDFG), NOAA's National Marine Fisheries Service (NMFS) became involved in fish passage issues at Stanford University's (Stanford) Felt Lake water intake on Los Trancos Creek in 2001. Stanford installed a fish screen and fish ladder at the Los Trancos Diversion in 1995, but the amount of bypass flow released to Los Trancos Creek below the diversion dam was in dispute with CDFG. NMFS became actively engaged in the discussions with CDFG and Stanford from 2004 through 2006. During 2005, NMFS conducted field studies on San Francisquito Creek. The results of this work were presented by NMFS in the February 2006 report, "*An assessment of bypass flows needed to protect steelhead below Stanford University's water diversion facilities on Los Trancos Creek and San Francisquito Creek*". In July 2006, Stanford, CDFG and NMFS agreed to an operations plan for Stanford's water intake facilities on Los Trancos Creek and San Francisquito Creek. This operations plan, with fish bypass flows, has been incorporated into Stanford's proposed Steelhead Habitat Enhancement Plan (SHEP) which is the subject of this consultation.

On December 18, 2001, representatives from the NMFS Santa Rosa Area Office attended a Los Trancos Creek site visit with staff from CDFG and Stanford. Earlier in the year, a consultant for Stanford, Francis Borcalli, completed an evaluation of fish passage and water diversion at the Felt Lake intake on Los Trancos Creek (Borcalli & Associates 2001).

By letter dated December 10, 2003, Stanford provided to NMFS background information regarding the San Francisquito Creek watershed, Stanford's Los Trancos Diversion facility, and monitoring efforts by Stanford in the watershed.

Technical drawings dated August 31, 2002, prepared by Wood Rogers Inc. for the design of a replacement fish ladder and water diversion structure on Los Trancos Creek were provided to NMFS in January 2004.

NMFS attended the March 10, 2004, Interagency Meeting hosted by the Corps in San Francisco. Attendees included representatives from the Environmental Protection Agency, NMFS, U.S. Army Corps of Engineers (Corps) and San Francisco Bay Regional Water Quality Control Board. At this meeting, Stanford presented plans to modify the Felt Lake water intake facility on Los Trancos Creek.

In April 2004, Stanford provided to NMFS preliminary engineering design criteria for the new fish ladder and fish screen at the Los Trancos Creek diversion dam prepared by Wood Rodgers, Inc. dated April 13, 2004 (Wood Rodgers 2004).

On May 13, 2004, Stanford hosted a meeting with NMFS, CDFG, and the Corps to introduce the proposed Los Trancos fish ladder and fish screen project.

On August 3, 2004, Stanford provided to NMFS by mail a report describing fish passage monitoring and evaluation on Los Trancos Creek. The report was written by Carmen Ecological Consulting, a consulting biology firm hired by Stanford.

On November 15, 2004, NMFS and CDFG met in Santa Rosa to discuss available information and Stanford's operational plans for the Los Trancos Diversion.

In response to a request from NMFS and CDFG, Stanford provided a report dated December 19, 2004, with analysis of water diversion/bypass scenarios for the Los Trancos Diversion facility.

By letter dated March 7, 2005, Stanford provided to NMFS additional results from Carmen Ecological Consulting's fish passage evaluation on Los Trancos Creek and a DVD with a video recording of the stream under various flow conditions.

On April 20, 2005, Stanford met with NMFS and CDFG regarding the results of Carmen Ecological Consulting's fish passage evaluation. At this meeting, Stanford proposed a revised description of project operations at the Los Trancos diversion.

Discussions regarding Stanford's operations at the Los Trancos facility continued at a meeting on May 17, 2005, with NMFS, CDFG, and Stanford. NMFS and CDFG continued to indicate the need for higher bypass flows on Los Trancos Creek, and Stanford expressed concern with their ability to fill Felt Lake each year. Higher minimum bypass flow below the Los Trancos

Diversion facility would limit the volume of water available to Stanford for its historic irrigation practices. At this meeting, the group began to develop the idea of offsetting Stanford's water supply reductions on Los Trancos Creek by increasing pumping rates at the San Francisquito Pump Station. Reductions in Stanford's diversions from Los Trancos Creek during low flow periods could be offset by increased diversions at Stanford's existing diversion facility located downstream on San Francisquito Creek where natural flow is much higher during winter months. Thus, the SHEP began to incorporate modifications at the San Francisquito Pump Station to recapture some of the increased bypass flow originating from Los Trancos Creek.

During May and June 2005, NMFS biologist, Dr. Bill Hearn, and Stanford's consultant, Bill Carmen, gathered site-specific information on Los Trancos and San Francisquito creeks to assess fish passage, and steelhead (*Oncorhynchus mykiss*) spawning and rearing habitat below Stanford's Felt Lake water intake on Los Trancos Creek and below Stanford's pumping plant on San Francisquito Creek.

In June 2005, Stanford provided further results of biological surveys performed by Carmen Ecological Consulting assessing steelhead passage and habitat quality on Los Trancos Creek.

Meetings among NMFS, CDFG, and Stanford continued on June 22, 2005, and September 23, 2005, to develop an operations plan that coordinated water diversions at Stanford's Los Trancos Creek and San Francisquito Creek facilities.

On September 14, 2005, NMFS provided to Stanford a draft report entitled "*An assessment of bypass flows needed to protect steelhead below Stanford University's water diversion facilities on Los Trancos Creek and San Francisquito Creek*". This NMFS report presented the result of field work performed by NMFS biologist, Dr. Bill Hearn, and Stanford's consultant, Bill Carmen. The report also utilized existing information regarding hydrology and steelhead habitat to assess the instream flow needs of steelhead in the two creeks.

On September 28, 2005, Stanford's consultant, Olberding Environmental, Inc., submitted to the Corps a revised and expanded project description for the replacement of Stanford's water diversion facilities. This expanded project description included modifications at the San Francisquito Pump Station in addition to the previously proposed modifications at the Los Trancos Diversion facility.

On October 11, 2005, Stanford submitted to the Corps a pre-construction notification package and nationwide permit application for the proposed construction of the Steelhead Habitat Enhancement Project (SHEP) at Los Trancos, Felt Reservoir, and San Francisquito Creek. The SHEP proposal includes modifications to Stanford's water diversion facility on Los Trancos Creek (Los Trancos Diversion) and expansion of the water pumping facility on San Francisquito Creek (San Francisquito Pump Station).

In November 2005, Stanford distributed to the Corps and NMFS a biological assessment for the SHEP prepared by Olberding Environmental, Inc.

By letter dated November 28, 2005, Stanford provided NMFS a summary of its analysis of alternative fish bypass scenarios and provided comments on the NMFS September 2005 draft report assessing steelhead bypass flow requirements.

By letter dated January 30, 2006, the Corps requested initiation of formal consultation with NMFS for Stanford's proposed SHEP.

On February 15, 2006, NMFS issues the final report titled "*An assessment of bypass flows to protect steelhead below Stanford University's water diversion facilities on Los Trancos Creek and San Francisquito Creek.*" This report describes a water diversion plan developed by NMFS and CDFG that would minimize impacts to steelhead while affording Stanford its water supply from Los Trancos and San Francisquito creeks. The report also describes the approach and methods employed to develop recommended minimum bypass flows and maximum rates of diversion for Stanford's facilities on Los Trancos and San Francisquito creeks.

By letter dated February 17, 2006, NMFS provided comments to Stanford on the university's November 28, 2005, proposal for operation of the Los Trancos and San Francisquito water diversions. The NMFS letter also provided comments on Stanford's November 2005 water supply assessment.

On February 21, 2006, NMFS and Stanford representatives attended the San Francisquito Watershed's Steelhead Task Force meeting to present the SHEP and its associated steelhead issues to the task force.

By letter dated February 23, 2006, NMFS informed the Corps that the January 30, 2006, consultation initiation request was incomplete, because it lacked information regarding the proposed operation of the facilities and the operational effects of the facilities on steelhead and designated critical habitat. The Corps' biological assessment contained information regarding the construction aspects of the project, but did not describe how the operation of the facilities would affect streamflows in Los Trancos and San Francisquito creeks.

On March 2, 2006, representatives from Stanford, NMFS, and CDFG met to discuss fish bypass flows and operation of Stanford's water diversion facilities.

By electronic mail message dated March 7, 2006, Stanford provided to NMFS and CDFG a revised fish bypass flow and operations plan for the University's water diversion facilities on Los Trancos and San Francisquito creeks.

By electronic mail message dated March 10, 2006, NMFS provided comments to Stanford and the Corps regarding Stanford's proposed revisions to bypass flow and operations plan.

By letter dated April 13, 2006, from Stanford to NMFS, Stanford clarified its approach and proposed modifications to the SHEP diversion facilities. The letter responded to comments presented in the February 17, 2006, letter from NMFS to Stanford and the March 10, 2006, electronic mail message from NMFS to Stanford.

By electronic mail message on the morning of April 24, 2006, from NMFS to Stanford and the Corps, NMFS outlined information needs to complete the section 7 consultation on the SHEP. During the afternoon of April 24, 2006, NMFS, CDFG, and the San Francisco Bay Regional Water Quality Control Board met with Stanford to discuss fish bypass flows, water diversion operations, and state permitting requirements.

By electronic mail message on May 5, 2006, Stanford provided NMFS and CDFG a revised proposal for fish bypass flows and water diversion operations on Los Trancos and San Francisquito creeks.

By letter dated July 7, 2006, Stanford provided the Corps a revised description of fish bypass flows and operations plan for the SHEP facilities on Los Trancos and San Francisquito creeks. This operations plan with fish bypass flows was the final result of approximately two years of discussions among NMFS, CDFG, and Stanford. This version of the SHEP operations plan has been incorporated into the project description of this biological opinion.

On September 7, 2006, Stanford provided to NMFS design plans dated August 15, 2006, for new fish screens at San Francisquito pumping plant.

On September 18, 2006, Stanford distributed a proposed “*Wetland and riparian mitigation and monitoring plan for permanent impacts*” for SHEP prepared by Olberding Environmental, Inc.

On February 28, 2007, Stanford provided NMFS design plans dated February 12, 2007, for new fish screens at San Francisquito pumping plant.

During October 2007, Stanford distributed a revised proposal for the “*Wetland and riparian mitigation and monitoring plan for temporary impacts*” associated with construction of the SHEP prepared by Olberding Environmental, Inc.

On October 18, 2007, Stanford distributed the “*Biological impact minimization plan*” for the SHEP prepared by Olberding Environmental, Inc.

By letter dated February 6, 2008, to NMFS, Stanford requested the biological opinion for the SHEP be completed immediately.

In a February 25, 2008, letter, NMFS informed Stanford that the biological opinion would be issued during March 2008.

This biological opinion is based primarily on information contained in the following documents:

- (1) "*Los Trancos Creek Fish Ladder Facility Modifications, Preliminary Design Criteria*" prepared by Wood Rodgers, Inc. dated April 13, 2004.
- (2) "*Biological Surveys for Steelhead Passage and Habitat Quality on Los Trancos Creek, 2003 - 2005*" prepared by Carmen Ecological Consulting, dated June 2005.
- (3) Pre-Construction notification and nationwide permit application for the Steelhead Habitat Enhancement Project, prepared by Olberding Environmental, Inc., dated October 2005.
- (4) "*Steelhead Trout Biological Assessment*", prepared by Olberding Environmental, Inc. dated November 2005.
- (5) "*An Assessment of Bypass Flows to Protect Steelhead below Stanford University's Water Diversion Facilities on Los Trancos Creek and San Francisquito Creek*" prepared by NMFS, dated February 15, 2006.
- (6) Stanford's "*SHEP Proposed Project Modifications and Operations & Maintenance Plan*", dated July 6, 2006.
- (7) "*Wetland and Riparian Mitigation and Monitoring Plan for Permanent Impacts*", by Olberding Environmental Inc. dated September 2006.
- (8) Design drawings and specifications for "*San Francisquito Creek Pump Station Capacity Upgrade Improvements*" prepared by Wood Rodgers, Inc. dated February 12, 2007.
- (9) "*Biological Impact Minimization Plan*", prepared by Olberding Environmental, Inc., dated October 2007.
- (10) "*Wetland and Riparian Restoration and Monitoring Plan for Temporary Impacts*", prepared by Olberding Environmental Inc. dated October 2007.

II. DESCRIPTION OF PROPOSED ACTION

The Corps proposes to issue a permit under Section 404 of the Clean Water Act (CWA) to Stanford to implement structural, mechanical, electrical, and site work improvements to the Los Trancos Diversion on Los Trancos Creek, and San Francisquito Pump Station on San Francisquito Creek. Both sites have existing water diversion facilities owned and operated by Stanford. The project sites are on: (1) Los Trancos Creek near the community of Portola Valley, and (2) San Francisquito Creek adjacent to Stanford University Golf Course on the border of San

Mateo and Santa Clara counties, California (Corps File No. 28630S) (Figure 1). Construction of these projects will be completed between June 15 and October 15, 2008, or June 15 and October 15, 2009, pending receipt of all necessary approvals.

Stanford exercises appropriative and riparian water rights to divert water from Los Trancos Creek and from San Francisquito Creek, and has exercised these water rights for more than a century. Diverted water is used primarily for irrigation of the campus golf course, athletic fields, and campus landscaping, as well as for environmental, recreational, aesthetic and groundwater recharge purposes on campus. The Los Trancos Creek Fish Ladder and Diversion Facility diverts water from Los Trancos Creek to nearby Felt Reservoir, never exceeding 40 cubic feet per second (cfs) in diversion rate. Stanford installed a fish screen and fish ladder and increased bypass flows at the Los Trancos Creek Diversion Facility in 1995. The San Francisquito Pump Station draws water from San Francisquito Creek into the campus water supply system through two pairs of pumps (four pumps in total) and an intake gallery. Each pair of pumps currently has a 4 cfs capacity.

Following the construction of the 1995 fish passage facilities, Stanford has experienced many problems with the screen and brush mechanisms at the mouth of the Felt Lake diversion flume. The configuration of the bypass channel, diversion flume, fish screen, and the ladder results in inefficient water diversion during medium and high creek flows because the water does not back up properly against the screen and flume entrance. Frequent clogging of the screen further exacerbates loss of diversion flow to the flume. To address the existing facility deficiencies, fish bypass flow issues raised by CDFG, and the 1997 listing of steelhead as a threatened species by NMFS, Stanford has proposed the SHEP. The SHEP would implement additional structural and operational measures to enhance creek conditions for steelhead while preserving Stanford's ability to meet its water supply needs. The two equal objectives of the Project are: (1) to improve the design of the existing fish passage facilities to further enhance passage conditions, and (2) to improve the efficiency and operational capabilities of Stanford's diversion facilities to accommodate increased bypass flows in Los Trancos and San Francisquito creeks while minimizing adverse effects to Stanford's water supply.

The primary components of the SHEP include:

- (1) Reconfiguring of the Los Trancos Diversion Facility with mechanized flow-regulating gates for the flume, replacement of the facility's Alaskan Steeppass fish ladder with a continuously operating step-pool and weir facility, and replacement/modernization of the water intake's fish screen;
- (2) Adding a surface intake screen and an additional 4 cfs pump to the San Francisquito Creek Pump Station;
- (3) Increasing the minimum bypass flow rates in Los Trancos Creek and San Francisquito Creek below both water diversion facilities; and
- (4) Excavating accumulated sediment in Felt Reservoir to restore its original capacity.

A. Description of Proposed Project Design and Construction Work

1. Proposed Modifications at Los Trancos Diversion/Ladder Facility

The SHEP involves modifications to the design of the current fish ladder and fish screen, such that Stanford can more efficiently divert water. The Project also improves the efficiency and performance of the fish passage components, by consolidating the bypass function with the fish ladder into one fishway. The proposed Los Trancos Creek Fish Ladder Facility modifications are described in the preliminary design report by Wood Rodgers, Inc. dated April 13, 2004 (Wood Rodgers, Inc. 2004). The proposed modifications include:

- (1) removing from service the existing fish screen cleaning system and fish ladder;
- (2) grout-filling and abandoning in place the existing bypass channel;
- (3) installing a new pool-and-weir fishway that will operate continuously (except during short maintenance periods in the summer);
- (4) installing a new diversion control structure;
- (5) modifying the fish screen; and
- (6) installing a local control station.

The reconfiguration of the facility and added components, including the control structure, will back the water up higher against the screens, which will improve the efficiency of the diversion and reduce debris clogging of the screens. The existing dam, radial gate, flume, and access structure will be preserved in place. Flow measurement devices will be installed in the diversion facility to facilitate controls and operation. The physical and operational modifications to the Los Trancos Diversion facility will rely on the use of modern electro-mechanical equipment and automated control mechanisms to regulate diversions and bypass flows according to project's *Operations and Bypass Procedure* described below (section II.B.).

The new fishway has been designed to comply with current CDFG and NMFS criteria for anadromous fish passage, and will be installed into the existing berm between the creek and flume. The fish screen modifications and proposed screen cleaning mechanism will also conform to current CDFG and NMFS criteria. The new diversion control structure, fishway slide gate, and automated control mechanisms will be installed and configured such that the diverted flow and bypass flow can be controlled as a function of total creek flow. Creek flow will be routed either through the new fishway, through the existing radial gate spillway structure, over the existing dam, or diverted through the modified fish screen structure and into Stanford's conveyance system to Felt Reservoir. The proposed modifications will facilitate and improve operations and enhance fish passage conditions during periods of low and high creek flows.

2. Proposed Modifications at San Francisquito Creek Pump Station

Proposed improvements at the San Francisquito Pump Station facility downstream of the Los Trancos Diversion/Ladder Facility will allow Stanford to capture a portion of the water bypassed at the Los Trancos facility. The existing San Francisquito Pump Station was constructed in 1998 and is located in San Francisquito Creek, just over one mile below the confluence of Los Trancos and San Francisquito creeks. The existing pump station consists of two pairs of pumps: one pair for the Lagunita diversion, and a second pair of pumps to supply water for Felt Lake. The Lagunita is an off-channel seasonal reservoir on the Stanford Campus. Each pair of pumps in the current station has a capacity of 4 cfs. The pumps have been operated one pair at a time, but not simultaneously, because of limitations of the intake system and the usually low creek flow rate in the spring when the Lagunita diversions are generally needed.

The SHEP's proposed San Francisquito Pump Station improvements will facilitate capture of the increased bypass flows at the modified Los Trancos Creek Diversion facility. The capacity of the San Francisquito Pump Station's "Felt pumps" will be increased from a current 4 cfs capacity to 8 cfs. This flow rate is the maximum rate that can be accommodated in the existing pipeline between the station and Felt Reservoir. The pumps used to divert water to the Lagunita will not be changed. The proposed modifications include:

- (1) Adding a new 4-cfs pump/motor in a new vault immediately upstream of the existing pump vault (the existing two 2-cfs pumps will remain as they are);
- (2) Upsizing of the entire electrical service and system to serve the new larger pump/motor;
- (3) Adding a 12-cfs capacity surface intake system, properly screened, in order to provide additional and more reliable intake capacity to the pumps;
- (4) Installing rock spurs upstream of the pump station, to guide and stabilize creek flow to the intake gallery and fish screens, where it was prior to the construction of the current pump station;
- (5) Raising of the pump vault lids above the low flow water level (for maintenance access); and
- (6) Installing a creek flow measuring device, so that diversions can be regulated with respect to flow.

3. Proposed Minimization Measures for Construction on Los Trancos and San Francisquito creeks

The October 2007 Biological Impacts Minimization Plan for the SHEP proposes the following general measures to avoid and minimize impacts to the aquatic environment during construction at both the Los Trancos and San Francisquito water diversion facilities:

- (1) Project activities that may affect stream channels or banks will be scheduled no earlier than June 15 and will end by October 15. Temporary instream structures will be removed by October 15.
- (2) Biologists will monitor construction activities associated with the project on a daily basis.
- (3) All sandbags, plastic, and construction materials and equipment will be removed from construction sites upon project completion.
- (4) Equipment will be maintained in good working order to prevent the leakage and spillage of hazardous materials into the watercourse.
- (5) All concrete structures will be isolated from the flowing stream until fully cured. Application of a water-base concrete sealer after a period of time will be applied to reduce the isolation time of the concrete from the stream.
- (6) Erosion control and sediment detention devices will be implemented at the time of construction for the purpose of minimizing fine sediment and sediment/water slurry input to the creek.
- (7) Erosion control measures including natural fiber matting, hydroseeding with native vegetation and replanting will be utilized in order to prevent streambank erosion after project construction.
- (8) If riparian vegetation must be removed, replanting of riparian vegetation will replace lost habitat at a 3:1 ratio on an area basis. Maintenance of re-vegetated sites will continue for at least three growing seasons.
- (9) In channel work areas will be isolated from the live stream by installing a cofferdam and bypassing water past the work site through a pipe.
- (10) A qualified fisheries biologist will be hired to monitor project areas and for removing and relocating fish from areas dewatered for construction. Use of electrofishing equipment for fish collection will comply with NMFS guidelines. Fish will be relocated to pools safely outside of the construction area.
- (11) Diversion dams will be constructed with sand bags and washed gravels at least 0.5 inches in diameter. Cofferdam installation and removal will take place by hand.
- (12) During construction all available streamflow will be allowed to pass downstream to maintain aquatic life.

4. Proposed Maintenance Excavation at Felt Reservoir

A component of SHEP includes restoration of the original storage capacity at Felt Reservoir on the Stanford Campus. Deposition of sediment in the reservoir has reduced its storage capacity by nearly 100 acre-feet. Stanford proposes to drain Felt Lake during the summer months and then excavate accumulated sediment using a scoop and lift approach. Excavated material will be placed in upland borrow pits and in an area several hundred yards north of the Felt Reservoir (Paddock Area).

Felt Reservoir is located at the terminus of the Felt Lake Diversion Canal and has no natural connection to Los Trancos Creek or San Francisquito Creek. Steelhead are not present in this lake and the site is not designated critical habitat. The water drained from the lake will not enter

Los Trancos or San Francisquito creeks. Therefore, the proposed maintenance excavation of Felt Reservoir is not discussed further in this biological opinion.

B. Operations and Bypass Procedures

In collaboration with CDFG and NMFS, Stanford has developed an operations plan which includes fish bypass flows (Operations and Bypass Procedure). The Operations and Bypass Procedure is proposed by Stanford as measures to protect steelhead and other aquatic species downstream of its water intake facilities. The Operation and Bypass Procedure for the Los Trancos Creek Diversion and San Francisquito Pump Station are presented below. Stanford proposes to operate to this plan immediately following the conclusion of construction and will continue in this manner in future years.

1. Los Trancos Creek Fish Ladder and Diversion Facility

Stanford proposes to operate the modified Los Trancos Diversion facility as follows:

- a) Stanford will not divert from Los Trancos Creek, under any basis of right, between May 1 and November 30.
- b) Diversions at the Los Trancos Creek diversion facility will be limited to the period between December 1 and April 30, as follows:
 - i) The maximum instantaneous diversion rate will be limited to 40 cfs, less the simultaneous rate of flow diverted at the San Francisquito Creek facility.
 - ii) Beginning December 1, the instantaneous bypass will not be less than 2 cfs (or natural flow, if less than 2 cfs).
 - iii) Beginning January 1, or earlier if the “trigger” event described in paragraph c (below) occurs prior to January 1, the instantaneous bypass flows will not be less than 5 cfs (or natural flow, if less than 5 cfs) when creek flow upstream of the facility is less than 8 cfs, and will be 8 cfs when creek flow upstream of the facility is equal to or greater than 8 cfs for two hours.
- c) The “trigger” event for flows described in paragraph b.iii (above) occurs when the mean daily (*i.e.*, calendar day) creek flow above the Los Trancos creek diversion facility is 8 cfs or more at any time after October 1.

2. San Francisquito Pump Station

Stanford proposes to operate the modified San Francisquito Pump Station facility as follows:

- a) Stanford will not divert from the San Francisquito Pump Station, under any basis of right, from July 1 through November 30.
- b) Consistent with paragraph c (below), the maximum instantaneous rate of diversion at the San Francisquito Pump Station (whether to the Felt Lake/campus distribution system, to Lagunita, or to both systems simultaneously) will not exceed 8 cfs.

- i) The maximum instantaneous rate of diversion to Lagunita will not exceed 4 cfs.
- ii) From December 1 through April 30, Stanford may divert up to 8 cfs at the San Francisquito Pump Station, even if the instantaneous diversion amount is greater than the flows simultaneously bypassed at the Los Trancos Creek Diversion facility, provided that the combined instantaneous diversions at the San Francisquito Pump Station and the Los Trancos Creek Diversion facility do not exceed 40 cfs.
- c) From December 1 through June 30, the instantaneous bypass flows and the maximum instantaneous rate of diversion at the San Francisquito Pump Station will be as described in Table 1.

Table 1: Diversion rates proposed at the San Francisquito Pump Station. Q_{SF} is the abbreviation for flow, in cubic feet per second (cfs), in San Francisquito Creek above the pumping plan.

Q_{SF} cfs	Diversion cfs
0 - 5	0
6	1
7	2
8	3
9	4
10	5
11	6
12-16	0
17	1
18	2
19	3
20	4
21	5
22	6
23	7
24-33	8
34-40	0 ^a
41-46	4 ^a
47+	8
^a Max diversion rate could be increased to 8 cfs over this range of flow if the Bonde Weir is modified to successfully and efficiently pass adult steelhead at flows of 16 to 100 cfs. (Modification of the Bonde Weir is not included in the SHEP.)	

C. Maintenance of Modified Facilities

Each of the modified diversion facilities will require routine maintenance for on-going operation. The Corps proposes that the permit issued for construction of the SHEP also provide for the routine maintenance efforts for each facility described below. On-going maintenance activities will not require subsequent permitting by the Corps unless substantial construction of additional or new facilities or major components is contemplated. Except as necessary for continued diversion operation, all such maintenance work will be performed in the summer low flow periods.

1. Los Trancos Fish Ladder and Diversion Facility

For the Los Trancos Fish Ladder and Diversion facility, maintenance efforts will include periodic gravel removal from the ladder, inspections and maintenance of the gates and brush mechanisms and screens, and repairs of the concrete structures. Prior to any work in the creek's flow path, if fish are observed a qualified fisheries biologist will capture any fish using small seines or dip nets, and the fish will be relocated to an area downstream of the bypass. Typically, ladder access for sediment removal or repairs will be accomplished by the redirection of flow through the radial gate, and removal of the cover grates and opening of clean-out ports in the bottom of the baffles, or hand clearing of accumulated sediment and other materials. Following large storms, accumulated gravel in the flume/ladder entry area will be removed as necessary by opening the radial gate and shoveling the material over the dam, for distribution by the stream flow during a subsequent high flow event. Any necessary concrete repairs will be made in a manner ensuring that fish are not exposed to uncured concrete.

2. San Francisquito Creek Pump Station Facility

For the San Francisquito Pump Station facility, maintenance efforts will include periodic inspection, repair and replacement of the pumps, screens, flow measurement devices, concrete structures, gravel removal from the vaults, and possible adjustment of the bendway weirs. The raising of the pump vault covers above the low creek water level will occur during construction of the SHEP. This will facilitate access to the pumps and vaults without entering the live stream. Also, slots and boards inside the new fish screens can be accessed without creek water entering the vaults. However, should access to the screens from the creek be necessary, and prior to any work being done, if fish are observed a qualified fisheries biologist will collect any fish using small seines or dip nets, and the fish will be relocated downstream of the bypass. If vegetation on the stream bank is disturbed by maintenance activities, areas will be re-vegetated in accordance with the temporary impacts re-vegetation plan associated with the SHEP work.

D. Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action (50 CFR 402.02). The location of Stanford's SHEP is within the San Francisquito Creek watershed

on Los Trancos and San Francisquito creeks in Santa Clara and San Mateo counties, California (Figure 1.). For the purposes of this consultation, the action area encompasses Stanford's facilities on San Francisquito Creek, Los Trancos Creek, and the stream reaches affected by operation of these water diversion facilities. Thus, the action area includes one contiguous reach of stream comprised of: (1) approximately 2.3 miles of Los Trancos Creek extending from the Los Trancos Diversion facility downstream to the confluence with San Francisquito Creek; and (2) approximately 8.3 miles of San Francisquito Creek extending from the confluence with Los Trancos Creek downstream to San Francisco Bay. Stanford's San Francisquito Pump Station Facility is located on San Francisquito Creek approximately one mile downstream of the confluence with Los Trancos Creek.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects on Central California Coast (CCC) steelhead Distinct Population Segment (DPS) associated with Stanford's proposed modification and operation of two existing facilities located on Los Trancos and San Francisquito creeks. CCC steelhead are listed as threatened under the ESA, as amended (January 5, 2006, 71 FR 834). The CCC steelhead DPS includes steelhead in coastal California streams from the Russian River to Aptos Creek, and the drainages of Suisun Bay, San Pablo Bay, and San Francisco Bay. In addition, this biological opinion analyzes the effects on designated critical habitat for threatened CCC steelhead (September 2, 2005; 70 FR 52488). Los Trancos and San Francisquito creeks are designated critical habitat for CCC steelhead.

A. Species Description and Life History

Steelhead are anadromous fish, spending some time in both fresh- and saltwater. The older juvenile and adult life stages occur in the ocean, until the adults ascend freshwater streams to spawn. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. General reviews for steelhead in California document much variation in life history (Shapovalov and Taft 1954, Barnhart 1986, Busby *et al.* 1996, McEwan 2001). Although variation occurs in coastal California, steelhead usually live in freshwater for 1 to 2 years in central California, then spend 2 or 3 years in the ocean before returning to their natal stream to spawn. Steelhead may spawn 1 to 4 times over their life. Adult steelhead which originate from the San Francisquito Creek watershed typically immigrate from the ocean to freshwater between December and April, peaking in January and February, and juveniles migrate as smolts to the ocean from January through June, with peak emigration occurring in April and May (Fukushima and Lesh 1998). Given the proposed construction period between June 15 and October 15, only juvenile steelhead are likely to be present in the action area during construction. However, all steelhead life stages (adults, eggs, fry, juveniles, and smolts) can be present during the year-round operation of Stanford's water diversion facilities on Los Trancos and San Francisquito creeks.

Steelhead fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Rearing steelhead juveniles prefer water temperatures of 7.2-14.4 degrees Celsius (°C) and have an upper lethal limit of 23.9°C (Barnhart 1986, Bjornn and Reiser 1991). They can survive in water up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids (Busby *et al.* 1996). Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows, to the ocean to continue rearing to maturity.

Adults returning to spawn may migrate several miles, hundreds of miles in some watersheds, to reach their natal streams. Although spawning typically occurs between January and May, the specific timing of spawning may vary a month or more among streams within a region, and within streams interannually. Spawning (and smolt emigration) may continue through June (Busby *et al.* 1996). Female steelhead dig a nest in the stream and then deposit their eggs. After fertilization by the male, the female covers the nest with a layer of gravel. Steelhead do not necessarily die after spawning and may return to the ocean, sometimes repeating their spawning migration one or more years. The embryos incubate within the nest. Hatching time varies from about three weeks to two months depending on water temperature. The young fish emerge from the nest about two to six weeks after hatching.

B. Status of Species

Historically, approximately 48 populations¹ of steelhead existed in the CCC steelhead DPS (Bjorkstedt *et al.* 2005). Many of these populations (about 20) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts. The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (Bjorkstedt *et al.* 2005, McElhaney *et al.* 2000).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby *et al.* 1996). Recent estimates for the Russian River are on the order of 4,000 fish (NMFS 1997). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas,

¹ Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

Waddell, Scott, San Vicente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). For more detailed information on trends in CCC steelhead abundance, see: Busby *et al.* 1996, NMFS 1997, and Good *et al.* 2005.

Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). Reduced population sizes and fragmentation of habitat in Central California coastal streams has likely also led to loss of genetic diversity in these populations.

CCC steelhead have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead have maintained a wide distribution throughout the DPS, roughly approximating the known historical distribution, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid species in worse condition. The most recent status review concludes that steelhead in the CCC steelhead DPS remain “likely to become endangered in the foreseeable future” (Good *et al.* 2005). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834).

C. Status of Critical Habitat

The condition of CCC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat²: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion entry to streams from upland areas, loss of shade (higher water temperatures) and loss of nutrient inputs (Busby *et al.* 1996, 70 FR 52488). Depletion and storage of natural river and stream flows have drastically altered natural hydrologic cycles in many of the streams in the DPS. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids.

² Other factors, such as over fishing and artificial propagation, have also contributed to the current population status of these species. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean conditions.

As part of the critical habitat designation process, NMFS created Critical Habitat Analytical Review Teams (CHART) to describe and assess potential critical habitat for several salmonid populations including, among others, CCC steelhead.³ Conservation values of “high”, “medium”, and “low”, were determined from a variety of data sources on quality, quantity, and distribution of physical or biological features associated with spawning, rearing, and migration. Because quality of habitat was only one of the rating factors used to determine conservation value, and habitat quality was considered at a relatively large geographic scale, specific stream reaches within any given area may, or may not, contain high quality of habitat, regardless of the area’s overall rating for conservation value. The assessment for the CCC steelhead DPS was divided into ten CALWATER Hydrologic Units (HU). The Santa Clara Subbasin HU includes several small watersheds draining into south San Francisco Bay. The Santa Clara Subbasin HU is divided into five hydrologic subareas (HSA); San Francisquito and Los Trancos creeks are included in the Palo Alto HSA. The Palo Alto HSA has a medium conservation value for CCC steelhead critical habitat (NMFS 2005).

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species in the action area. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

For the purposes of this consultation, the action area encompasses approximately 2.3 miles of Los Trancos Creek extending from the Los Trancos Diversion facility downstream to the confluence with San Francisquito Creek, and approximately 8.3 miles of San Francisquito Creek extending from the confluence with Los Trancos Creek downstream to San Francisco Bay. These reaches are contiguous and represent the stream reaches affected by Stanford’s water diversion operations.

A. Action Area Overview

The San Francisquito Creek watershed is located on the San Francisco Peninsula, and includes portions of both San Mateo and Santa Clara counties. The watershed is approximately 45 square miles, extending from the ridge of the Santa Cruz Mountains to San Francisco Bay. The climate is Mediterranean, with over 90 percent of annual precipitation occurring between November and April. Cool, moist coastal fog generally alternates with clear, warm weather during the months

³ Final assessment of the National Marine Fisheries Service’s Critical Habitat Analytical Review Team seven salmon and steelhead Evolutionarily Significant Units in California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 23 pages plus appendixes.

of May through September, and significant rainfall during that time is rare. The watershed includes a diversity of urban, rural, and natural habitats. Headwater areas are located in protected open space preserves, with residential and commercial development of moderate density predominating at lower elevations.

San Francisquito Creek and its tributaries, including Los Trancos Creek, is one of two San Mateo County watersheds on the west side of San Francisco Bay with an anadromous population of CCC steelhead. San Mateo Creek to the north is thought to support a remnant population of steelhead, but information regarding this population is lacking. Although passage obstacles exist within the San Francisquito watershed, excellent spawning and rearing habitat is present in the upper reaches. High quality habitat in the larger tributaries of the upper watershed supports the spawning and rearing of steelhead. Flows within the watershed are highly variable and can go quickly from low base flow conditions to high flows and then quickly recede again. Flows range from several hundred cfs during and immediately following winter storm events, to less than 1 cfs during most summers. Portions of the watershed, including Los Trancos Creek, can run dry in late summer and in fall.

Dry conditions in the late summer and fall may be exacerbated in the future due to global climate change. The acceptance of global climate change as a scientifically valid and anthropogenic driven phenomenon has been well established by the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change, and others (Davies et al. 2001, Walther et al. 2002, UNFCCC 2006). Global climate change is likely to manifest itself differently in different regions. One impact predicted for California by the California Energy Commission is an increase in critically dry years (Cayan et al. 2006). Many of the threats already identified for salmonid populations are related to a reduction in surface flow of tributary streams. Future climate change may therefore substantially increase risk to the species by exacerbating dry conditions.

Specific information regarding the species abundance within San Francisquito Creek watershed is incomplete. In the late 19th and early 20th centuries, upper watershed tributaries (*i.e.*, Bear Creek) were home to a steelhead sport fishing industry (San Francisquito Coordinated Resource and Management Plan 2001). Stanford's Conservation Biology Center has conducted fisheries sampling throughout the watershed in recent years and confirmed the presence of steelhead and their distribution throughout the watershed (Smith and Hardin 2001).

B. Status of Steelhead and Critical Habitat in the Los Trancos and San Francisquito Creeks Action Area

1. Los Trancos Creek

Los Trancos Creek is one of three major tributaries entering the free flowing section of San Francisquito Creek downstream of Searsville Dam. An approximately eight mile long stream with a roughly 7.6 square mile watershed, Los Trancos Creek is the boundary between San

Mateo and Santa Clara counties. Carmen and White (2004) summarize existing information and data concerning the steelhead run in Los Trancos Creek. Fish studies have been conducted on Los Trancos Creek since the 1970s, but the surveys performed by CDFG in 1992 and 1993 (Anderson 1995) provide the most information regarding steelhead abundance. In the summer of 1993, Anderson (1995) found several age classes of steelhead above and below Stanford's Los Trancos Diversion facility. Sampling performed by Stanford University in August 1998 and 1999 found abundant steelhead throughout Los Trancos Creek (Launer and Holtgrieve 2000). Vogel (2000) performed snorkel surveys in Los Trancos Creek and observed abundant numbers of steelhead juveniles. Santa Clara Valley Water District (SCVWD) (2004) reports information concerning steelhead spawning habitat in Los Trancos Creek and identified many factors in the watershed that could limit steelhead productivity. Surveys performed by SCVWD in March and April 2003 found "relatively healthy" numbers of steelhead (SCVWD 2004). Recent surveys of Los Trancos Creek were performed by Carmen Ecological Consulting on behalf of Stanford University in 2003, 2004, and 2005. Carmen's surveys found numerous steelhead from all life stages and they observed redds paired with adults downstream of the Los Trancos Diversion (Carmen and White 2005).

Instream habitat conditions in the action area of Los Trancos Creek are generally good to excellent. Although habitat quality is diminished by the lack of large woody debris and low/dry flow conditions during the summer and fall, small and medium size pools provide high quality habitat for juvenile steelhead. Riffles and runs are generally comprised of streambed materials that are of sufficient size for quality spawning and rearing. Instream cover is provided by small boulders, large cobbles, undercut banks, woody debris, and riparian vegetation. The creek is moderately well shaded by an overstory of second growth redwoods, alder, and bay trees. Overwinter habitat conditions may be limited by the presence of few secondary channels and backwater areas, but other features such as small boulders and undercut banks provide some refugia from high velocity flow events. Available information indicates Los Trancos Creek provides high quality spawning and rearing habitat for steelhead in the action area. Based on current channel conditions, designated critical habitat within the action area is slightly degraded from properly functioning condition due to low flow conditions created by water withdrawals, bank stabilization, and fish passage impediments.

2. San Francisquito Creek

Little information is available regarding steelhead on the mainstem of San Francisquito. In June, August, and September 2004, steelhead were collected at two locations in San Francisquito Creek associated with the construction of the Sand Hill Road bridge project and the removal of an instream golf cart crossing (Alley 2004). The Sand Hill Road bridge site is located immediately downstream of Stanford's San Francisquito Pump Station while the golf cart crossing is immediately upstream of the pump station. Young-of-the-year and yearling steelhead were collected at both sites throughout the summer of 2004 (Alley 2004).

Adult steelhead migrate up San Francisquito Creek to access its tributaries during the winter season. Spawning is known to occur in the tributaries, but has not been observed within the mainstem of San Francisquito Creek. Adjacent land uses along the 8.3 miles reach of San Francisquito Creek in the action area include commercial and residential development, Stanford University facilities, Stanford University Golf Course, and numerous road crossings. The San Francisquito Pump Station is located on San Francisquito Creek adjacent to the Stanford University Golf Course. Native and non-native riparian trees and herbaceous vegetation are present along the banks of the creek. Portions of the San Francisquito Creek action area have been engineered or channelized, while other areas are in a semi-natural state. Smith and Harden (2001) identified five principal artificial barriers to steelhead passage on San Francisquito Creek.

C. Factors Affecting the Species Environment and Critical Habitat in the Action Area

Primary constituent elements (PCEs) of designated critical habitat for CCC steelhead in the action area of Los Trancos and San Francisquito creeks include water quality and quantity, foraging habitat, natural cover including large substrate and aquatic vegetation, and migratory corridors free of obstructions. Within Los Trancos Creek, PCEs are slightly degraded. Residential land use and Stanford campus development have resulted in non-point source pollutant contamination, removal of riparian vegetation, and construction of road crossings, and other fish passage impediments. Bank erosion has been stabilized with rip-rap, concrete walls, and other materials. On San Francisquito Creek, PCEs of designated critical habitat are moderately degraded. Stanford's golf course, campus academic facilities, residential development, commercial development, roadways, and engineered channels for flood control have resulted in non-point source pollution, fish passage impediments, loss of riparian vegetation and loss of instream habitat complexity and diversity.

1. Los Trancos

The Los Trancos Fish Ladder and Diversion are located on Los Trancos Creek approximately 2.3 miles upstream from the confluence with San Francisquito Creek. Winter flows range from over 200 cfs average per day following storm events while summer flows average less than 1 cfs and surface flow may cease in some reaches during some summer months (Carmen and White 2005). Stanford currently operates the Los Trancos Diversion at a maximum intake rate of 40 cfs between December 1 and April 31. Up to 900 acre feet of water may be diverted annually by Stanford at this location under water right License No. 1732. Under current operations, Stanford's operational procedure is to bypass 0.5 cfs prior to initial storms. After an initial storm event and subsequent storms, Stanford's bypass procedure is to release 5 cfs for two consecutive days and then provide a flow of 1 cfs. The existing Alaskan Steeppass ladder does not function until Los Trancos Creek flows exceed 3 cfs. In combination with current water diversion operations, the existing fish ladder precludes the upstream passage of adult steelhead for extended periods under most winter and spring base flow conditions.

Water withdrawal at Stanford's Los Trancos Diversion has adversely affected aquatic habitat conditions in the action area. The Los Trancos Diversion Dam was a significant fish passage impediment until a fish ladder and fish screen were constructed in 1995. This existing structure consists of a large concrete dam positioned across the channel of Los Trancos Creek. Water is diverted at the dam by gravity from Los Trancos Creek into the Felt Lake Diversion Canal. The Felt Lake Diversion Canal is a constructed concrete lined flume which allows water to be diverted to Felt Reservoir approximately 3,000 feet to the northeast of the diversion dam. Creek flow not diverted into the diversion canal is bypassed downstream in Los Trancos Creek through a juvenile bypass structure, or through an existing metal fish ladder, or through an overflow structure. A shallow pool has formed in the creek at the base of the existing Los Trancos Diversion Dam.

Due to structural inefficiencies at the existing Los Trancos Diversion and fish screen facility, current bypass flows in Los Trancos Creek downstream of the water intake vary widely and frequently exceed the bypass rate of Stanford's operational procedure described above. The effects of Stanford's diversion on Los Trancos Creek has impacted steelhead migration, spawning, and incubation by reducing winter base flow volumes and reducing hydrologic peaks during light and moderate storm events. Flows for summer rearing have been unaffected by this diversion, because Stanford's water right precludes diversion from Los Trancos Creek between May and November of each year.

Aquatic habitat in Los Trancos Creek below Stanford's water intake has been moderately affected by human activities. Within the action area, Los Trancos Creek parallels Alpine Road and is primarily on the campus of Stanford University. Stanford has leased lands along the creek for use by plant nurseries and equestrian facilities, while other areas along side the creek contain campus facilities or remain as open space. Landscaping, equestrian facilities, fences, roadways, and other structures may be found in close proximity to the bank of Los Trancos Creek.

2. San Francisquito Creek

In the action area, San Francisquito Creek parallels the Stanford campus and runs through the cities of Palo Alto and Menlo Park to San Francisco Bay. Adjacent land uses in the action area include Stanford's golf course, campus academic facilities, residential development, commercial development, and roadways. Through the Stanford Golf Course, a narrow riparian corridor separates the creek from the fairways and greens. Downstream of campus, private residences and associated patios, and landscaping may be found in very close proximity to the creek. Roadways and commercial development also border the creek. Numerous locations along the bank and in-channel have been stabilized with rock riprap and concrete to minimize erosion and prevent the channel from moving laterally. Downstream of the San Francisquito Pump Station portions of the stream channel have been engineered or channelized for flood protection for the cities of Menlo Park and Palo Alto.

Stanford's San Francisquito Pump Plant facility is situated on the eastern bank of San Francisquito Creek and consists of four water pipes that extend from an intake gallery submerged in the bottom of the San Francisquito Creek channel. In the past, water withdrawal by Stanford at the San Francisquito Pump Station has generally been limited to low rates of diversion. The existing facility contains two sets of pumps. Each pair of pumps in the current station has a capacity of 4 cfs to make a combined total of 8 cfs, but the pump sets cannot be operated simultaneously due to limitations of the existing intake system. Under current operations, Stanford diverts at a maximum rate of 4 cfs from San Francisquito Creek from December 1 through June 30. The pump station's infiltration gallery did not function properly until 2004, as a result of sediment deposits along the inside of the bend in the creek atop the infiltration gallery. The San Francisquito Pump Station has affected aquatic habitat conditions downstream of the pump station by reducing stream flows for steelhead migration and rearing. The existing San Francisquito Pump Station has no bypass flow requirements for the protection of aquatic habitat downstream.

Several fish passage barriers exist in the action area of San Francisquito Creek. Smith and Hardin (2001) identified five barriers to upstream migration in San Francisquito Creek. The most significant barrier in the action area is a concrete weir across the stream near Alma Street in Menlo Park (known as the Bonde Weir). This weir consists of concrete sill that is 11 feet long and 45 feet wide. The weir structure is only between 2 and 3 feet high in elevation, but fish passage is difficult because stream flow spreads across the incline and it becomes very shallow for the entire 11-foot length. Suitable conditions for upstream fish passage over this facility are not available until creek flows exceed 35 cfs. The Bonde Weir has been the subject of investigations and considered for modification to minimize its impact to upstream fish movements. In March 2005, the San Francisco Bay Salmonid Habitat Restoration Fund granted \$156,000 to the City of Menlo Park to design and remedy fish passage at this location. An additional \$70,000 has been granted to Menlo Park by the NOAA Restoration Center for this project. Preliminary design plans for the Bonde Weir propose to modify the structure in a manner that will allow for upstream passage during San Francisquito Creek flows as low as 5 cfs (Howard 2007).

Upstream of the action area, water flows in San Francisquito Creek are impounded by Searsville Reservoir and Dam. Searsville Dam, which is owned and operated by Stanford, releases flow into San Francisquito Creek above the project action area. There is no fish passage facilities at Searsville Dam. Steelhead have not had upstream access to the watershed above Searsville Dam since the facility's construction in the 1890s. From Searsville Dam, the San Francisquito Creek flows approximately 12 miles to San Francisco Bay.

Bear Creek is a large tributary to San Francisquito Creek and its confluence is immediately downstream of Stanford's Searsville Dam. In Bear Creek watershed, the California Water Service operates two water diversion facilities. On Bear Gulch, California Water Service's Upper Diversion Dam diverts up to 12.4 cfs of streamflow year-round, while the Station 3 Pumping Plant on Bear Creek diverts up to 4.7 cfs during the winter and spring months. Under

low flow conditions, the operation of these two California Water Service facilities under low flow conditions could reduce streamflow volumes arriving to San Francisquito Creek below Searsville Dam.

D. Previous Section 7 Consultations Affecting the Action Area

NMFS has completed informal consultations for bank stabilization and levee maintenance projects within the action area along San Francisquito Creek. NMFS completed a formal consultation with the Corps on May 26, 2004, regarding Stanford Management Company's replacement of the Sand Hill Road Bridge over San Francisquito Creek. Construction occurred in the summer and fall of 2004. Fish were collected and relocated in San Francisquito Creek for the dewatering of the construction site and there was single mortality of a young-of-year steelhead. Approximately 81 juvenile steelhead were successfully collected and relocated to areas outside of the construction zone. The single mortality of a juvenile steelhead during construction of the Sand Hill Road bridge replacement is unlikely to affect the current steelhead population in the watershed and all other impacts associated with this project were temporary construction effects or beneficial. The Sand Hill Road Bridge project widened an existing bridge and improved the condition of steelhead migration habitat by removing a concrete low water crossing. No other formal consultations pursuant to section 7 of the Endangered Species Act (ESA) with NMFS have affected the action area.

V. EFFECTS OF THE ACTION

The project activities that are expected to affect steelhead and designated critical habitat include construction of the new fish screen and fish ladder on Los Trancos Creek, construction of the new fish screen and pump station facilities on San Francisquito Creek, and the operation of both water diversion facilities. Construction effects are expected to be limited to the period between June 15 and October 15 in 2008 or 2009. Only juvenile steelhead are anticipated to be in the action area during this construction period. Operation of the Los Trancos Diversion on Los Trancos Creek and the San Francisquito Pump Station on San Francisquito Creek will occur during the winter and spring months. Thus, all life stages of steelhead will be subject to the effects of the on-going operation of these water diversions, the new fish screens, and the new fish ladder.

A. Project Construction

1. Fish Relocation Activities

Fish collection and relocation will be performed in coordination with dewatering for construction purposes at both the Los Trancos Diversion and the San Francisquito Pump Station facilities. On Los Trancos Creek, the existing facility will be dewatered (approximately 40 linear feet) and an additional 50 feet of channel downstream of the existing facility will be dewatered to construct the new fishway. The temporary water diversion system on Los Trancos for construction

purposes will consist of a cofferdam across the channel immediately upstream of the existing facility to shunt water into the existing Los Trancos Diversion Dam's intake system, down the Felt Lake Diversion Canal, and into a temporary trench for discharge back into Los Trancos Creek immediately downstream of the construction area. Before and during dewatering, juvenile steelhead and other fish will be collected by seines or backpack electrofisher and relocated to a suitable habitat either upstream or downstream of the project area. Electrofishing will be performed in conformance with NMFS and CDFG guidelines.

The number of steelhead that may be relocated from the Los Trancos Creek project site prior to construction may be estimated from observations in the large pool at the base of the existing diversion dam. Steelhead in this pool have not been enumerated, but observations indicate that juvenile steelhead representing several age classes are present. The 50-foot length of natural channel to be dewatered at this site includes this pool and a portion of the riffle/run area immediately downstream. Steelhead relocation activities will occur during the summer low-flow period after emigrating smolts have left and before adults have immigrated to the proposed project site. Therefore, NMFS expects the CCC steelhead that will be captured during relocation activities will be limited to pre-smolting juveniles. Although the reach to be dewatered is short, the reach includes an important large pool area. Based on visual observations by NMFS biologists and the quality of habitat, it is estimated that between 50 and 80 juvenile steelhead may be residing at the existing diversion dam structure and in the natural channel below. Therefore, NMFS estimates that up to 80 juvenile steelhead may be collected from the dam, pool, and channel during the dewatering of this site prior to construction.

At the San Francisquito Pump Station approximately 180 feet of stream channel will be dewatered for construction. A cofferdam will be installed upstream of the existing facility and a diversion pipeline will be used to convey the flow of San Francisquito Creek around the construction site. As on Los Trancos Creek, fish will be collected by seine or backpack electrofisher before and during dewatering. Fish will be relocated to a suitable area upstream or downstream of the construction site.

The results of fish relocation by the Sand Hill Road bridge replacement project provide information to estimate the number of steelhead that could be relocated at the San Francisquito Pump Station site prior to construction. At both the Sand Hill Road bridge site and the golf cart crossing site, approximately 40 juvenile steelhead per 100 linear feet of stream were collected by electrofishing in June and September 2004. These sites are in close proximity to the Pump Station construction site and habitat conditions are similar. Since the SHEP proposes to temporarily dewater approximately 180 linear feet of stream for construction, it is estimated that 80 to 100 juvenile steelhead may be present in the San Francisquito Creek Pump Station construction zone prior to dewatering. As with the Los Trancos Creek construction site, steelhead relocation activities will occur during the summer low-flow period after emigrating smolts have left and before adults have immigrated to the proposed project site. Therefore, the CCC steelhead that will be captured during relocation activities will be limited to pre-smolting juveniles.

Fish relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely, depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following both CDFG and NMFS guidelines, direct effects to and mortality of juvenile salmonids during capture will be minimized. Data from two years of similar salmonid relocation activities in Humboldt County indicate that average mortality rate is below one percent (Collins 2004). Those fish that avoid capture may be exposed to risks described in the following section on dewatering.

Although sites selected for relocating fish should have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat. Some of the fish released at the relocation sites may choose not to remain in these areas and move either upstream or downstream to areas that have more vacant habitat and a lower density of steelhead. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. NMFS cannot accurately estimate the number of fish affected by competition, but does not believe this impact will adversely affect the survival chances of individual steelhead or cascade through the watershed population of these species based on the small area that will likely be affected and the small number of salmonids likely relocated.

2. Dewatering

Cofferdams will be placed upstream at both work sites to isolate the construction area from the live stream. On Los Trancos Creek, the dewatered area consists of the existing diversion dam facility and an additional 50 feet of natural channel downstream. On San Francisquito Creek, the dewatered area will extend approximately 180 feet at the existing Pump Station location. A bypass system will temporarily divert flow around the work sites. Thus, NMFS anticipates no changes in stream flow within and downstream of the project site during dewatering and construction activities. Stream flow in Los Trancos and San Francisquito creeks should be the same as free-flowing conditions except in the area actually dewatered. Overall dewatering is expected to cause minor, temporary loss, alteration, and reduction of aquatic habitat for several weeks during construction.

The temporary cofferdam structures in the creeks are not expected to impact juvenile steelhead movements. During the summer and fall, stream flow at all sites is typically low and may be intermittent in a dry year. The cofferdam isolation structure will restrict movement of juvenile steelhead in a manner similar to the seasonally normal isolation of pools by intermittent flow conditions.

Benthic (*i.e.*, bottom dwelling) aquatic macroinvertebrates within the project site may be killed or their abundance reduced when creek habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from dewatering will be temporary because construction activities will be relatively short-lived, the dewatered reach is relatively small (up to 250 square feet) and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates is expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile salmonids is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas since stream flow, if present, will be bypassed around the project work site, and food sources derived from the riparian zone will not be affected by the project. Based on the foregoing, the loss of aquatic macroinvertebrates as a result of dewatering activities is not expected to adversely affect threatened CCC steelhead.

3. Increased Mobilization of Sediment in the Stream Channel and Water Quality

Dewatering will enable project construction to occur in the dry creek bed and minimize impacts to water quality during construction. During the subsequent winter's initial rainfall events, construction disturbance on the streambank can lead to increase sediment runoff into the creeks. The project plans for both sites will not leave any areas of exposed soil on the bank, however. So following construction, no soil erosion from the work sites is expected during the subsequent winter rainfall and storm events.

During construction, minor and temporary increases in turbidity may occur as the streambed is disturbed. However, turbidity levels are expected to be very low since the work site will be dewatered and the flow in Los Trancos and San Francisquito creeks is low during the summer and fall months. Construction sites will be fully dewatered. Thus, no vehicles or heavy equipment will enter the live stream channel. NMFS expects the minor and temporary disturbance in the channel could result in limited behavioral effects to steelhead juveniles due to construction noise and turbidity. Behavioral changes would primarily consist of temporarily vacating preferred habitat or temporarily reduced feeding efficiency. These behavioral changes are not expected to reduce the survival chances of individual salmonids in the action area.

When construction of the project is completed, re-watering of the work areas could allow the waters of the creeks to come into direct contact with wet or curing concrete. Concrete which has not completely dried may contaminate the waters of the creek by altering the pH. Wet or curing concrete can emit an alkali that is harmful to aquatic life. If concrete used during construction is not adequately cured and dried, the discharge to surface waters can elevate the pH of the creek and possibly result in aquatic life/fish kills. To address this issue, Stanford proposes to use curing agents and sealants which will allow for concrete to fully dry and cure prior to re-watering the site. This is expected to prevent the waters of Los Trancos and San Francisquito creeks from coming in direct contact with wet concrete. Alkali should not be released into the stream and pH in the creeks should not be affected when the site is re-watered.

B. Los Trancos Fish Ladder and Diversion Operation

1. Operation of the New Fish Screen and Fish Ladder

The new fish screen will prevent the entrainment and impingement of juvenile steelhead into the Felt Lake Diversion Canal. The screen is designed to provide an approach velocity of 0.33 cfs or less which will allow the smallest life stages of steelhead to freely swim away from the face of the screen (*i.e.*, avoid impingement). The screen will also have a mesh opening of 3/32 inch in diameter or less which will prevent steelhead from being entrained into the intake. The fish screens will be fully submerged, thereby reducing approaching water velocities and optimizing seasonal operation. Sweeping flows are expected to adequately provide for fish to continue to move past the facility under all streamflow conditions. Improved sweeping velocities are also anticipated to transport debris off the screens and prevent the accumulation of debris on the screens.

The new fish ladder design will consolidate the bypass function with the fish ladder into one fishway. The fishway will consist of a sloped, rectangular channel partitioned by weirs or baffles aligned perpendicular to the flow direction. Located at intervals of approximately five feet, the weir baffles will create a step-wise arrangement of resting pools for migrating steelhead. The fishway will be designed to dissipate the nine-foot head differential across the Los Trancos Diversion Dam by generating plunging flow at each pool and weir arrangement. The new fishway will have a total length of approximately 113 feet, thereby allowing for approximately 14 pool and weir arrangements. The fishway is designed to double back for approximately 38.5 feet before turning at a ninety-degree angle to allow for flows to drain into the pool that lies immediately downstream of the diversion dam. The weir heights are designed to allow for the upstream passage of both adult and juvenile steelhead.

With the new ladder and fish bypass flows (operations are discussed in detail below), adult steelhead will be able to pass upstream under a wide range of flow conditions. The new ladder is designed in conformance with NMFS fish passage guidelines and will provide suitable conditions for passage during base winter flow rates and during storm events to flows as high as 100 cfs. The new ladder will not provide suitable passage conditions during the hydrologic peak of a large storm event, but it is unlikely that steelhead adults will be ascending the stream under these conditions. Anadromous salmonids have adapted their migration patterns to minimize energy expenditure and they typically avoid the areas of fastest water by swimming nearshore or along the stream bottom (Quinn 2005). The majority of upstream steelhead migration is expected to occur before and following the hydrologic peak of storm events. Thus, the new fish ladder is expected to effectively pass adult steelhead upstream when the fish are actively migrating and delays to passage will be limited to no more than a few hours during the peak flow of the largest annual storm events.

In addition to adult passage, the fishway design and the year-round operation of the ladder will allow juvenile steelhead to pass from below the diversion dam to areas upstream of the dam.

Juvenile steelhead may move upstream or downstream during the summer and fall months in response to diminishing streamflows, increasing water temperatures, or territorial interactions with other individuals (Kahler *et al.* 2001). The new fishway's pool and weir arrangements will allow for juveniles to freely pass upstream and downstream under a wide range of flow conditions.

The project also includes the installation of a local master control station and stream gage station. The gage station in combination with the electro-mechanical controls will ensure water diversions, the fishway, fish screens, and fish bypass flows operate as designed. These devices will minimize the need for Stanford staff to travel to the site during and following storm events. Automation devices are anticipated to improve the ability of the structure to maintain proper bypass flows for steelhead under changing stream flow conditions.

2. Operation of Los Trancos Creek Diversion

Fish migrating upstream must have streamflows that provide suitable water velocity and depths for successful upstream passage (Bjornn and Reiser 1991). In addition, it is important to preserve streamflows that provide adequate depths and velocities supporting suitable and preferred habitats for temporarily resting and more stationary fishes, as well as spawning and incubation. The artificial reduction of stream flows can adversely affect steelhead by limiting opportunities for instream migrations and by reducing the quantity and quality of available habitat for steelhead.

To assess the effects of the operation of the Los Trancos Diversion on steelhead, this section of the biological opinion presents: (a) a description of Stanford's proposed bypass flow plan under the SHEP; (b) information and methods used to assess the relationship of instream flows to steelhead habitat conditions; and (c) the effects of proposed SHEP bypass flows on the freshwater life stages of steelhead.

a. SHEP Operations and Bypass Procedures for Los Trancos Diversion

When construction of SHEP facilities is completed, Stanford proposes to revise the operations plan and fish bypass flows at the Los Trancos Diversion facility. Under the SHEP, Stanford will operate the modified diversion dam with higher bypass flows during the season of diversion between December 1 and April 31. From December 1 through December 31, Stanford will not operate the Los Trancos Diversion when flows in Los Trancos Creek are less than 2 cfs, and all stream flow will remain in the channel to pass downstream of the diversion dam. However, if a storm event on Los Trancos Creek occurs during December or has occurred since October 1 of that year, which creates a daily average flow event in Los Trancos Creek of 8 cfs or greater (*i.e.*, "trigger"), Stanford will not operate the Los Trancos Creek Diversion when the creek flow is less than 5 cfs. After the "trigger" event, Stanford will allow 5 cfs to pass downstream prior to diverting water at the Los Trancos Diversion. Between January 1 and April 31, Stanford will provide a 5 cfs bypass at all times and the Los Trancos Diversion will only operate when flows in

Los Trancos Creek exceed 5 cfs. If and when flows in Los Trancos Creek exceed 8 cfs for a period of two hours or more at any time during the season of diversion (December 1 and April 31), Stanford will operate the Los Trancos Diversion to bypass 8 cfs of flow downstream of the facility. When flows drop to rates below 8 cfs, the Los Trancos Diversion will be operated to bypass 5 cfs (January through April) or to 2/5 cfs (December in conformance with the “trigger”).

b. Method of Assessment of SHEP Operations at Los Trancos Diversion

Bypass flow needs to protect fisheries below the Los Trancos Diversion were assessed by NMFS using Los Trancos Creek information reported by Smith (1995) and Carmen and White (2004; 2005), as well as relevant scientific literature concerning the ecology of anadromous salmonids. In an assessment of stream flow requirements for migrating steelhead in Los Trancos Creek, Smith (1995) reported the depths across a series of five shallow riffles during at least three separate flow conditions. Carmen and White (2004) provided physical habitat data at five representative riffles and five pools in the reach of Los Trancos Creek downstream from the Los Trancos Diversion facility during flows ranging from 0.5 to 15 cfs. In 2005, Carmen and White (2005) systematically video-recorded riffles and pools in Los Trancos Creek over a range of flow conditions.

Additional information regarding the relationship of streamflow to suitable habitat and fish passage is available through published literature. Changes in streamflow will effect habitat suitability for steelhead upstream and downstream migration, spawning, egg incubation, rearing, and holding. For the upstream migration of adult steelhead, Thompson (1972) recommends a minimum passage depth criterion of 0.6 feet and he developed a method to determine passage flows for adult salmonids. Thompson’s method entails identifying a series of shallow riffles that potentially affect fish passage, establishing transects across the shallowest locations, and then determining, for each transect, the flow at which a minimum depth criterion is maintained across both at least 25 percent of the total channel width and a contiguous minimum width of 10 percent of the channel. This method and modifications of this method have been widely used to establish appropriate instream flow regimes for adult salmonid passage.

Less information is available regarding the water depth requirements of downstream migrating juveniles and smolts, but 0.15 feet reported by Smith (1995) is likely the minimum necessary for downstream movements. Seaward smolt migrations of steelhead and salmon often coincide with increases in water discharge (White and Huntsman 1938; Allen 1944; Osterdahl 1969; Raymond 1979; Northcote 1984). Relatively large freshets also appear to cause large downstream movements of juvenile coho salmon (Chapman 1965). It is well documented that stream flow affects the travel rates of migrating smolts. Berggren and Filardo (1993), who examined the time that it takes juvenile steelhead to migrate through reaches in the Snake and Columbia rivers, reported that estimates of smolt travel time for yearling steelhead were inversely related to average river flows. Moreover, delays in the rate of downstream movement can influence smolt survival. Cada *et al.* (1994) concluded that relevant studies “*generally supported the premise that increased flow led to increased smolt survival.*”

Steelhead spawning and egg incubation conditions are significantly influenced by streamflows. The amount of spawning area available in a stream is regulated by the area covered by water and the velocities and depths of water over the gravel beds (Bjornn and Reiser 1991). Preferred water depths and velocities for steelhead have been determined from measurements at redds. Bjornn and Reiser (1991) report that steelhead typically spawn in water depths of approximately 0.8 feet and water velocities ranging from 1.3 to 3.0 feet per second. Higher flows typically provide greater riffle and pool depths, increased riffle velocities and pool volumes, and greater riffle widths than lower flows. Greater riffle and pool depths are expected to improve conditions for steelhead spawning and egg incubation. More inundated gravel surface areas will be available under higher flow conditions and higher water velocities typically enhance conditions within a redd for incubating eggs through replenishment of dissolved oxygen and removal of metabolic wastes (Bjornn and Reiser 1991)

For holding by both adult and juvenile steelhead, streamflow rates affect the amount of cover and susceptibility to predation. Water depth and surface turbulence provide important cover for fishes located in pools (Raleigh 1982; Raleigh *et al.* 1984). The value of elevated surface turbulence as cover for stream-dwelling salmon and steelhead has been recognized by many researchers (Jenkins 1969; Griffith 1972; Everest and Chapman 1972; Gibson 1978; Bjornn and Reiser 1991). Johnson *et al.* (1998) developed a classification system for rating the habitat value of various levels of surface turbulence, and the Federal Highway Administration (FHWA) acknowledges the role of surface turbulence as cover for fishes within pools (FHWA 2004). In Los Trancos Creek, most of the pools are relatively shallow (< 3 feet deep), and surface turbulence provides important cover from potential predators, including human poachers (NMFS 2006).

c. Effects of SHEP Operations at Los Trancos Diversion

Based on the results of work by Carmen and White (2004; 2005), Smith (1995), NMFS (2006), and published literature on the habitat requirements of steelhead, Stanford's proposed bypass flow criteria for the Los Trancos Diversion was assessed. The following assessment is presented chronologically through Stanford's season of diversion on Los Trancos Creek (December 1 through April 30).

Beginning December 1, the Los Trancos Diversion will bypass either 2 cfs (no "trigger" event) or 5 cfs ("trigger" event has occurred). This December minimum bypass flow is designed to provide a higher bypass flow (*i.e.*, 5 cfs) if there has been sufficient rainfall and an associated Los Trancos Creek flow event that allows adult steelhead to move upstream from San Francisco Bay through San Francisquito Creek into Los Trancos Creek. If no such storm event has occurred, it is unlikely that adult steelhead have entered Los Trancos Creek, and Stanford may operate the Los Trancos Diversion in a manner that maintains a base flow level consistent with typically natural flow conditions during the late fall months. This minimum bypass flow criteria of 2 cfs is expected to provide adequate conditions under dry conditions during December for

juvenile steelhead residing in Los Trancos Creek, because the channel will remain wetted to the confluence with San Francisquito Creek and provide adequate water depths for residing juvenile fish. Smith (1995) concluded that 1 cfs flow in Los Trancos Creek is sufficient to sustain juvenile steelhead and provide for marginal downstream movements by smolts. The SHEP's proposed 2 cfs bypass for the month of December provides for twice the rate judged as sustaining by Smith (1995).

From January 1 through the end of the diversion season on April 30, the minimum bypass flow will be 5 cfs and no diversion of water may occur from the Los Trancos Diversion facility until streamflows exceed 5 cfs. By maintaining the frequency and duration of unimpaired flows of 5 cfs and less, the operation of the Los Trancos Diversion is expected to protect low flow periods and provide suitable conditions for spawning, incubation, rearing and smolt passage downstream of this water intake facility. Instream flow rates will not be reduced under these low flow conditions by the Stanford's Los Trancos Diversion, and both adult and juvenile steelhead will be unaffected during winter and spring base flows. Water depths and surface turbulence will be maintained to protect resting migrants and more stationary individuals.

When flows in Los Trancos Creek exceed 8 cfs, available information indicates water depths at riffles downstream of the Los Trancos Diversion will allow for the upstream passage of adult steelhead. Therefore, the Los Trancos Diversion operations plan provides for an increase in the minimum bypass flow to 8 cfs, when streamflows in Los Trancos Creek equal or exceed 8 cfs. This increase in the minimum bypass flow during periods of higher water is expected to facilitate the upstream passage of adult steelhead. The 8 cfs minimum bypass flow will remain continuous until flows in Los Trancos Creek naturally diminish to a rate less than 8 cfs. At which time, the 5 cfs minimum bypass flow criteria becomes effective. The 8 cfs bypass flow for the upstream migration of adult steelhead is supported by stream specific depth and velocity measurements at riffles in Los Trancos Creek downstream of the diversion facility. Smith (1995) and Carmen and White (2004 and 2005) both conclude a bypass flow of 8 cfs should adequately protect opportunities for upstream migration by adult steelhead, although Smith (1995) does caution regarding barriers formed by mobilized gravels needs to be considered in any bypass flow recommendation for Los Trancos Creek.

Overall, this two-stage (5 cfs and 8 cfs) minimum bypass flow criteria is anticipated to minimize the impacts of Stanford's water diversions upon steelhead in Los Trancos Creek. This protection of low flows in Los Trancos Creek is also expected to benefit streamflow in San Francisquito Creek below the confluence with Los Trancos Creek. Under dry conditions, higher bypass flows released to the channel below the Los Trancos Diversion will comingle with low flows in San Francisquito Creek and benefit steelhead spawning, incubation, rearing, and migration in San Francisquito Creek.

3. Maximum Rate of Diversion and Channel Morphology

Salmonid habitat quality is influenced by high stream flow events that move water sediment, and wood through stream channels (Montgomery 2004). Steelhead and salmon rely on streams to provide clean gravels, instream cover, sheltered pools, and channel/habitat diversity. In general, these important habitat attributes are maintained by fluvial processes including high stream flow events. A high rate of water withdrawal can cause a reduction in peak flows. Peak flow events (sometimes called “flushing flows”) clean accumulated sediment and algae, maintain an active channel bed, and support a healthy, vibrant riparian vegetation community.

Rosgen and Silvey (1996) describe bankfull flows as those discharge events which channel maintenance occurs. Channel maintenance (*e.g.*, removing fine sediment, forming and reforming bars, and meandering) includes flow events that sustain natural geomorphic processes. Bankfull flows in Los Trancos Creek likely provide the necessary discharge rate for periodic channel maintenance functions. Storm events commonly create peak flows in Los Trancos Creek in excess of 100 cfs (Carmen and White 2005). Stream gage records for Los Trancos and San Francisquito creeks indicate bankfull flow events or greater occur in the creek every 1-2 years. Based on hydrological records and channel configuration, the high flow events that sustain geomorphic processes in Los Trancos Creek are not likely be significantly diminished by the operation of the Los Trancos Diversion. Therefore, it is expected that the magnitude and frequency of high flow events will continue to be sufficient for channel forming processes in Los Trancos Creek.

4. Maintenance Activities at the Los Trancos Fish Ladder and Diversion

The Los Trancos Fish Ladder and Diversion will require periodic maintenance. Maintenance efforts will include periodic gravel and debris removal from the ladder, inspections, maintenance, and repairs of gates and brush mechanisms and screens, and repairs of concrete structures. Clearing of accumulated gravel, sediments and debris may result in the discharge of small amounts of sediment into the flowing waters of the creek and an increase in turbidity downstream. These minor and localized elevated levels of turbidity will quickly disperse with stream flow downstream. Therefore, turbidity associated with sediment or debris removal is not expected to impair or harm steelhead and will not result in short-term or long-term impacts to aquatic habitat. Concrete repairs will be made in a manner ensuring the creek and fish are not exposed to uncured concrete. Thus, no impacts to fish or water quality are anticipated with concrete repairs.

If any juvenile steelhead are present in an area about to be disturbed by a maintenance activity, Stanford proposes to have a qualified fisheries biologist collect the individual fish with a small seine or dip net and relocate them to a suitable site in Los Trancos Creek downstream from the facility. The need for fish relocation of this type is expected to be rare since most maintenance activities will not occur in the live stream. Maintenance effects, other than fish relocation, are expected to minor, short term, and discountable.

C. San Francisquito Pump Station

Stanford's planned modifications for the San Francisquito Pump Station were developed in coordination with proposed changes at the Los Trancos Diversion. Prior to collaborative discussions between NMFS, CDFG, and Stanford, the SHEP only included project modifications at the Los Trancos Creek Diversion. The proposed modifications at the Los Trancos Diversion would greatly enhance the efficiency of the facility to annually divert water at a rate of up to 40 cfs between December 1 and April 30. As the need for higher bypass flows on Los Trancos Creek were identified by CDFG and NMFS, the SHEP incorporated modifications at the San Francisquito Pump Station to recapture some of the increased bypass flow originating from Los Trancos Creek.

1. Operation of the New San Francisquito Pump Station Fish Screen.

The new fish screen will prevent the entrainment and impingement of juvenile steelhead into Stanford's water system pipelines. The screen is designed to provide an approach velocity of 0.33 cfs or less which will allow the smallest life stages of steelhead to freely swim away from the face of the screen (*i.e.*, avoid impingement). The screen will also have a mesh opening of 3/32 inch or less which will prevent steelhead from being entrained into the intake. The fish screens are expected to provide adequate sweeping flows for fish to continue to move past the facility in San Francisquito Creek.

2. Operation of the Expanded San Francisquito Pump Station

As discussed above for Los Trancos Creek, it is important to preserve streamflows that provide adequate depths and velocities for upstream passage of adult steelhead and provide suitable habitat conditions for holding, spawning, incubation, and rearing. The reduction of stream flows due to water diversions can adversely affect steelhead by limiting opportunities for instream migrations and by reducing the quantity and quality of available habitat for steelhead.

To assess the effects of the operation of the San Francisquito Pump Station on steelhead, this section presents: (a) a description of Stanford's proposed bypass flow plan under the SHEP; (b) information and methods used to assess the relationship of instream flows to steelhead habitat conditions; and (c) the effects of proposed SHEP bypass flows on steelhead in San Francisquito Creek.

a. SHEP Operations and Bypass Procedures for the San Francisquito Pump Station

Upon completion of construction of the new fish screen, new surface intake, and expanded pump facilities, Stanford proposes to operate the modified San Francisquito Pump Station to always maintain a minimum bypass flow of 5 cfs (Table 1). As streamflows in San Francisquito Creek increase above 5 cfs, diversion rates may ramp up with increasing streamflow to a diversion rate

of 6 cfs, but all diversion will cease when the creek is flowing between 12 and 16 cfs. When San Francisquito Creek is flowing at 17 cfs and higher, diversion rates may ramp up to the full 8 cfs diversion capacity, but diversion must again cease when the creek is flowing between 34 and 40 cfs. When San Francisquito Creek is flowing at 41 cfs and higher, diversion rates may again ramp up with streamflow to the full 8 cfs diversion capacity. The operational restriction from 34-40 cfs is designed to provide for the upstream passage of adult steelhead at the Bonde Weir. When structural improvements for fish passage at the Bonde Weir are completed, the operational restriction between 34 and 40 cfs will no longer apply.

b. Method of Assessment of SHEP Operations at San Francisquito Pump Station

As discussed above for Los Trancos Creek, fish migrating upstream must have streamflows that provide suitable water velocity and depths for successful upstream passage (Bjornn and Reiser 1991). On San Francisquito Creek, the focus of the NMFS' assessment below was on adult upstream passage and juvenile downstream passage, because the habitat conditions below the San Francisquito Pump Station are marginally suitable for steelhead spawning and juvenile rearing. San Francisquito Creek is primarily within an urban setting. Fine sediment, limited riparian vegetation, low habitat diversity, limited instream cover, and warm summer water temperatures render less than adequate conditions for steelhead spawning and rearing. However, rearing and spawning may occur in lower San Francisquito Creek and these conditions are included in the assessment below.

Bypass flow needs to protect fisheries below the San Francisquito Pump Station were assessed by NMFS using site-specific information collected by Stanford's consultant, Bill Carmen and NMFS biologist, Dr. Bill Hearn, and applying a modification of Thompson's (1972) method to determine passage flows for adult salmonids (NMFS 2006). Field data was collected at five riffle habitats in San Francisquito Creek during May 2005, using representative cross-sections. Depths across the study transects on San Francisquito Creek were determined by surveying each transect's bed profile, measuring the water surface elevation at three separate flows, and measuring depth and velocity across each transect at the middle flow. The hydraulic component of RHABSIM (Tom R. Paine & Associates' Riverine Habitat Simulation model) was used to interpolate and extrapolate depths and wetted width data at additional flows (NMFS 2006).

As presented above for Los Trancos Creek, additional information regarding the relationship of streamflow to suitable habitat and fish passage is available through published literature (Chapman 1965, Thompson 1972, Raymond 1979, Northcote 1984, Bjornn and Reiser 1991, Berggren and Filardo 1993, Cada *et al.* 1994). Using the site specific data from San Francisquito Creek and information from the published literature, streamflow rates were examined for potential effects to steelhead upstream and downstream migration, spawning, egg incubation, rearing, and holding in San Francisquito Creek downstream of the Pump Station.

c. Effects of SHEP Operations and Bypass Procedures at San Francisquito Pump Station

The operation of the San Francisquito Pump Station is anticipated to effect the migration of both adult and juvenile steelhead, as well as, holding, resting, and juvenile rearing. Steelhead spawning has not been recorded downstream of the San Francisquito Pump Station and habitat conditions suggest this area has limited value for spawning and egg incubation due to poor substrate quality.

Based on the results of work by Smith (1995) and NMFS (2006), the upstream migration of adult steelhead in San Francisquito Creek is constrained by more than one flow condition. Data collected at several riffles indicated that passage becomes difficult for adults moving upstream at most natural riffles when flow drops below 16 cfs. However, a formidable barrier to steelhead movement currently exists at a single location, known as the Bonde Weir. The Bonde Weir presents steep and shallow flow conditions in San Francisquito Creek across large concrete sill. Smith and Hardin (2001) report upstream passage is very difficult, but possible at 30 cfs. NMFS (2006) estimate passage is possible for highly motivated fish at flows ranging from 30 to 50 cfs. The Bonde Weir has been the subject of investigations and plans to modify the structure for fish passage are under development. Preliminary design plans propose to modify the Bonde Weir in a manner that will allow for upstream passage during San Francisquito Creek flows as low as 5 cfs (Howard 2007).

To address fish passage at both the natural riffle barriers and the currently unmodified Bonde Weir, a two-stage minimum bypass flow criteria has been proposed by the SHEP for the San Francisquito Pump Station. During periods of creek flow rates less than 12 cfs, shallow water depths at natural riffles make it difficult for adult steelhead to pass upstream. Pursuant to the SHEP's Operations and Bypass Procedure, when San Francisquito Creek flows are between 12 and 16 cfs, all pumping will cease and these flows become fully available for the upstream passage of steelhead adults and the downstream migration of smolts. When streamflows exceed 16 cfs, water diversions at the San Francisquito Pump Station may ramp up with increasing streamflows to full 8 cfs capacity and remain at full capacity until the creek is flowing at 34 cfs. At 34 cfs, diversions will again cease until streamflow exceeds 41 cfs. These two windows of no pumping, 12-16 cfs and 34-41 cfs, protect instream flow in San Francisquito Creek for upstream passage of adult steelhead and the seaward movement of smolts. However, when the Bonde Weir is modified to improve fish passage under low flow conditions, the upper window (*i.e.*, 34-40 cfs) of no pumping is no longer required, and Stanford's Operations and Bypass Plan allows elimination of this constraint. These operational measures are expected to minimize the downstream effects of water diversions at the San Francisquito Pump Station on migrating steelhead.

A third, low level, stage for minimum bypass flows has been proposed for the San Francisquito Pump Station to protect holding fish, spawning adults and rearing juveniles. The 5 cfs minimum bypass flow is expected to adequately protect stationary fish, such as adults resting in pools, spawning, and non-migrating juveniles. Available information indicates 5 cfs will maintain

substantial depth in the stream's pools during the winter and spring (NMFS 2006). Data from the United State Geological Survey (USGS) gage on San Francisquito Creek indicates flows of 5 cfs or greater are exceeded only 56 percent of the time over the long-term between December 1 and April 30th. This means that flows in San Francisquito Creek are less than 5 cfs 44 percent of the time and, during this period, no water diversions will occur at the Pump Station. As discussed above for Los Trancos Creek, the minimum flow of 5 cfs is expected to improve conditions for juvenile steelhead through surface turbulence in pools and riffles, as well as, greater riffle and pool depths. Since Smith (1995) and NMFS (2006) report flows in excess of 12 cfs are required to provide adequate water depths over most riffles for adult upstream passage, the 5 cfs minimum flow will not facilitate the upstream migration of steelhead.

In summary, the variable increasing rate of diversion immediately following the three periods of no pumping is designed to ensure that 5 cfs, 16 cfs, and 34 cfs minimum is maintained in San Francisquito Creek when these natural flow conditions exist. The proposed operations plan for the San Francisquito Pump Station is expected to provide adequate conditions for holding fish and the maximum diversion rates of 8 cfs will be avoided when flows are in the vicinity of the critical passage thresholds of 12-16 cfs and 34-40 cfs.

3. Maximum Rate of Diversion and Channel Morphology

As discussed above for Los Trancos Creek, habitat quality for steelhead in San Francisquito is influenced by high stream flow events that move water, sediment, and wood through stream channels. Although urban conditions adjacent to the banks of San Francisquito Creek have degraded instream habitat conditions, the stream within the action area does provide some areas with clean gravels, instream cover, sheltered pools, and channel/habitat diversity. These important habitat attributes are maintained by fluvial processes including high stream flow ("flushing") events.

Based on hydrological records and channel configuration, the high flow events that sustain geomorphic processes in San Francisquito Creek will not likely be diminished by the expanded diversion capacity of the San Francisquito Pump Station. Storm events commonly produce peak flows in San Francisquito Creek of several hundred cfs (Jones and Stokes 2006). Therefore, it is expected that the magnitude and frequency of high flow events will continue to be sufficient for channel forming processes in San Francisquito Creek. The proposed withdrawal of up to 8 cfs is anticipated to have little to no effect on stream channel morphology downstream of the San Francisquito Pump Station.

4. Maintenance Activities at the San Francisquito Pump Station

The San Francisquito Pump Station will require periodic maintenance. Maintenance efforts will include periodic inspection, repair, and replacement of the pumps, screens, flow measurement devices, gravel, and debris removal from the vaults, and repair of concrete structures. Clearing of debris from the vaults will occur when the covers are above the water surface. Slots and

boards inside the fish screens can be adjusted without creek water entering the vaults. Thus, no impacts to the creek are expected to occur during entry to the vaults and maintenance activities from the vaults.

Frequent cleaning of the screen will occur automatically with small jets of water in a backwash system. This cleaning system is anticipated to maintain screen openings and low water velocities through the screens.

If any juvenile steelhead are present in an area about to be disturbed by a maintenance activity, Stanford proposes to have a qualified fisheries biologist collect the individual fish with a small seine or dip net and relocate them to a suitable site in San Francisquito Creek downstream from the facility. This type of fish relocation is expected to be rare since most maintenance activities will not occur in the live stream. Overall, maintenance activities at the San Francisquito Pump Station are not expected to impact fish or degrade water quality.

D. Impacts to Designated Critical Habitat

The potential effects of the new SHEP facilities and their operation on designated critical habitat are primarily beneficial. The new fish screens on Los Trancos Creek and on San Francisquito Creek will prevent the entrainment and impingement of juvenile steelhead at both water intakes. The new fish ladder on Los Trancos Creek will significantly improve fish passage conditions, particularly by providing passage under low flow conditions. Construction of the fish screens, ladder and other facilities associated with the two water diversions is expected to result in short-term disturbance to the streambed in front of both existing facilities, but they will generally be localized and minor. Construction-related impacts to steelhead habitat have been presented above. The potential effects of Stanford's implementation of new operations plans for both facilities are also beneficial. Bypass flows will be provided below both water intake facilities. As discussed above, bypass flows are designed to provide for all freshwater life stages of CCC steelhead. In general, operation of Stanford's water diversion facilities will provide suitable conditions for fish passage, spawning, rearing, holding, and outmigration. Upon completion of the SHEP and implementation of the new Operations and Bypass Procedure, the project is expected to have negligible and discountable impacts on PCE's of designated critical habitat in both Los Trancos Creek and San Francisquito Creek.

E. Summary of Effects

Juvenile steelhead are expected to be present within the action areas on Los Trancos and San Francisquito creeks during construction. It is estimated that approximately 80 juvenile steelhead will be collected and relocated for dewatering and construction at the Los Trancos site, and approximately 100 fish will be collected and relocated at the San Francisquito Creek construction site. These fish likely make up a very small proportion of steelhead from the San Francisquito Creek watershed or the CCC steelhead DPS. Due to the timing of the proposed action, no adult steelhead or migrating steelhead smolts are expected to be adversely affected by the project

construction. Impacts to individual steelhead will be minimized as the applicant proposes to relocate any steelhead present in the construction areas.

Based on the low mortality rates for relocation efforts and the small area of dewatering for construction, NMFS anticipates no more than two percent⁴ of the juvenile steelhead present at the construction site will be harmed or killed by fish relocation activities. Experienced fish biologists are expected to have low injury and mortality rates during fish collections. Fish that elude capture and remain in the project areas during construction activities will likely be lost to thermal stress or crushed by heavy equipment. Steelhead are well distributed throughout the San Francisquito watershed. Due to the relatively large number of juveniles produced by each spawning pair, steelhead spawning in this watershed in future years are likely to produce enough juveniles to replace the few that may be lost at the project site due to relocation and dewatering. It is unlikely that the small potential loss of juveniles by these projects will impact future adult returns.

Upon completion, the new fish screens and new fish ladder are expected to benefit CCC steelhead. Potential entrainment and impingement of steelhead fry and juveniles is unlikely to occur due to the installation of fish screens that conform to NMFS and CDFG standards. Adult and juvenile steelhead will have full access to pass upstream at the Los Trancos Diversion structure under a wide range of flow conditions through the new fishway. Upon completion of construction, the SHEP will provide suitable fish bypass flows below the intakes in both Los Trancos and San Francisquito creeks with the implementation of the proposed new operational procedures.

On Los Trancos Creek, Stanford's diversion will be operated to achieve bypass flow rates of 5 cfs and 8 cfs. On San Francisquito Creek, Stanford's operations plan will provide minimum bypass flows of 5 cfs, 12 cfs, or 34 cfs which are based upon steelhead life history needs and instream flow and habitat conditions. The new bypass flows are expected to provide suitable conditions for adult upstream migration, spawning, egg incubation, juvenile rearing, and smolt outmigration. While the project will divert some flows from these creeks, these diversions are anticipated to have negligible and discountable impacts on PCEs of designated critical habitat on Los Trancos and San Francisquito creeks for CCC steelhead in the action area.

Habitat impacts, including effects to designated critical habitat, due to project construction are expected to be mostly temporary and minor disturbances to the streambed and flow of the streams. Project construction is not expected to impact riparian vegetation or the stream bank.

In summary, the proposed project is expected to result in minor and short term adverse effects to CCC steelhead and designated critical habitat during construction activities. The anticipated long-term effects of the project are beneficial to CCC steelhead and designated critical habitat by largely eliminating the impacts of Stanford's water diversions on stream flows important to

⁴ Anticipated mortality from electrofishing and dewatering combined may exceed 1 percent of the fish in the area dewatered.

ensuring listed salmonids can complete their life history cycle. The proposed action is not expected to appreciably reduce the likelihood of the survival and recovery of CCC steelhead.

VI. CUMULATIVE EFFECTS

NMFS is not aware of any future State or private activities that are reasonably certain to occur within the action areas.

VII. CONCLUSION

After reviewing the current status of CCC steelhead, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed construction of Stanford's SHEP, and operation of the Los Trancos Diversion and the San Francisquito Pump Station are not likely to jeopardize the continued existence of threatened CCC steelhead.

After reviewing the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed SHEP is not likely to result in the destruction or adverse modification of designated critical habitat for CCC steelhead.

VIII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps or Stanford for the exemption in section 7(o)(2) to apply. The Corps has continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions, or (2) fails to require its designees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or Stanford must report the

progress of the actions and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(I)(3)).

A. Amount or Extent of Take

The number of threatened steelhead that may be incidentally taken during construction at the Los Trancos Diversion is expected to be approximately 80 juvenile fish and limited to the pre-smolt juvenile life history stage. At the San Francisquito Pump Station, approximately 100 juvenile steelhead may be incidentally taken during fish collection and relocation activities. NMFS anticipates no more than two percent of the juvenile steelhead present in the project areas to be dewatered will be harmed or killed during relocation, dewatering, and construction activities.

The number of threatened steelhead that may be incidentally taken during the operation and maintenance of the Los Trancos Diversion and the San Francisquito Pump Station is expected to include the juvenile and smolt life stages of CCC steelhead. However, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take of CCC steelhead. The precise number of fish cannot be accurately quantified due to: (1) the number of adult steelhead that may be migrating and spawning in San Francisquito and Los Trancos creeks in each year is unknown; (2) the precise number of juvenile steelhead rearing below Stanford's intakes is unknown; and (3) the precise number of outmigrating smolts from the watershed is unknown. Therefore, the water quality and habitat conditions for various steelhead life stages that would result from implementation of Stanford's Operations and Bypass Procedures for each facility shall serve as an ecological surrogate for the anticipated amount of incidental take associated with the on-going operation of Stanford's Los Trancos Diversion and San Francisquito Pump Station. Stanford's Operations and Bypass Procedure for the Los Trancos Diversion facility consist of the following:

- a) Stanford will not divert from Los Trancos Creek, under any basis of right, between May 1 and November 30.
- b) Diversions at the Los Trancos Creek diversion facility will be limited to the period between December 1 and April 30, as follows:
 - i) The maximum instantaneous diversion rate will be limited to 40 cfs, less the simultaneous rate of flow diverted at the San Francisquito Creek facility.
 - ii) Beginning December 1, the instantaneous bypass will not be less than 2 cfs (or natural flow, if less than 2 cfs).
 - iii) Beginning January 1, or earlier if the "trigger" event described in paragraph c (below) occurs prior to January 1, the instantaneous bypass flows will not be less than 5 cfs (or natural flow, if less than 5 cfs) when creek flow upstream of the facility is less than 8 cfs, and will be 8 cfs when creek flow upstream of the facility is equal to or greater than 8 cfs for two hours.
- c) The "trigger" event for flows described in paragraph b.iii (above) occurs when the mean daily (*i.e.*, calendar day) creek flow above the Los Trancos Creek diversion facility is 8 cfs or more at any time after October 1.

Stanford's Operations and Bypass Procedure for the San Francisquito Pump Station consist of the following:

- a) Stanford will not divert from the San Francisquito Pump Station, under any basis of right, from July 1 through November 30.
- b) Consistent with paragraph c (below), the maximum instantaneous rate of diversion at the San Francisquito Creek pump station (whether to the Felt Lake/campus distribution system, to Lagunita, or to both systems simultaneously) will not exceed 8 cfs.
 - i) The maximum instantaneous rate of diversion to Lagunita will not exceed 4 cfs.
 - ii) From December 1 through April 30, Stanford may divert up to 8 cfs at the San Francisquito Pump Station, even if the instantaneous diversion amount is greater than the flows simultaneously bypassed at the Los Trancos Creek diversion facility, provided that the combined instantaneous diversions at the San Francisquito Pump Station and the Los Trancos Creek diversion facility do not exceed 40 cfs.
- c) From December 1 through June 30, the instantaneous bypass flows and the maximum instantaneous rate of diversion at the San Francisquito Pump Station will be as described in Table 1.

Table 1: Diversion rates proposed at the San Francisquito Pump Station. Q_{SF} is the abbreviation for flow, in cubic feet per second (cfs), in San Francisquito Creek above the pumping plan.

Q_{SF} cfs	Diversion cfs
0 - 5	0
6	1
7	2
8	3
9	4
10	5
11	6
12-16	0
17	1
18	2
19	3
20	4
21	5
22	6
23	7
24-33	8
34-40	0 ^a
41-46	4 ^a
47+	8
^a Max diversion rate could be increased to 8 cfs over this range of flow if the Bonde Weir is modified to successfully and efficiently pass adult steelhead at flows of 16 to 100 cfs. (Modification of the Bonde Weir is not included in the SHEP.)	

NMFS anticipates operation of the project in conformance with the above Operations and Bypass Procedures will maintain instream flow conditions in a manner that adequately protects and conserves habitat downstream of Stanford's water diversions. If Stanford's operation of the Los Trancos Diversion or the San Francisquito Pump Station creates flow conditions which deviate from the Operations and Bypass Procedures, the anticipated level of incidental take caused by the proposed action will be exceeded.

B. Effect of the Take

In the accompanying biological opinion, NMFS has determined that the anticipated take is not likely to result in jeopardy to CCC steelhead.

C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of CCC steelhead:

1. Undertake measures to ensure that harm and mortality to listed steelhead resulting from fish relocation and dewatering activities is low.
2. Undertake measures to minimize harm to listed steelhead during and resulting from construction of the project.
3. Monitor operation of the Los Trancos Diversion and the San Francisquito Pump Station to ensure streamflows below the water intakes conform with the Operations and Bypass Procedures.
4. Prepare and submit a report to document the effects of construction and relocation activities and performance.
5. Prepare and submit an annual report regarding Los Trancos Diversion and San Francisquito Pump Station operations and fish bypass flows.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps and Stanford must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The following terms and conditions implement reasonable and prudent measure 1:
 - a. The applicant shall retain qualified biologists with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. The applicant shall identify to NMFS the personnel designated to conduct the fish relocation activities described in this opinion prior to project commencement and confirm their experience through resumes or other evidence of their accomplishments. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to the *NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act, June 2000*. See: <http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf>.

- b. The biologists shall monitor the construction sites during placement and removal of cofferdams, channel diversions, and access ramps to ensure that any adverse effects to salmonids are minimized. The biologists shall be on site during all dewatering events to capture, handle, and safely relocate ESA-listed salmonids. The Corps or the biologist shall notify NMFS biologist Gary Stern at (707) 575-6060 or Gary.Stern@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.
 - c. ESA-listed fish shall be handled with extreme care and kept in water to the maximum extent possible during rescue activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream, and fish shall not be removed from this water except when released. To avoid predation, the biologists shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location in which suitable habitat conditions are present to allow for adequate survival of transported fish and fish already present.
 - d. If any salmonids are found dead or injured, the biologist shall contact NMFS biologist Gary Stern by phone immediately at (707) 575-6060 or the NMFS Santa Rosa Area Office at 707-575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS Santa Rosa Area Office without obtaining prior written approval from the NMFS Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.
2. The following terms and conditions implement reasonable and prudent measure 2:
- a. The Corps shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the project sites during activities described in this opinion.
 - b. Once construction is completed, all project-introduced material (pipe, gravel, cofferdam, sandbags, *etc.*) must be removed, leaving the creeks as they were before construction. Excess materials will be disposed of at an appropriate disposal site.

- c. Construction equipment used within the creek channels will be checked each day prior to work within the creek channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel (top of bank to top of bank), the Corps, the permittee, or their contractor will contain the spill and remove the affected soils.
 - d. All pumps used to divert live stream flow, outside the dewatered work area, will be screened and maintained throughout the construction period to comply with NMFS' *Fish Screening Criteria for Anadromous Salmonids*. See: <http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf>.
 - e. In areas where concrete is used, a dry work area must be maintained to prevent direct contact between curing concrete and the surface waters of adjacent streams at all times. Water that inadvertently contacts uncured concrete must not be discharged into surface waters. All concrete shall be poured in the dry and shall be allowed to cure a minimum of seven (7) days before contact with water.
3. The following term and condition implements reasonable and prudent measure 3:
- a. Stanford shall develop and install a system for accurately measuring daily stream flows on Los Trancos Creek and San Francisquito Creek including the amount of bypass flow downstream of these water intakes. Gage design plans shall be submitted to NMFS for review and approval by September 15, 2008. The stream gaging systems shall be operational no later than October 15, 2009.
4. The following term and condition implements reasonable and prudent measure 4:
- a. The Corps or permittee shall provide a written report to NMFS by January 15 of the year following construction of the project. The report shall be submitted to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The reports shall contain, at a minimum, the following information:
 - i. **Construction related activities** -- The report shall include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any effect on ESA-listed fish; the number of salmonids killed or injured during the project action; and photographs taken before, during, and after the activity from photo reference points.

ii. Fish Relocation -- The report shall include a description of the locations from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electrofisher was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

5. The following term and condition implements reasonable and prudent measure 5:

a. Stanford shall provide a written report to NMFS by August 15 of each year regarding Los Trancos Creek stream flow conditions at the Los Trancos Diversion facility and San Francisquito Creek stream flow conditions at the San Francisquito Pump Station. The report shall be submitted to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The reports shall contain, at a minimum, the following information:

- i. Los Trancos Diversion Operations.** The report shall include the dates water diversion began and was completed; daily water diversion rates, and total annual diversion volume.
- ii. Los Trancos Fish Bypass Flows.** The report shall include the daily average stream flow of Los Trancos Creek immediately downstream of the water intake. The report shall be organized by water year and Stanford's diversion season (*i.e.*, December 1 through April 30) with daily average stream flow rates for each day of the diversion season.
- iii. San Francisquito Pump Station Operations.** The report shall include the dates water diversion began and was completed; daily pumping rates, and total annual pumping volume.
- iv. San Francisquito Pump Station Fish Bypass Flows.** The report shall include the daily average stream flow of San Francisquito Creek immediately downstream of the water intake. The report shall be organized by water year and Stanford's diversion season (*i.e.*, December 1 through June 30) with daily average stream flow rates for each day of the diversion season.

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and

threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or to develop information.

- (1) The Corps should work collaboratively with Stanford, the San Francisquito Watershed Council and other property owners in the San Francisquito watershed, and NMFS to remedy fish passage impediments for steelhead in Los Trancos Creek and San Francisquito Creek.
- (2) The Corps should work collaboratively with Stanford, the San Francisquito Watershed Council, NMFS and other interested parties in the San Francisquito watershed to restore fish passage at Searsville Dam on San Francisquito Creek.

X. REINITIATION NOTICE

This concludes formal consultation on the proposed construction of Stanford's modifications to the Los Trancos Diversion facility and the San Francisquito Pump Station on the Stanford University Campus, California. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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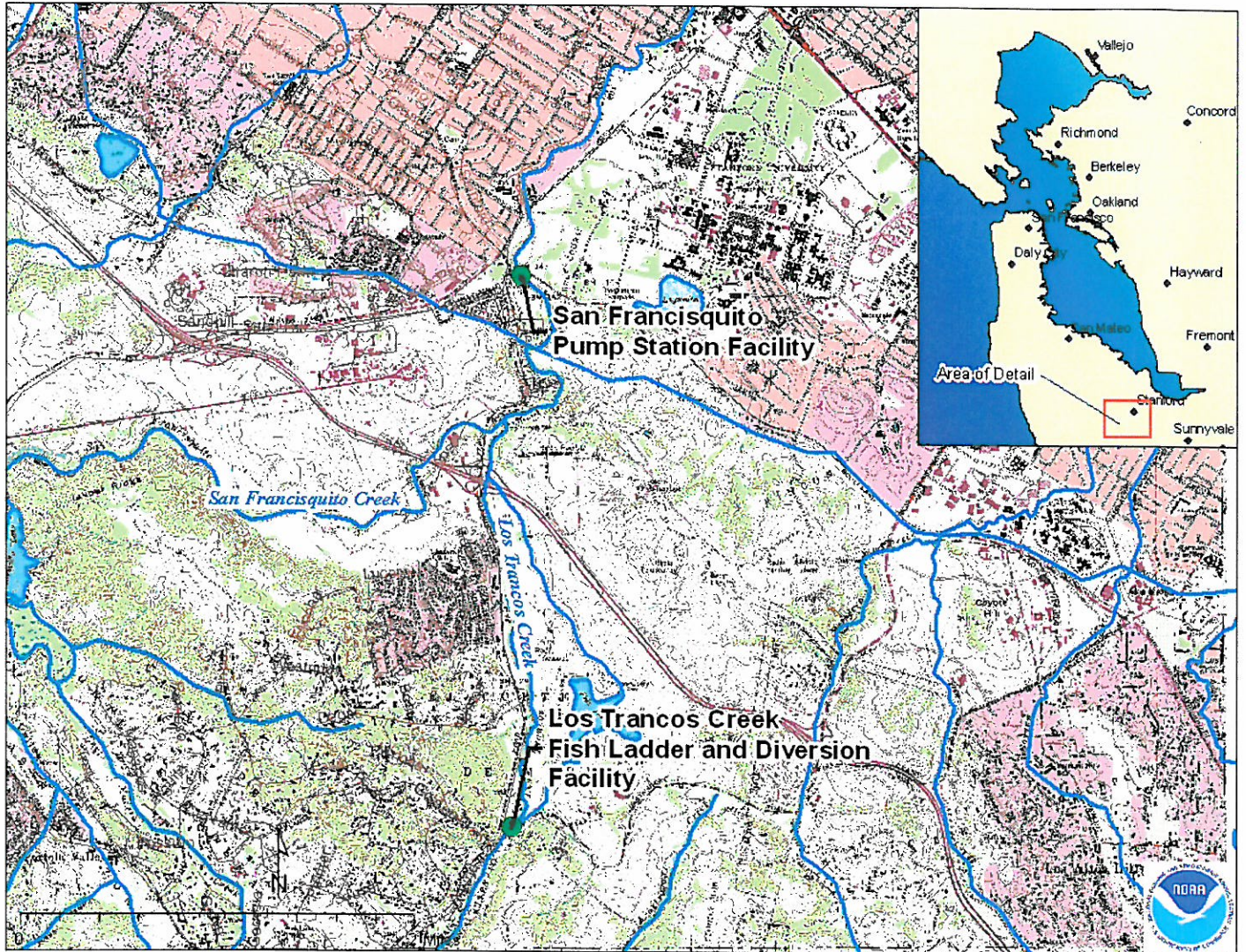


Figure 1. Map of the project area, including the locations of the Los Trancos Creek Fish Ladder and Diversion Facility and the San Francisco Pump Station Facility.