Appendix C

Preliminary Analysis of Potential Impacts on Fish in Marsh Creek

Jones & Stokes

[*Note to Reader: The HCPA is currently in discussions with NOAA Fisheries regarding the potential effects of the covered activities and what conservation measures could be incorporated into the Plan to minimize effects and avoid taking these species. We provided this memorandum to them to begin discussions about potential impacts. In preliminary discussions, NOAA-Fisheries has agreed with our conclusion that anadromous fish likely do not need to be covered by this Plan.*]

Memorandum

Date: July 3, 2003

To: Susan Boring, NOAA Fisheries

cc: East Contra Costa County Habitat Conservation Plan Association, c/o John Kopchik, Contra Costa County Community Development Department

From: Jim Robins and Warren Shaul

Subject: **Preliminary Impact Analysis for Salmonids in the East Contra Costa County HCP/NCCP**

This memorandum summarizes the framework, methods, and results of the preliminary impact analysis for salmonids in the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP). Specific species addressed in this analysis include the Central valley fall-run chinook salmon (*Onchorhynchus tshawytscha)*, a federal candidate species, and the federally threatened Central California Coast steelhead (*Oncorhynchus mykiss)*. Prior to delving into the methods and results of the impact analysis, this memorandum also provides an overview of the HCP/NCCP process and a discussion of both the known extent and potential habitat for salmonids within the Inventory Area (see Appendix A for Inventory Area boundaries).

HCP/NCCP Background

Eastern Contra Costa County is one of the fastest growing regions in the state, with a population that is predicted to grow by 127,000 people by 20251. Much of this growth will occur on rangelands and irrigated crop lands and will displace a variety of natural habitats, including valley floor and foothill grassland, oak woodland, oak woodland savannah, chaparral, riparian woodland, emergent wetland, and vernal pool habitat. Anticipated growth could also threaten key habitat corridors needed to protect a variety of state and federally listed threatened and

1 ABAG, Projections 2002. By 2025, the populations of Brentwood, Oakley, Pittsburg, and Antioch are expected to grow by 123%, 57%, 52%, and 30%, respectively.

endangered species. Approximately 154 special-status species occur or could occur in the East County area, including the San Joaquin Kit Fox, California Red-Legged Frog, Alameda Whipsnake, Golden Eagle, Western Burrowing Owl, Vernal Pool Fairy Shrimp, and Diablo Helianthella. The East County area is also home to productive agricultural lands, including intensively cultivated areas with high quality soils in lower elevations and productive grazing lands in the hills that cover a large part of the region. Agriculturalists depend on these lands for income and as an important investment.

Conflict between these different land uses or community values is, to some extent, unavoidable. However, coordinated conservation planning offers an opportunity to reduce the level of conflict and to uncover mutually acceptable approaches to these problems.

In an effort to realize coordinated conservation planning, a number of key stakeholders in East County have come together to develop the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan. The mission statement, below, outlines the broad goals of this effort.

> The East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan will provide comprehensive species, wetlands and ecosystem conservation and contribute to recovery of endangered species within East Contra Costa County, while:
>
> - balancing open space, habitat, agriculture, and urban development;
> - reducing the cost and increasing the clarity and consistency of federal and state permitting by consolidating and streamlining these processes into one, locally controlled plan,
> - encouraging, where appropriate, the multiple use of protected areas, including recreation and agriculture,
> - sharing the costs and benefits of the habitat conservation plan as widely and equitably as possible, and
> - protecting the rights of private property owners.

In addition to these broad goals, the East Contra Costa County HCP/NCCP has also developed a draft list of biological goals and objectives. The goals and objectives for wetlands and streams habitats (*Goal 1. Establish and maintain a reserve system that maintains and enhances the processes, functions, and values of wetlands, ponds, and streams and the biological diversity*

they support) and riparian woodland/scrub habitats (*Goal 5. Establish and maintain a reserve system that maintains and enhances the processes and functions of the full variety of the riparian woodland/scrub community and the biological diversity it supports*) contained in the draft HCP/NCCP are directly related to conservation of stream biota, and as such should frame the following discussion of impacts on salmonids. See Appendix B for a complete list of Goal 1 and Goal 5 objectives related to conservation of stream biota.

Background on Salmonid Issues in Eastern Contra Costa County

In November 2001, adult chinook salmon were observed in lower Marsh Creek, near Oakley in Contra Costa County. Chinook salmon were also observed in lower Marsh Creek during fall and winter 2002 (Walking, pers comm.). Prior to these observations, anecdotal evidence from local fishermen and staff with the East Bay Regional Park District and Contra Costa Water District indicated the presence of chinook salmon in lower Marsh Creek during the late fall and early winter over the past decade.

After confirmation of Chinook salmon use in 2001, Erika Cleugh of the California Department of Fish and Game documented the presence of juvenile Chinook salmon in Marsh Creek through seining studies conducted in March 2002. The size of the juveniles collected (40–60mm) indicates that these fish were likely fall-run progeny (Cleugh, pers. comm.).

Chinook salmon are likely to be restricted to the lower 4 miles of Marsh Creek by a drop-structure adjacent to the Brentwood Wastewater Treatment Plant between Delta and Sunset Roads. Due to the size of this drop-structure (approximately 6 ft from stream invert to top), it is possible that fish may be able to pass upstream during high flows. Lower Marsh Creek is a channelized flood control channel and lacks riparian vegetation and/or instream habitat complexity. Adjacent land uses include urban development, cropland, and open fields of ruderal vegetation. Nonetheless, the lower reaches of Marsh Creek provide habitat for Central Valley fall-run chinook salmon, possibly supporting adult migration, spawning, incubation, and rearing. NOAA Fisheries has determined that listing of the Central Valley fall and late fall-run chinook salmon ESU under the federal Endangered Species Act (ESA) is not warranted at this time; it currently considers this ESU a candidate species (Federal Register: September 16, 1999).

Central Valley steelhead trout, listed as threatened under the federal ESA, may also use Marsh Creek. However, steelhead have not been found in Marsh Creek or elsewhere in the Inventory Area (Cleugh pers. comm.). Critical habitat for Central Valley steelhead includes all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. Marsh Creek may be considered part of the designated critical habitat for steelhead; however, the critical habitat designation is currently under review by NOAA

Fisheries.

Covered activities under consideration for inclusion in the East Contra Costa County HCP/NCCP do not include construction within the stream. However, covered activities within the Marsh Creek watershed could affect chinook salmon and steelhead and their habitat. Proposed development, particularly in Antioch and Brentwood, has the potential to adversely affect the water quality (e.g., sediment load, temperature, chemical pollutants) and hydrology (e.g., timing, duration, and magnitude of flows) of Marsh Creek. The HCP/NCCP will include conservation measures and mitigation to address these potential impacts through stormwater runoff control plans, flood attenuation strategies, and the development of stream buffers to maintain opportunities for restoration and reduce future encroachment.

Our preliminary impact analysis indicates that implementation of the measure articulated in the draft conservation strategy and adherence to the new C.3 Provisions of the County's Regional NPDES Permit would reduce the effects of HCP/NCCP-covered activities on Marsh Creek water quality and hydrology such that take of any special-status fish would be avoided. The operating assumption is that there will be no need to include steelhead or chinook salmon as covered species in the HCP/NCCP.

This memorandum should be a springboard for informal discussions with NOAA Fisheries to verify that the HCP/NCCP conservation/mitigation measures will adequately protect steelhead and/or chinook salmon in the Marsh Creek watershed and that inclusion of these species in the HCP/NCCP is unnecessary.

Overview of Current Habitat Conditions for Salmonids in Marsh Creek and Its Main Tributaries, Deer Creek and Sand Creek

These observations represent a collection of field visits (approximately 20) by Jones & Stokes resource ecologist, Jim Robins, and fisheries biologist, Francine Mejia. These visits occurred between June 2000 and August 2002 and include observations of the lower and upper creek and some sections of two tributaries of Marsh Creek: Deer Creek and Sand Creek.

Adult Migration

Marsh Creek is channelized with limited riffle-pool complexes. Current occurrence of anadramous fish is restricted to the lower 4 miles of Marsh Creek from its mouth at Big Break to the Brentwood Wastewater Treatment Plant. Upstream passage is currently blocked by the approximately 6-foot-high drop-structure adjacent to the Brentwood Wastewater Treatment Plant, between Delta and Sunset Roads. Conservative vertical limit for adult fish is 4.5 feet for

steelhead and 3.0 feet for chinook salmon; fish passage is best facilitated by jumps of 1 foot or less. If the drop-structure were removed or modified,[2] chinook salmon and steelhead could move farther upstream to the Marsh Creek Dam, providing 7 to 8 miles of additional stream channel. Surface flows in the reaches just below Marsh Creek Dam are likely a result of leakage and underflow from the dam. Although surface water was observed in this reach in August 2002, flow was intermittent during summer 2001.

Most of the flow in lower Marsh Creek is provided by return flows from agricultural lands within the watershed. Water used for irrigation is diverted from the Delta and may contribute to straying of hatchery chinook and steelhead from other systems (e.g., Feather River).

During the summer months, Sand Creek often provides upwards of 50 percent of the instream flow in Marsh Creek. Like Marsh Creek flows, flow in Sand Creek is provided by agricultural return flow. Due to limited instream barriers along Sand Creek, field reconnaissance was conducted to ascertain whether suitable over-summering habitat for steelhead was available in the upper reaches of Sand Creek. Field reconnaissance with East Bay Regional Park District staff in Black Diamond Mines Regional Preserve indicated a lack of suitable habitat in the headwaters of Sand Creek.

Summer water temperature in Marsh Creek, measured in August 2002 about 50 feet downstream of the drop-structure, was about 78°F at approximately 3:00 PM.

Spawning and Incubation

Spawning gravel within the lower 4 miles of Marsh Creek is very limited. The streambed is composed mainly of rip-rap and sand. The substrate immediately downstream and upstream of Marsh Creek Dam appears more suitable for spawning. Gravel substrates ranging from 1 to 4 inches provide optimal spawning habitat (Raleigh et. al., 1986). At the John Marsh House, approximately 1 mile downstream from the dam, the average diameter of gravels was greater than 4 inches, but there were some small patches (less than 100 feet) with gravel of 1 to 2 inches diameter. There were other locations upstream of Marsh Creek Dam that had substrate with gravels of 1 to 2 inches in diameter.

Juvenile Rearing

Environmental conditions such as water temperature, substrate, area, water velocity, water depth, and cover are major factors affecting the quantity and quality of rearing habitat.

[2] Current efforts are underway with funding from NOAA Fisheries and American Rivers to assess the potential for modification and/or removal of this structure

Juvenile chinook salmon rear in riffles, runs, pools, and inundated floodplains before their downstream migration. Juvenile steelhead are year-round residents and generally use riffles and runs in the main and secondary channels, along with the heads and tails of pools. Shallow riffles are the most important channel type for steelhead during their first year (Barnhart 1986).

The lower 4 miles of Marsh Creek are channelized with some riffle-pool complexes and limited overhead and instream cover. Large vegetation has been removed for flood control. Scirpus, marsh primrose, and tules are the most common type of emergent vegetation. Water depth is approximately 1 to 4 feet in most of the channel, but there are also some shallower areas. Most of the instream cover is provided by rip-rap. Water temperature at about 3:30 p.m. was between 72°F and 78°F, depending on location. Steelhead can show significant mortality at temperatures exceeding 77ºF (25ºC) (Raleigh et. al., 1984, Myrick and Cech 2001). Steelhead would not be expected to successfully rear in Marsh Creek because Marsh Creek exceeds steelhead water temperature requirements during the summer months.

Juvenile Movement and Migration

Juvenile downstream movement does not seem to have any major barriers or any risks of being entrained or diverted. The stream has been channelized and provides limited refugia from predators. Rip-rap, tules, and scirpus species are the major sources of cover. Rip-rap is known to provide habitat for non-native predatory fish species such as sunfish and largemouth bass.

Preliminary Impact Analysis

The impact analysis of an HCP or NCCP has two primary purposes: 1) to clearly identify the impacts to covered species and natural communities from covered activities and projects, and 2) to define what impacts must be mitigated in the conservation strategy. Impact analyses are required components of HCPs and NCCPs, and the regulatory agencies will issue their permits based, in part, on the adequacy of the impact analysis. This analysis will include a discussion of types of impact, the relationship between impacts and take, and covered activities and draft conservation measures.

Types of Impacts

The impact analysis in the HCP/NCCP will focus on three primary types of impacts: 1) direct impacts, 2) indirect impacts, and 3) cumulative impacts.

Direct Impacts
Direct impacts are those that remove habitat for covered species or populations (or portions of populations) of covered species. Direct impacts can be either permanent or temporary. Direct impacts on salmonids resulting from covered activities could include the following:

- Filling, rerouting, or culverting streams;
- Removal of riparian vegetation and/or other types of stream cover;
- Operation, maintenance, and construction of flood control channels; and
- Temporary affects from riparian and/or stream restoration activities

Indirect Impacts.
The U.S. Fish and Wildlife Service (USFWS) defines *indirect impacts* as "those that are caused by the proposed action and are later in time, but are still reasonably certain to occur" (50CFR 402.02). Our definition of indirect impacts also includes impacts that occur at the time of the proposed action but occur beyond the footprint of a project or activity (i.e., beyond the area of land disturbance). The HCP/NCCP must consider the indirect impacts in its impact analysis and mitigate these impacts to the maximum extent practicable.

Potential indirect impacts to salmonids include:

- Increased runoff from urban development that may contain pollutants,
- Increased peak flows and resultant bank erosion from urban development,
- Increased sediment (or other pollutant) inputs during construction,
- Harassment or disturbance from the larger human population, and
- Harassment from additional pet populations.

Cumulative Impacts
Cumulative impacts result from the proposed action's incremental impacts added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them. Cumulative impacts can result from individually minor but collectively significant actions that take place over time. The HCP/NCCP will consider the cumulative effects of covered projects and activities because of the requirement to address this issue under the California Environmental Quality Act (CEQA), the National Environmental

Policy Act (NEPA), and Section 7 of the Endangered Species Act (ESA). For cumulative impacts on salmonids, the HCP/NCCP covered activities will likely capture the vast majority of potential impacts over the next 20 to 50 years. Moreover, the majority of future projects outside of the direct scope of HCP/NCCP and within the range of the salmonids in east County are restoration projects; such projects would likely have a net-positive impact on salmonids. These projects include removal/modification of the Marsh Creek drop-structure, restoration of an active floodplain and riparian gallery in central Brentwood at the confluence of Marsh and Sand creeks, and acquisition and restoration of 1,200 acres of tidal marsh and floodplain habitat adjacent to Marsh Creek just north of the Contra Costa Canal. Thus, analysis of cumulative impacts is limited to expansion of accessible habitat from the existing 4 miles to the entire 11 miles of stream downstream of the dam. A more in-depth analysis of cumulative impacts will be added to the impact analysis for the administrative draft HCP/NCCP.

Relationship between Impacts and Take

This impact analysis focuses on ascertaining whether the potential impacts resulting from covered activities rise to the level of "take" as defined by the Federal Endangered Species Act. *Take* is defined under the ESA as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. 1532[19]). The potential impacts fall into three broad categories: 1) hydrograph modification, 2) degraded water quality, and 3) removal/alteration of habitat. The resulting potential take would therefore likely be "harm" or "kill." While the definition of *kill* is self-explanatory, the definition of *harm* has been controversial. NOAA Fisheries defines harms as, "…an act that actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, and sheltering" (National Marine Fisheries 1999). Thus, for this impact analysis, an impact will rise to the level of take if it leads to death or injury to salmonids occurring in the Inventory Area.

Covered Activities and Conservation Measures

A key component of the impact analysis is a clearly defined set of covered activities and covered projects. In the best case scenario, the location, intensity, duration, and frequency of covered activities and projects are well defined. This level of detail is typically not possible in a regional HCP with a relatively long permit duration because of the uncertainty in future development patterns on such a large scale. The permit duration for this HCP/NCCP is estimated to be 30 years, which is a relatively long period. Although the HCP Authority (HCPA) has not yet clearly defined the location or type of activities that will be covered in this HCP/NCCP, the preliminary activities listed in Table 1 will provide the basis for this impact analysis. Only a limited subset of potential covered activities might impact salmonids in Eastern Contra Costa

County. Although ambiguity remains regarding the extent and location of future growth in East County, this impact analysis only addresses impacts to salmonids and thus has a discrete geographic scope: Marsh Creek, downstream of the Marsh Creek Dam, and Sand Creek (tributary to Marsh Creek).

Table 1. List of Likely Covered Activities

1.	Residential, commercial, and industrial development
2.	Road and highway construction and maintenance
3.	Water infrastructure construction and maintenance
4.	Flood control project construction and maintenance
5.	Population surveys, species relocation, habitat restoration, management, and scientific research on preserve lands or potential preserve lands
6.	Sanitary system infrastructure construction and maintenance
7.	Rural recreational facility construction, maintenance, and operation
8.	Recreational use of rural parks and preserves
9.	Miscellaneous development outside the Urban Limit Line
10.	Population surveys, species relocation, habitat restoration, management, and scientific research on preserve lands or potential preserve lands

Although a number of the covered activities could potentially have an impact on riparian and/or stream habitats, covered activities such as habitat restoration (Activity 5 in Table 1) will have a net-positive effect on these habitats and consequently a net-positive effect on salmonids. Specific restoration actions might include reestablishing channel sinuosity, reconnecting channels and floodplains, removing fish passage barriers, and planting of woody riparian vegetation. The HCP/NCCP will provide funding to support ongoing restoration efforts, including removal of the Marsh Creek drop-structure and restoration of the floodplain at the confluence of Marsh Creek and Sand Creek. In addition, draft conservation measures clearly articulate protection of perennial streams such as Marsh Creek and Sand Creek. The following measures avoid direct impacts to stream and riparian habitat.

- Avoid all streams and riparian woodland/scrub within the Inventory Area to the maximum extent practicable.

- Avoid all unconfined, perennial creeks (Marsh Creek and Sand Creek).

- Create a 100-foot stream setback for all new development on protected streams (Marsh Creek, Sand Creek, and others), measured from the top of bank or outboard dripline of existing riparian vegetation.

- Implement 1:1 restoration goal to ensure no net loss of streams anywhere in the Inventory Area.

- Avoid temporary direct impacts on streams and riparian woodland/scrub during construction or other temporal activities. This will be accomplished by staking of appropriate buffers by a qualified biologist. Temporary fencing will be erected around these resources as well as a suitable buffer zone depending on the resource extent, quality, site conditions, and planned activity. For example, construction activities using heavy equipment will require a wider buffer zone (e.g., 50 to 100 feet) than an on-going activity such as clearing vegetation for a fuel brake (e.g., 20-foot buffer zone).

- Implement a restoration timing window to ensure that restoration and enhancement efforts along Marsh Creek, downstream of the dam, are conducted between April 30 and October 1 to avoid direct impacts on salmonids.

In addition to these conservation measures, the HCP/NCCP will require all covered activities to meet the NDPES standards articulated in the county's regional permit. This permit was reissued by the Regional Water Quality Control Board (RWQCB) in February of 2003 and reflects changes mandated by "Bellflower Decision." In essence, this decision forced the regional boards throughout the state to amend or reissue regional National Pollutant Discharge Elimination System (NPDES) permits to incorporate measures to address increases in pollutant load and both volume and velocity of stormwater runoff generated by urban development. These new measures require the following:

- treatment measures that capture and treat and/or infiltrate stormwater runoff (the permit describes acceptable procedures for designing facilities);

- development and implementation of an operations and maintenance verification program for treatment measures;

- management of peak runoff flow and runoff volume for projects where increased flow and/or volume is likely to cause increased erosion of creek beds and banks, silt pollution generation, or other impacts to beneficial uses due to erosive force;

- development and implementation of a Hydrograph Modification Management; and

- amendments to general plans to ensure consistency with C.3. provisions.

In addition, these measures address infiltration and groundwater quality and provide guidance and standards for reviewing and revising local site design criteria, guidance, and standards for enhanced source control measures, and guidance for developing an alternative compliance compensatory mitigation program. See Appendix C for a more detailed explanation of the provisions of Contra Costa County's new NDPES permit.

Although the NPDES permit provisions provide adequate protections to reduce the potential for impacts of new development on salmonids, we have added a few additional measures to ensure that all activities, not just new development and redevelopment, are implemented in a way that reduces potential impacts. Draft measures include the following:

- Parking construction vehicles and equipment on pavement, existing roads, and previously disturbed areas;

- Prompt and proper removal of all trash generated by covered activities from the site;

- No vehicle refueling within 100 feet of wetlands, ponds, streams, or riparian woodland/scrub unless a bermed and lined refueling area is constructed;

- Creation of appropriate erosion control measures (e.g., hay bales, filter fences, vegetative buffer strips) to reduce siltation and runoff of contaminants off-site and into wetlands, ponds, streams, or riparian woodland/scrub;

- Use of certifiably weed free hay bales for erosion control;

- Application of seed mixtures for erosion control that do not intentionally contain invasive non-native species, and that are composed of native species to the extent feasible;

- Locating stream crossings in stream segments without riparian vegetation and building bridge footings outside the ordinary high water mark of these streams;

- Prohibiting herbicide application, within 100 feet of wetlands, ponds, streams or riparian woodland/scrub.

Lastly, new sewage treatment plants will need to obtain project-specific NPDES permits from RWQCB. In fact, water quality measurement in Marsh Creek during fall 2001 revealed that water discharged from the Brentwood Wastewater Treatment Facility had higher dissolved oxygen, lower temperature, and lower total dissolved solids than samples from Marsh Creek upstream from the outfall (Lindemuth, pers. comm.).

As such, the combination of stringent NPDES permit conditions for all new development and redevelopment projects, the adherence to those standards for all covered activities in the HCP/NCCP, and the additional conservation measures articulated above will result in complete mitigation of any potential indirect impacts resulting from hydrograph modification and/or degraded water quality.

Potential for Take of Salmonids

Preliminary synthesis of the potential impacts to salmonids resulting from covered activities in this HCP/NCCP indicates that the majority of impacts could result from the following mechanisms: direct impacts from habitat destruction or modification, and indirect impacts from degradation of water quality and modifications to the local hydrograph. In addition to these mechanisms, this impact analysis will be informed by three key pieces of information: 1) species life history, 2) extent of potential suitable habitat, and 3) condition of existing habitat. The two key salmonid species covered in this impact analysis differ in both their life history strategies and their potential utilization of the Marsh Creek system. Therefore, impacts and the potential for take will be addressed independently for each species.

Central Valley Steelhead Trout

Potential Impact

Central Valley steelhead trout are the only listed salmonid that may occur in the lower reaches of Marsh Creek below the Marsh Creek drop-structure. Although limited fisheries surveys have been conducted along the lower reach of Marsh Creek, there are no empirical data to support the hypothesis that steelhead enter Marsh Creek. Anecdotal evidence suggests that adult steelhead may occasionally enter lower Marsh Creek (Cleugh pers. comm., Robins pers. comm.), but no conclusive observation have been made in this system. As described above, the lower reaches of Marsh Creek are a trapezoidal earthen flood control channel, lacking riparian vegetation and containing extremely limited instream cover (eroded rip-rap). This habitat is not suitable for spawning or over-summering for steelhead.

Regardless of whether this species does occasionally enter the lower part of this system, extensive habitat surveys indicate that no suitable spawning, rearing, or over-summering habitat would be accessible to steelhead trout once they enter the Marsh Creek system. If they were able to pass the lower Marsh Creek drop-structure, Marsh Creek Dam, approximately 11 miles upstream from the creek's mouth, would still block passage to suitable habitat in the upper watershed.

Resulting Potential for Take

Our preliminary impact analysis indicates that the potential impacts to Central Coast steelhead trout (direct, indirect, or cumulative) resulting from covered activities in this HCP/NCCP would not rise to the level of take as defined in ESA and applied by NOAA Fisheries.

Fall-Run Central Valley Chinook Salmon

Potential Impact

Unlike steelhead, fall-run Central Valley chinook salmon are not currently listed under the ESA. However, fall-run Central Valley chinook are considered a federal candidate species. We therefore we believe that potential take should be analyzed within the context of an HCP with a permit duration of between 20 and 50 years.

To assess potential impacts to this species, it is important to understand the key life history strategies of fall-run chinook. This species typically utilizes mainstem river channels and associated floodplains for spawning and rearing. Unlike steelhead that over-summer in natal streams, fall-run chinook adults will *typically* enter Central Valley systems between September and November, and juveniles/smolts out-migrate between February and April. Central to this life history strategy is the fact that successful reproduction of this species does not require over-summering habitat within the natal stream. Thus, although the currently accessible habitat in lower Marsh Creek exhibits high summer water temperatures, limited in-stream cover, and non-existent riparian cover, this degraded stream may provide suitable habitat for both spawning and rearing (see discussion above under Spawning and Incubation for details on spawning). In addition, if the lower Marsh Creek drop-structure were removed, fall-run chinook would have access to suitable spawning habitat (e.g., inundated gravels, channel with average depth over 2.5 ft, and heavy riparian canopy) in the 2 plus miles of Marsh Creek directly downstream of the Marsh Creek Dam. Therefore, for this analysis we define the habitat in the Marsh Creek system as Marsh Creek downstream of the dam and Sand Creek.

Because of the presence of this species in the lower 4 miles of Marsh Creek, the potential for this species to become federally listed during the permit term (20–50 years), and the high potential for this species to gain access to suitable upstream habitat following modification/removal of the Marsh Creek drop-structure, we believe that this species requires a full assessment of potential

impacts.

Although the entire Marsh Creek channel downstream of Dry Creek (8 miles) is a highly modified flood control channel, direct impacts on fall-run chinook salmon could result from further channelization, culvert installation, and/or flood control activities. Any and all of these modifications to the existing channel could impact the existing pockets of habitat in the lower 4 miles of Marsh Creek and/or reduce the potential for future upstream migration. Moreover, modification and encroachment in the 2 plus miles of Marsh Creek between Dry Creek and the Marsh Creek Dam could have an adverse impact on potential suitable spawning and rearing habitat for Chinook salmon. Finally, efforts to restore and/or enhance sections of lower Marsh Creek, downstream of Dry Creek (i.e. the flood control channel), could result in temporary direct impacts to migration, spawning, and/or rearing habitat for this species.

Our analysis indicates that the draft conservation measures articulated above provide more than adequate protection for lower Marsh Creek and Sand Creek. In addition, the draft conservation measures specifically highlight Marsh Creek (below the dam) and Sand Creek as priority receptor sites for restoration activities. We therefore conclude that the existing conservation measures will reduce the potential for negative direct impacts to Chinook and in fact, provide a net benefit the species.

Implementation of this HCP/NCCP will allow development on existing agricultural and open space lands within the urban limit line in the Marsh Creek watershed. Because the Marsh Creek Dam currently functions as a major hydraulic and hydrologic barrier between the upper watershed and the lower watershed, it is unlikely that land use changes upstream of the Marsh Creek Dam would have significant indirect downstream impacts on fall-run Chinook (Robins and Cain 2002). On the other hand, development in the Deer Creek and Sand Creek watersheds and in-fill of existing agricultural land along lower Marsh Creek can have negative indirect impacts on downstream hydrology and water quality.

Increased development will result in increased impervious surfaces in the watershed. Increased impervious surfaces can lead to increased peak flows during storm events as runoff is rapidly conveyed across the landscape with limited potential for infiltration. Increased peak flows can negatively affect chinook salmon in a number of ways. First, increased peak flows can destroy or damage redds, leading to high levels of egg mortality. Second, increased peak flows can increase instream erosion leading to channel simplification and the degradation of existing pockets of potential habitat. Lastly, increased peak flows can result in injury and/or mortality of juveniles. In addition to the potential effect on peak flows, an increase in impervious surfaces generally leads to reduced infiltration and groundwater recharge. Reduced recharge can, in turn, lead to lower baseflows, which might adversely affect migration of adult fish and reduce potential spawning and rearing habitat in the system.

Indirect impacts to fall-run chinook salmon can also result from degradation of water quality in lower Marsh Creek. Particular water quality concerns include the introduction of urban and residential contaminants (hydrocarbons, pesticides, herbicides, etc.) into Marsh Creek and its tributaries, and increased sediment loading resulting from upland earth disturbance.

The final potential indirect impact to fall-run chinook salmon would be the effects of removal of riparian habitat in the 2 plus mile stretch of Marsh Creek between Dry Creek and the Marsh Creek Dam. Removal of this vegetation could lead to reduced bank stability, increased water temperatures, sedimentation of gravels, and a general reduction in instream habitat complexity. Although this reach is not currently accessible to salmonids, it is likely to become accessible within the duration of the HCP permit.

Our analysis indicates that adherence to the C.3. provisions of the county's NDPES permit will ensure that potential indirect impacts are mitigated. In addition, restoration actions such as reestablishing channel sinuosity, reconnecting channels and floodplains, and excavating and revegetating floodplains and riparian areas will further reduce the potential impacts from covered activities and will have a net-positive impact on both red survival (by reduced channel scouring) and juvenile rearing (by access to refugia during high flows and increased rearing habitat).

Resulting Potential for Take

Incorporation of the conservation measures articulated above, together with the restoration action included in the covered activities, will ensure that none of the potential direct and indirect impacts resulting from this HCP/NCCP will rise to the level of take for fall-run Central Valley Chinook salmon. In fact, this analysis indicates that implementation of the HCP/NCCP will have a net-positive effect on fall-run Central Valley chinook salmon.

Conclusion

Although residential development and the associated infrastructure will result in the modification or loss of existing wildland and agricultural habitat in Eastern Contra Costa County, this HCP/NCCP has been designed to address species protection at a regional level and to provide adequate protection for special-status species. To determine the potential impacts of covered activities and the adequacy of the draft conservation measures on salmonid conservation, we reviewed the known information on salmonid use of the Inventory Area, surveyed reaches that could become accessible in the near future for suitable habitat, and analyzed the potential direct and indirect impacts that could result from covered activities. Results indicate that Central Coast steelhead are not likely to use any part of the Marsh Creek system downstream of the Marsh Creek Dam. There is currently no suitable spawning or over-summering habitat for this species downstream of the dam. Therefore, we do not believe that this species would be affected by any

of the covered activities or conservation measures contained in the HCP/NCCP. Therefore, take of steelhead will not result from implementation of this HCP.

However, we know that fall-run Central Valley chinook salmon currently migrate and rear in the accessible lower 4 miles of Marsh Creek. Although juvenile fish were observed in lower Marsh Creek during the out-migration season, there are no definitive data to suggest that these juveniles were either rearing in their natal stream or out-migrants from a Central Valley fishery such as the Feather River. Regardless of the origin of these juveniles, adult chinook salmon are attempting to spawn in Marsh Creek and juveniles are using the creek for rearing. This impact analysis identified potential positive and negative impacts to this species that could result from covered activities. This impact analysis indicates that implementation of stream and riparian restoration actions in lower Marsh Creek and Sand Creek, in combination with the draft conservation measures, stringent NPDES requirements for all new development and redevelopment projects, existing requirements for Streambed Alteration Permits, and project-specific NPDES Permits will have a net-positive impact on chinook. As such, we do not believe that implementation of this HCP/NCCP would constitute take of this species.

This document is a draft and all aspects of the HCP/NCCP are currently in draft form. We are asking NOAA Fisheries to review this impact analysis and to provide feedback to the HCP/NCCP team. We welcome any thoughts on additional impacts or mitigation.

References

Printed References

Barnhart, R.A.. 1986. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest). Biological report 82(11.60) TR EL-82-4. June.

Myrick, C.A. and J.J. Cech. Jr. 2001. Temperature Effects on Chinook Salmon and Steelhead: A review focusing on California's Central Valley Populations.

Natural Heritage Institute. 2002. Stream Corridor Master Plan for Brentwood.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P. C. Nelson. 1984. Habitat suitability information: rainbow trout. U.S. Fish. Wildl. Serv. FWS/OBS-82/10.60 64 pp.

Raleigh, R.F., W.J. Miller, and P.C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: chinook salmon. U.S. Fish and Wildlife Service Biological Report 82(10.122). 64 pp.

Robins, J.D. and J.R. Cain. 2002. The Past and Present Condition of the Marsh Creek Watershed.

Personal Communications

Cleugh, Erica. Fisheries Biologist. California Department of Fish and Game. March 2002.

Lindemuth, Thomas. High School Chemistry Teacher. Freedom High School, Oakley, Ca. December 2002.

Walking, Richard. Restoration Ecologist. Natural Heritage Institute. April 2003.