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**Guidelines for Maintaining Instream Flows to Protect Fisheries
Resources Downstream of Water Diversions
in Mid-California Coastal Streams**

(An update of the May 22, 2000 Guidelines)

**California Department of Fish and Game
and the
National Marine Fisheries Service**

June 17, 2002

(Errata note, dated 8-19-02)

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UNITED STATES DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

United States Marine Mammal Commission

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June 17, 2002

Mr. Ed Anton, Chief
State Water Resources Control Board
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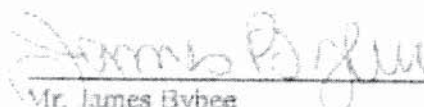
Dear Mr. Anton:

In May 2000, DFG and NMFS distributed draft guidelines for maintaining instream flows to protect fisheries resources downstream of water diversions in mid-California coastal streams. These guidelines provided bypass flow recommendations and measures for protecting natural hydrographs that were reviewed and supported by peer review (Moyle et al. 2000). Previously permitted on-stream reservoirs have limited the ability of the SWRCB to use the guideline component concerned with avoiding cumulative impacts. Subsequent analysis and discussions by SWRCB, DFG, and NMFS staff have resulted in an alternative approach for conserving natural hydrographs and assessing cumulative impacts of multiple water projects. This method, which has been adopted by SWRCB staff, involves computation of a Cumulative Flow Impairment Index (CFII).

Although DFG, NMFS, and SWRCB environmental staff are in agreement on the application of this new method, there has been no clear written description of this procedure. Furthermore, the relationship of this procedure to DFG/NMFS guidelines for water diversions has been unstated. For that reason, we have updated DFG/NMFS May 22, 2000 guidelines to include use of the CFII method for conserving natural stream hydrographs and addressing the issue of cumulative impacts. Enclosed are six copies of these updated draft guidelines.

We greatly appreciate the efforts of SWRCB staff in helping to develop components of these guidelines. We look forward to continued opportunities for the State Water Resources Control Board and our agencies to cooperate in the conservation of listed species. If you have any questions or comments concerning the guidelines, contact Dr. William Hearn (NMFS) at (707) 575-6062 or Ms. Linda Hanson (DFG) at (707) 944-5562.

Sincerely,



Mr. James Bybee
NMFS Habitat Manager
Northern California



Mr. Robert W. Floerke, Regional Manager
Department of Fish & Game
Central Coast Region



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ERRATA

These guidelines were initially distributed to the California State Water Resources Control Board on June 17, 2002. Copies were then widely distributed to interested parties. A minor error and inconsistency in the guidelines was subsequently detected. For clarification the following error and intended correction is noted:

On page 7, in paragraph 2 under Section II-B-Item 5 (Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts), Line 16 and Line 18 incorrectly provide a season of October 1 to March 31 for computations of unimpaired runoff. Consistent with Appendix A, the correct season for computation of unimpaired runoff is December 15 to March 31.

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Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams

1. INTRODUCTION

The California Department of Fish and Game (DFG) and the National Marine Fisheries Service (NMFS) jointly developed draft guidelines for diverting water from central-coastal watersheds in California. Those guidelines, which were dated May 22, 2000, were developed in response to concern that current practices for issuing water rights were not adequate to protect and recover anadromous salmonids in coastal watersheds. These watersheds are often highly regulated, extensively developed and subject to significant levels of impairment. Depletion and storage of stream flows have significantly altered natural hydrological cycles and adversely affected aquatic habitats and resources. Reduced flows also interrupt invertebrate drift, disrupt channel dynamics, increase deposition of fine sediments, inhibit recruitment of spawning gravels, and promote encroachment of riparian and non-endemic vegetation into spawning and rearing areas.

The May 22, 2000 guidelines were developed pursuant to respective agency mandates and missions to protect and restore anadromous salmonids and their habitats. These guidelines provide standard recommended protective terms and conditions to be followed in the absence of site-specific, biological, and hydrologic assessments. The guidelines call for limiting new water right permits to diversions during the winter period (December 15-March 31) when stream flows are generally high. Minimum bypass flows and cumulative maximum rates of diversion are recommended to ensure that streams are adequately protected from new winter diversions. The guidelines also recommend that, except for limited circumstances, storage ponds should be constructed off-stream, rather than on-stream. Water diversions should also be screened using NMFS or DFG screening criteria, and fish passage facilities should be provided where appropriate.

The May 22, 2000 guidelines recommended that conservation of the natural hydrograph and avoidance of significant cumulative impacts could be accomplished by limiting the cumulative maximum rate of diversion from a watershed. The recommended cumulative maximum rate of diversion is equivalent to 15% of the "winter 20% exceedence flow" at the point of diversion. Following its distribution, the State Water Resources Control Board (SWRCB) staff stated that the DFG/NMFS guideline element for protecting the natural hydrograph and limiting cumulative impacts to salmonids was impractical, because many existing, legal storage ponds store 100% of a stream's runoff while they are filling. Therefore, on-stream ponds inherently exceed any maximum rate of diversion, at least temporarily. Rather than adopt a quantitative procedure to address this problem, SWRCB proposed an alternative approach for protecting the natural hydrograph and limiting cumulative impacts of numerous diversions. That alternative

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approach, described in SWRCB (2001), limits cumulative impacts and conserves the natural hydrograph by limiting the maximum cumulative volume of water that can be diverted in a watershed. Similar to the maximum rate of diversion, this maximum cumulative volume guideline is recommended for projects for which there has been insufficient site-specific, biological assessment of instream flow needs to protect fisheries. DFG and NMFS accept the reasonableness of this alternative "cumulative volume" approach to limiting cumulative impacts. Therefore, this update of the May 22, 2000 guidelines provides a technical description of the calculations required for this alternative method (see Appendix A). This update also reflects a minor change to the May 22, 2000 guidelines by noting that protecting spawning habitat for salmonids is largely achieved through conservation of the natural hydrograph. Except for these two changes, this update of the DFG/NMFS guidelines for maintaining instream flows in Mid-California coastal streams is unchanged from the May 22, 2000 draft guidelines.

These guidelines are recommended for use by permitting agencies, planning agencies and water resource development interests when taking proposed actions that would divert or act to reduce stream flows in California's mid-coastal watersheds containing anadromous salmonids. These guidelines do not constitute a final agency action for purposes of the National Environmental Policy Act or the California Environmental Quality Act. Nor do these guidelines define, or authorize take for purposes of State or Federal Endangered Species Acts. Rather, the guidelines are intended to preserve a level of flow that ensures that anadromous salmonids will not be adversely impacted by diversions. Altering stream flows outside these guidelines may impact salmonids by: blocking and/or delaying migration; reducing usable habitat; impacting habitat quality; stranding fish; entraining fish into poorly screened or unscreened diversions; and increased juvenile mortality resulting from increased water temperatures.

These joint guidelines are organized in two parts. The first, (*Terms and Conditions to be Incorporated into Water Rights Permits for Small Diversions*) consists of specific terms and conditions to be incorporated into water rights permits, issued by the State Water Resources Control Board (SWRCB) for small diversions where adequate site-specific biological data are not available. The guidelines were developed based on the biology and ecology of anadromous salmonids and their habitat requirements. The second part of these guidelines (*Implementation and Effectiveness Monitoring*) is programmatic in nature, addressing watershed-level initiatives necessary to ensure that the standards and protocols are consistent with conserving salmonids and their habitats.

The following guidelines are not developed for use in areas outside of the identified mid-coastal region. NMFS and DFG may develop similar guidelines for other regions of California in the future. Those guidelines should be based on anadromous salmonid habitat requirements, hydrologic characteristics, and other specific factors for those

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II. TERMS AND CONDITIONS TO BE INCORPORATED INTO WATER RIGHTS PERMITS FOR SMALL DIVERSIONS

1. Diversions > 3 cfs or > 200 acre-feet

For diversions larger than 3 cfs or greater than 200 acre-feet from streams in watersheds that currently or historically contained anadromous salmonids, water right permit applicants must consult with the NMFS and DFG to plan and conduct a site specific study for the purpose of determining appropriate flow related terms and conditions to be incorporated into the permitted water right. The study plan should include, at a minimum, the following:

- 1) A habitat based stream needs assessment that incorporates habitat, species, and life history criteria specific to each diverted stream or stream reach;
- 2) An evaluation of the existing level of impairment (diversion) and limiting factors for salmonid restoration based upon habitat, species, and life history specific criteria for each diverted stream or stream reach;
- 3) A specific proposal to provide periodic channel maintenance and flushing flows that are representative of the natural hydrograph; and
- 4) A plan to monitor the effectiveness of stipulated flows and procedures for making subsequent modifications, if necessary.

2. Small Diversions <3 cfs and <200 acre-feet

1) Geographic Limitations

For small diversions less than or equal to 3 cfs and less than or equal to 200 acre-feet, default guidelines have been developed for coastal watersheds from the Mattole River to San Francisco, and for coastal streams entering northern San Pablo Bay. This area generally includes streams within California's Mendocino, Sonoma, Marin, and Napa Counties, as well as a few coastal streams in Humboldt County south of the Eel River. The default guidelines are based on the hydrology and life history requirements of resident anadromous salmonids in this area. For streams within this area, the default guidelines may be incorporated into the terms and conditions of a permitted water right, in lieu of results from site-specific biological studies.

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For coastal streams north of the Mattole River or coastal watersheds to the south of San Francisco, DFG and NMFS have yet to develop detailed default guidelines for maintaining stream flows to protect fisheries resources downstream from water diversions. However, until such guidelines are developed, these agencies recommend that, in the absence of site-specific studies, in watersheds north of the Mattole River or south of San Francisco: 1) the diversion season for new water rights permits should be limited to the period of seasonal "high-flows", 2) additional on-stream reservoirs should not be constructed or permitted unless consistent with the exemptions provisions described below, 3) sufficient minimum bypass flows should be maintained to protect fisheries resources, 4) the cumulative maximum rate of withdrawal should be limited to maintain a near natural hydrograph and avoid cumulative impacts, 5) adequate passage and protection measures must be provided to facilitate instream movements of fishes and avoid entrainment in diversion intakes, and 6) the applicant should describe the project specific mechanism(s) that adequately ensure compliance with diversion limits. For coastal watersheds north of the Mattole River or south of San Francisco, default guidelines for the bounds of the diversion season, minimum bypass flows, and cumulative maximum rates of withdrawal have yet to be determined. Until detailed guidelines are available for diversions in these watersheds, applicants seeking diversion permits for those areas should consult with DFG and NMFS for stream flow recommendations.

2) Seasonal Limits on Additional Diversions:

The diversion season will be limited to the period December 15 to March 31. From April 1 to December 14 instantaneous inflow to the point of diversion must equal the instantaneous outflow to downstream reaches past the point of diversion.

Justification: In its water rights proceedings for the Russian River, Navarro River, and Napa River watersheds, the SWRCB has found that new water diversions should be confined to the period December 15 to March 31. This period is the time of highest winter flow and the time when water withdrawals would be least likely to adversely affect fisheries resources. Additional water withdrawals between April 1 and mid-May may adversely affect anadromous salmonids, because flows generally subside during that time, and juveniles typically emigrate during the higher flow events in that period. Additional water withdrawals between May 1 and October 1 may adversely affect salmonids, because rainfall in north-

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central coastal streams is minimal during that period, and diversions during that time would probably reduce the availability of already limited habitat for juvenile salmonids. Additional water withdrawals between September 1 and December 15 may unnecessarily affect salmonids, because that is a time when flows are relatively low, and high flows are infrequent and sporadic.

3) No Additional Permitting of Small On-stream Reservoirs:

Water diversion projects requiring new permits should avoid construction or maintenance of on-stream dams and reservoirs, including existing unpermitted storage ponds. Thus, storage must be to an off-stream reservoir. Exceptions are provided for special circumstances involving Class III streams as defined by 14 CCR 916, riparian management regulations for protecting watercourses and lake protection zones (see Exemptions below).

Justification: On-stream reservoirs should be prohibited, because they 1) eliminate, within the reservoir footprint, free-flowing stream habitat that may either support listed salmonids or the production of riffle-dwelling aquatic invertebrates that serve as food sources for downstream fishes (Corrarino and Brusven 1983; Resh and Rosenberg 1984; Keup 1988), 2) eliminate or reduce the magnitude and frequency of naturally occurring intermediate and high flows necessary for natural channel maintenance processes, 3) trap coarse bedload material and impede bedload transport, 4) act as barriers to migrating fishes, and 5) provide habitat for non-native aquatic species (*e.g.*, bullfrogs).

4) Maintenance of Minimum Bypass Flows:

Provide bypass flow regimes that adequately protect salmonids and aquatic resources in reaches downstream from the point of diversion. The determination of the bypass flow's adequacy can be based on site specific biological investigations conducted in consultation with NMFS and DFG, or in the absence of site-specific data, it would be not less than the estimated unimpaired February median flow at the point of diversion.

Justification: The unimpaired February median flow guideline is based partly on the observation that (at relatively low to moderate flows) available spawning and incubation habitat is generally positively correlated with discharge, but that naturally higher flows must be sustained for a substantial period of time in order to have "effective spawning and incubation habitat". The February median flow is a conservatively high

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bypass flow because it conserves “typical” winter flows to which native fishes are adapted. February is generally the wettest month in the 4-county area, and therefore the long-term February median flow is a hydrologic metric that permits diversions only during the higher flows of winter. This is appropriate given uncertainties regarding site specific flow needs for numerous aquatic biological processes (including both invertebrate and vertebrate production). However, it must be recognized that a minimum bypass flow equivalent to the February median does not protect all stream functions including channel maintenance flows, migratory flows in headwaters, and in many small watersheds, spawning flows for salmonids. To protect these latter functions it is necessary to protect the natural hydrograph as described in Item 5 below. The unimpaired February median flow can be estimated using a modification of the SWRCB Stream Simulation model for the Russian River Watershed Region or comparable hydrologic analytical techniques.

5) Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts:

The diversion will be operated with a maximum rate of withdrawal that preserves a natural hydrograph with no appreciable diminishment (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance (e.g., unimpaired flows with a recurrence interval of 1.5 or 2 years). The diversion will also not appreciably reduce the frequency and magnitude of unimpaired moderate and high flows (e.g., flows higher than median February) used by migrating and spawning fishes in small streams. Unless there is compelling site-specific biological and hydrologic information indicating that additional water can be diverted without adversely impacting anadromous salmonids, diversions should not be permitted or otherwise sanctioned if 1) the cumulative maximum rate of instantaneous withdrawal at the point of diversion exceeds a flow rate equivalent to 15% of the estimated “winter 20% exceedence flow” OR 2) the total cumulative volume of water to be diverted from the stream at historical points of anadromy exceeds 10% of the unimpaired runoff between October 1 and March 31 during normal water years. For projects contributing to a cumulative diversion of 5 to 10% of the normal unimpaired runoff between October 1 and March 31, hydrologic analysis must demonstrate that the project will not cause or exacerbate significant adverse cumulative effects to migration and spawning flows for salmonids. The “winter 20% exceedence flow” is the 20% exceedence value of the stream's daily average flow duration curve for the period December 15 to March 31. Cumulative reduction refers to the effects of this and other permitted or licensed projects as well as diversions under riparian rights.

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Justification: Natural, periodic, intermediate and high flows should be maintained downstream of diversion sites (Barinaga 1996; Poff et al. 1997). High flows are essential for 1) cleansing fine sediments from coarse substrates, 2) removing encroaching vegetation and contributing to the deposition of instream woody cover, and 3) serving as cues for and facilitating the migratory movements of fishes. Protection of intermediate and high flows during winter months must be accomplished through an assessment of cumulative impacts and placing limits on the cumulative rate of instantaneous water withdrawals from the stream, or on the total volume of water diverted. A discussion of the need for and rationale for limiting cumulative maximum instantaneous withdrawals to a portion of the "winter 20% exceedence flow" in northern coastal California streams is provided in NMFS (2000). Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water are described in Addendum A.

6) Fish Passage and Protection Measures:

The potential effect of stream flow diversions on upstream and downstream movements of anadromous salmonids must be addressed. If anadromous salmonids have the likely potential to ascend the stream to the point of diversion, then adequate passage facilities and screening at the diversion intake must be provided. Screening must be in accordance with NMFS and DFG's screening criteria.

Justification: Diversion structures and instream reservoirs may block fishes from reaching their natal spawning areas. Diversion structures also have the potential to entrain fishes, with resulting mortality.

7) Special circumstances allowing onstream reservoirs:

If a proposed diversion is located 1) in a stream reach where fishes or non-fish aquatic species were not historically present upstream, and 2) where the project could not contribute to a cumulative reduction of more than 10% of the natural instantaneous flow in any reach where fish are at least seasonally present, and 3) where the project would not cause the dewatering of any fishless stream reach supporting non-fish aquatic species, then no stream flow or fish passage protection measures are required. By cumulative reduction we refer to the effects of this and other permitted or licensed projects as well as diversions under riparian rights. For diversion sites meeting the above three criteria, on-stream reservoirs

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may be permitted.

Justification: The need for the above instream flow and fish protection measures is dependent upon the quality of the stream at the diversion site. Instream diversions and on-stream reservoirs on a limited number of ephemeral headwater streams naturally without fish or other aquatic species (*i.e.*, Class 3 streams, under 14 CCR 916) will not significantly impact fisheries resources, if the flows of streams with fishes (*i.e.*, Class 1 streams, under 14 CCR 916) are not reduced by more than 10% from unimpaired levels. Exemptions under the above criteria will enable water users to develop small on-stream reservoirs while ensuring that stream reaches containing fishes (either year-round or seasonally) will not have additional on-stream dams or stream flows reduced more than 10% from unimpaired levels. Stream reaches containing aquatic species without fishes (*i.e.*, Class 2 streams, under 14 CCR 916), will not be dewatered. These exemptions are consistent with allocating water for beneficial uses and protecting fishery resources.

8) Quantify All Water Rights of Applicant

To facilitate assessment of stream diversion impacts to fisheries, the applicant must identify all other basis of rights (appropriative, riparian, adobe, pre-1914), in streams potentially affected by the proposed diversion.

Justification: The determinations of maximum rate of withdrawal and potential impacts of cumulative withdrawals require information concerning all water withdrawals within the impacted watershed. Records concerning existing water rights are limited. Applicants seeking additional appropriative rights should provide known information concerning their diversion activities within the affected watershed.

9) Compliance and Monitoring Measures:

Prior to issuance of permit, the applicant must identify, to the satisfaction of NMFS, DFG, and the SWRCB the mechanism(s) that assure that the bypass flows will be maintained and rates of diversion will not be exceeded at the project. The applicant will provide a description of mechanism(s) for assuring bypass flows and rates of diversion to the SWRCB. The SWRCB will provide this information to NMFS and DFG for review and comment. Diversion projects will provide DFG personnel access to all points of diversion and places of use for the purpose of conducting routine and or random monitoring and compliance inspections.

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However, the responsibility for ensuring compliance and enforcement of water rights issued by the SWRCB and/or any other permit or regulatory instrument that approves or allows water diversion or causes reduction in stream flows, rests with that permitting agency.

Justification: In order to protect anadromous salmonid habitat, mechanisms must be provided to ensure that bypass flows and constraints on diversion rates are maintained. Mechanisms to verify compliance with permit conditions may vary and be dependent on site-specific conditions. The determination of the specific mechanisms for assuring compliance with the diversion guidelines is the responsibility of the applicant and subject to approval by NMFS, DFG, and SWRCB.

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III COMPLIANCE AND EFFECTIVENESS MONITORING

Inherent in the application of this, as well as any other, instream flow standard setting technique is the need for effectiveness monitoring to address and corroborate assumptions used in developing the flow standard. In addition, a prerequisite for reasonable flow allocation and habitat protection, is an accounting of existing diversions and enforcement of unpermitted diversions. It is essential, if instream resources are to be protected and over-allocation is to be avoided, that an accurate evaluation of all existing diversions be conducted prior to the issuance of any new water rights permits. Therefore, DFG and NMFS recommend the following initiatives:

1) Program to Verify Effectiveness and Refine the Flow Standard as Necessary

The SWRCB, DFG, and NMFS will cooperate in the development and implementation of an evaluation plan to monitor the effectiveness of flow standards being applied in the water rights process. This program should include specific monitoring activities to determine whether the standard provides a consistent and protective level of salmonid habitat conservation for streams of various size, order, elevation and geomorphic characteristics. The effectiveness monitoring program should also contain a protocol for making any refinements to the flow standard, as necessary to mitigate adverse affects on anadromous salmonid resources and their habitats.

2) Compliance and Enforcement Program

A compliance and enforcement program should be developed. This program should include flow gaging and routine, random compliance inspections. This program should be focused on a watershed approach and include the installation of stream flow gaging and recording devices at key locations within each stream basin for determining compliance with bypass flow requirements and current level of impairment. In addition, a separate schedule for routine, random compliance inspections should be developed for each watershed, based upon the level of impairment and sensitivity of anadromous salmonid habitat. As part of this program the SWRCB should require applicants to develop and implement measures that will ensure compliance with the bypass terms. The plans should specify measuring and recording devices and bypass facilities to be installed, the criteria for operation of the reservoir, and other measures that will be taken by the applicant to confirm compliance with permit terms. DFG and NMFS encourage water rights permit applicants to install "passive" bypass facilities (*i.e.*, facilities that will automatically bypass flows without any action by the permittee) whenever feasible. The plan should also include a measure for documenting that facilities have been installed and are being maintained.

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3) Preventing Stream Over-Allocation

In order to prevent the over-allocation of anadromous salmonid streams by new diversions and to identify those streams currently over-allocated, it is necessary to document actual and potential levels of impairment. Prior to issuance of any new water rights the SWRCB should provide an evaluation and comprehensive accounting of all diversions currently in place including a disclosure of all basis of right in effect on the stream to be diverted and quantify the total maximum volume and maximum rate of withdrawal possible at any given time including rights not fully and/or currently exercised. The results of this evaluation should be compared on a month by month basis to the estimated unimpaired hydrograph to ensure that sufficient flow remains in the stream to provide a sufficient minimum bypass flow to protect salmonids in downstream reaches. Further, that the maximum cumulative rate of withdrawal from proposed and existing diversions will not appreciably diminish the natural hydrograph (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance and will not appreciably reduce the frequency and magnitude of unimpaired moderate and high flows (e.g., flows higher than median February) used by migrating and spawning fishes.

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Addendum A

Procedures for assessing cumulative impacts of water diversions
based on the cumulative total volume of diverted water

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Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water

Determination of water availability:

Before issuing any new Water Rights permits, the State Water Resources Control Board (SWRCB) must first determine whether water is available for diversion. This determination is achieved through a Water Availability Analysis (WAA). Among other things, the WAA must estimate expected unimpaired stream flow (the natural flow without diversions) at the diversion site. In addition, it must then consider the water that has already been allocated to existing water rights holders (both riparian and senior appropriative) and the water that is required for the protection of public trust resources.

Requirements for resource protection based on potential cumulative impacts:

Minimum bypass flows must be maintained to ensure that threatened and endangered salmonid species are protected. At the same time, additional mechanisms must be employed to conserve intermediate and high flows (*i.e.*, maintaining a near natural hydrograph) so that other life history requirements of these species are met (see guidelines section for justification).

In the central coastal counties (Napa, Marin, Sonoma, and Mendocino), near natural hydrographs can be preserved by 1) limiting cumulative maximum instantaneous rates of withdrawal consistent with the DFG and NMFS guidelines (*i.e.*, 15% of the “winter 20% exceedence flow”), or 2) by limiting the cumulative volume of water diverted from the watershed. The guidelines section of this document addresses preserving the natural hydrograph using the “maximum instantaneous rate of withdrawal” approach. This addendum describes an alternative “volumetric” cumulative impact assessment method based on the total volume of water being diverted.

An analysis of site-specific flow requirements of anadromous salmonids in many western streams indicates that in small watersheds the optimal flows for spawning are variable, and often higher than the long-term, unimpaired February median flow (Hatfield and Bruce 2000). Hydrologic analysis indicates that adequate spawning flows, and near natural hydrographs, are generally maintained when the natural volume of winter runoff is impaired (*i.e.*, reduced) by less than 10% (SWRCB unpublished data).

Spawning habitat for anadromous salmonids can be adversely affected by diverting more than 10% of winter runoff. Cumulative diversions of even 5 to 10% of annual runoff can also impact spawning habitats if the diversions reduce stream flows to minimum levels for several days during critical spawning periods in early winter.

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Determining the Cumulative Flow Impairment Index (CFII):

To evaluate the potential cumulative effects of water diversions using a “volumetric” approach, the volume of water that is naturally available must be compared with the total volume of water that is, or can be, legally diverted from the watershed through existing water rights. The potential level of impairment to stream flow caused by these cumulative diversions can be evaluated by calculating the Cumulative Flow Impairment Index (CFII), as follows:

$$\text{CFII} = \frac{\text{Cumulative Diverted Volume (CDV)}}{\text{Estimated Unimpaired Runoff (EUR)}}$$

where,

CDV = potential volume of water diverted under all bases of right between October 1 and March 31 in a normal water year (in AF)

EUR = estimated volume of surface flow in the stream passing the point of interest between December 15 and March 31 in a normal water year (in AF)

Calculating the Cumulative Diverted Volume portion of the equation (Impaired flow):

The Cumulative Diverted Volume (CDV) is the volume of water diverted under all water rights potentially affecting the stream flow at a given Point of Interest (Points of Interest are discussed in more detail below). An October 1 to March 31 season is used to calculate the CDV because it reflects the season of diversion for many existing permits. Therefore, use of the CDV season facilitates a more accurate assessment of the cumulative effect of authorized diversions upon flows within a watershed. Calculations of the CDV must include all existing legal diversions (including pre-1914 rights, riparian rights, small domestic and stockpond registrations, and other appropriative rights) together with the proposed project under consideration for a new water right. The computation of CDV is done for average (*i.e.*, normal) water years.

If a portion of the direct or riparian diversion is highly unlikely to occur during most or all of the CDV season, then that portion of the volume of riparian or direct diversion may be discounted when computing the CDV. This is appropriate in situations with year-round water rights that are typically not exercised during the winter months (*e.g.*, when irrigation of a particular crop does not occur during wet winter months). However, riparian diversions for frost protection must be included when calculating CDV. All computations

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of CDV must be accompanied by a list of the diversions used in the calculation. The list must also include: 1) the season of diversion, 2) the potential maximum instantaneous rate of diversion, 3) the potential maximum volume of diversion, 4) the existing water rights excluded from the computations, and 5) any other assumptions related to the calculations for each diversion listed.

Calculating the Estimated Unimpaired Runoff portion of the equation (Unimpaired flow):

The Estimated Unimpaired Runoff (EUR) is calculated for the high flow (winter) season from December 15 to March 31. This season represents the period during which it is assumed that some water may still be available for diversion without additional environmental impact. All computations must be done using standard hydrologic techniques that may include prorating known gauge data, application of precipitation runoff models, or other accepted methods. Calculations of EUR (unimpaired flow) will be accompanied with descriptions of computational methods, input data, data sources, and assumptions sufficient for reviewers to fully understand and replicate the results. As with the CDV, these computations are done for average (*i.e.*, normal) water years.

Locations requiring CFII calculations for a project:

A CFII is typically calculated for several Points of Interest (POI's) within the watershed. Generally a POI is calculated at the Point of Diversion (POD) and then again for points immediately downstream at each confluence of a major intervening tributary between the project site and the mainstem of coastal rivers. In the case of small mainstem coastal streams (*e.g.*, Sonoma Creek), points of interest extend to the stream's estuary.

The location of the Points of Interest requiring CFII values will be determined by DFG and NMFS staff. To ensure consistency, POI's will be provided directly by NMFS and DFG to SWRCB staff for dissemination to Applicants, their consultants, and other interested parties.

Level of potential cumulative impact based on the CFII calculations:

The level of impairment identified by the CFII will determine the likely study effort needed to address the significance of cumulative impacts of the new water right project.

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- If the CFII is greater than 10%, then there is a reasonable likelihood of significant cumulative impacts. When the CFII is greater than 10%, site specific studies will be required to assess impacts and the water right permit Applicant is referred to NMFS and DFG for the scoping of site-specific fisheries studies to assess these impacts.
- When the CFII is between 5 and 10%, the Applicant must provide additional hydrologic analysis documenting the estimated effects of cumulative diversions on the stream hydrograph at the POI's during three representative normal and two representative dry years. If the natural hydrograph is appreciably impaired during the migratory and spawning period of anadromous salmonid species, additional site specific study may be warranted.
- If the CFII is less than 5%, there is little chance of significant cumulative impacts due to the diversion and the project does not require additional studies to assess these impacts.

Scope and purpose of site specific studies:

Site-specific studies prompted by a CFII greater than 10% (or when there is an appreciable impairment of the hydrograph on projects with CFII between 5-10%) are performed to establish terms and conditions that ensure that habitats for anadromous salmonids are not further degraded. For most projects, three issues need to be addressed:

- 1) What are the cumulative effects of this and other projects on channel maintenance (flushing) flows needed to protect geomorphological processes downstream from the project site? Does the project under consideration contribute to a significant adverse effect on flushing flows needed to maintain the stream channel and avoid exacerbating stream sedimentation? Does the project affect the timing of the opening or closure of estuarine mouths with sand bars?
- 2) What minimum bypass flow and maximum instantaneous rate of withdrawal are needed for the project to protect spawning habitat for anadromous salmonids downstream from the project site?
- 3) What minimum bypass flow and maximum instantaneous rate of withdrawal are needed for the project to facilitate migratory movements of anadromous salmonids downstream from the diversion site(s)?

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The Applicant should consult with NMFS and DFG concerning the scope and methods of site-specific studies to address these issues. Performance of site-specific studies does not guarantee that stream flow terms and conditions will be consistent with an economically viable project.

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