JOINT RECOMMENDATIONS
FOR THE
NORTH COAST INSTREAM FLOW POLICY

Introduction

The conservation organization Trout Unlimited, the Wagner & Bonsignore water resource engineering firm and the Ellison, Schneider & Harris law firm jointly submit to the State Water Resource Control Board (State Water Board or Board) the following principles for a North Coast Instream Flow Policy (policy) to satisfy Assembly Bill 2121 (Kuehl 2004) and California Water Code section 1259.4.

This draft, dated April 12, 2009, contains recommendations for water right procedures and review standards for calculating bypass flows and rates of diversions. These principles and rationale expand upon our May 1, 2008 joint comment letter submitted on the Board's December 2007 Draft Instream Flow Policy. We consider the following set of shared principles, and the recommendations in the May 1 comment letter, to be mutually dependent, and we do not necessarily support each individual principle in the context of a policy that does not advance the other principles. (For example, TU cannot support these flow standards, or any others, without adequate monitoring and reporting, and W&B/ESH cannot support these flow standards, or any others, without improvements to water right processing.) We intend to submit more detailed recommendations based on the May 1 letter for other subjects shortly.

Contact information

Trout Unlimited Brian Johnson 510-528-4772 bjohnson@tu.org	Ellison, Schneider & Harris Peter Kiel 916-889-8582 pjk@eslawfirm.com
McBain & Trush (consultant to TU) Bill Trush 707-826-7794 bill@mcbaintrush.com	Wagner & Bonsignore Bob Wagner 916-441-6850 rcwagner@wagner-engrs.com

1. Introduction

2. Policy Framework

3. Applicability

4. Review Procedures for Water Right Applications and Petitions

4.1. Application and Petition Processing

This policy establishes new procedures for Division processing of water right applications, petitions, and registrations defined in Section [3.3]. Unless otherwise stated, this section shall refer generally to water right application, petition, and registration as "application", and applicant, petitioner and registrant as "applicant". The new procedures in this policy are consistent with and complimentary to existing procedures defined in the Water Code and Code of Regulations. An application process flow chart is provided in Exhibit XX. Separate strategies are provided for processing individual applications, for processing groups of applications within a geographic region, and for coordinated processing of applications within a watershed.

4.2. General Procedures Applicable to All New and Amended Applications

4.2.1. Project Scoping Conference for New and Amended Applications

The applicant and Division staff shall have an early conference to discuss the scope of the application, the required environmental and water availability analyses, and the analytic methodologies for those analyses (within 60 days of application filing). This procedure shall apply to new applications and for amended applications.

4.2.2. Application Work Plan

The applicant and Division staff shall mutually develop a work plan within 60 days from the project scoping conference. The work plan shall delineate the major tasks necessary to process the application and clearly delineate the respective responsibilities of the applicant, the consultants, and Division staff.

4.2.3. Early Consultation with Protestants and Responsible Agencies

The applicant and SWRCB staff shall have an early consultation conference with protestants and responsible agencies to exchange basic information about the project and concerns with the project. Early consultation may occur through in-person meetings or telephone conversations. Applicants, protestants, and responsible agencies are encouraged to arrange a site visit and to confer regarding the application work plan.

4.3. Environmental Review Procedures Applicable to all Processing Strategies

4.3.1. Environmental Impact Analyses

1. Coordination of Environmental Analyses

Applicants within a watershed shall coordinate the water availability, CEQA and/or public trust analyses where feasible.

2. Impact Assessment Criteria and Study Guidelines

Section 5 of policy establishes narrative criteria, numeric criteria, and study methodologies for salmonid resources. The Division shall develop guidelines for environmental impact analyses (including narrative criteria, numeric criteria where applicable and available and study methodologies) for non-salmonid resources including non-salmonid aquatic resources (such as amphibians and warm water fishes) and terrestrial resources, for assessing the effects of onstream dams, and similar resource issues.

A narrative criterion is a description of the desired biological or hydrological condition to be protected or impact to be avoided, such as the minimum stream flow necessary to maintain salmonid spawning below the point of diversion. The criteria should be tailored to address the specific features of projects within the region and the potential impacts caused by those projects. The criteria should function to screen smaller projects with lesser impacts into an expedited review process from larger projects with greater effects into a more involved evaluation process.

3. Model Environmental Analyses

The Division shall maintain a library of model environmental analyses that represent a reasonable range of water diversions (e.g., onstream storage, diversion to offstream storage, direct diversion, etc.), affected biological resources (e.g., salmonid fishes, non-salmonid fishes, amphibians, etc.), watershed size, and clear impact assessment methodologies or thresholds.

4. Scale of Analyses

The water availability, CEQA and public trust analyses shall consider relevant watershed-scale issues wherever possible.

4.3.2. Options for Retention of Consultants for Projects Where the State Water Board is Lead Agency

The State Water Board may employ one of the following arrangements or a combination of them for preparing a draft environmental analysis listed in CEQA Guidelines section (Cal. Code Regs., tit. 14, § 15084):

(1) Preparing the draft environmental analysis directly with its own staff.

(2) Contracting with another entity, public or private, to prepare the draft environmental analysis.

(3) Accepting a draft prepared by the applicant, a consultant retained by the applicant, or any other person.

(4) Executing a third party contract or memorandum of understanding with the applicant to govern the preparation of a draft environmental analysis by an independent contractor.

(5) Using a previously prepared environmental analysis.

Before using a draft prepared by another person, the lead agency (State Water Board) shall, as required by the Guidelines, subject the draft to its own review and analysis. The draft environmental analysis which is sent out for public review must reflect the independent judgment of the lead agency. The lead agency is responsible for the adequacy and objectivity of the draft environmental analysis. (Cal. Code Regs., tit. 14, § 15084.)

Where a new environmental analysis is required and the State Water Board requires the cost of the analysis to be borne by the applicant, in most cases the applicant may elect to prepare a draft environmental analysis or contract with another entity to prepare the draft (option 3) or execute a memorandum of understanding (MOU) for preparation by an independent contractor (option 4).

The applicant maybe required to enter into an MOU (option 4) where the project involves matters of significant policy, legal or technical concern for the State Water Board.

4.4. Pre-decisional Review - Trial Program

The Division shall establish a trial program that provides an opportunity for applicants and protestants to appeal to an appointed Member of the Board before final action on the application, petition or registration is taken by the Board on Division staff determinations including but not limited to following issues:

- Whether the diversion is from a natural watercourse subject to the permitting jurisdiction of the Board;
- Whether the application is subject to CEQA, or is subject to CEQA, but categorically exempt from further analysis;
- Whether a CEQA document satisfies the requirements of CEQA;
- Whether a water availability analysis satisfies the requirements of the Water Code and this policy;
- Whether a protest shall be accepted or rejected, or dismissed.

Where applicants and protestants have been unable to settle a protest by the time the Division is ready to make a decision on the proposed application, the Division shall provide them an opportunity to propose competing draft Division Decisions for the Division's consideration.

4.4.1. Individual Application Processing[1]

4.4.2. Group Application Processing

4.4.3. Watershed Application Processing

[1] The parties may have additional procedural recommendations as the policy moves forward, based on prior work done by the North Coast Water Rights discussion group and the SWRCB Strategic Plan group working to reengineer the water right process.

5. Review Standards for the Calculation of Bypass Flows, Rates of Diversion, Season of Diversion, and Cumulative Effects

[Note: By the logic of the Draft Policy, the first 5 subsections that follow would go in Section 2 (Policy Framework) as a replacement for the Draft's Regional Criteria, and the rest would go in Section 4 (Water Right Applications), but for now it's together in one section.]

5.1. Introduction

This section defines overall management objectives for the principles stated in Section 2.2 and the standards necessary for processing water right applications.

The Policy defines two flow thresholds that provide significant biological functions, namely salmon or steelhead spawning and migration (Salmon Spawning Flow) and inundated riffles (Winter Low Flow).

The management objectives are designed to ensure that: (1) most diversions take place when unregulated streamflows are above levels necessary to sustain natural availability of salmon and steelhead spawning habitat (Q_S), (2) diversions at unregulated streamflows greater than Q_S do not significantly interfere with adult salmon and steelhead migration or geomorphic stream processes, (3) diversions when unregulated streamflows are below Q_S do not significantly impair natural spawning and juvenile rearing habitat availability or impair adult migration, and (4) winter low flows sufficient to maintain inundated riffles (Q_{WLF}) are maintained to sustain stream biological productivity, supply good juvenile anadromous salmonid winter rearing habitat, and successfully incubate eggs through fry emergence. These management objectives have been designed to allow diversions to be permitted without creating significant cumulative impacts within watersheds sustaining, or potentially sustaining, anadromous salmonid populations.

Either Q_S or Q_{WLF} may be calculated using site specific studies or by regional estimates.

5.2. Flow Thresholds - Definitions

5.2.1. Salmon Spawning Flow

The Salmon and Steelhead Spawning and Migration Flow Threshold ("Salmon Spawning Flow" or Q_S) is a streamflow threshold important for managing the protection of two steelhead and salmon life history needs in small North Coast California streams: (1) maintaining natural abundance and availability of spawning habitat; and (2) minimizing unnatural adult exposure, stress, vulnerability, and delay during adult spawning migration.

See Appendix [Guidance for Estimating Q_{WLF} and Q_S] for a field methodology and analytical framework to calculate Q_S and a maximum diversion rate above Q_S.

5.2.2. Winter Low Flow

The Winter Baseline Flow Threshold (Q_{WLF}) is a streamflow threshold important to managing several steelhead and salmon life history needs in small North Coast California streams: (1) maintaining good benthic macroinvertebrate habitat in riffles to foster high stream productivity, (2) preventing redd desiccation and maintaining hyphoreic subsurface flows, (3) sustaining high quality and abundant juvenile salmonid winter rearing habitat, and (4) facilitating smolt out-migration.

See Appendix [Guidance for Estimating Q_{WLF} and $Q_{S,}$ at bottom] for a field methodology and analytical framework to calculate Q_{WLF} and a maximum diversion rate between Q_S and $Q_{WLF.}$

5.3. Flow Management Objectives

The Flow Management Objectives define acceptable changes in stage from cumulative diversions when daily average unimpaired flows (Q_D) are at different levels.

- When Q_D exceeds Q_S, diversions shall cumulatively cause no more than 0.1 ft change in depth at the median Riffle Crest Thalweg at the Points of Evaluation.
- When Q_D is between Q_{WLF} and Q_S, diversions shall cumulatively cause no more than 0.05 ft change in depth at the median Riffle Crest Thalweg at the Points of Evaluation.
- When Q_D is less than Q_{WLF}, diversions are not allowed except as stated in section 5.6 [small projects above the Upper Limit of Spawning Habitat].
- Points of Evaluation for this purpose shall include the Upper Limit of Spawning Habitat and points of interest downstream from there.

The Flow Management Objectives will protect winter life history stages of salmonids, by minimizing cumulative effects, sustaining a productive stream environment, and maintaining channel forming flows. Other elements of the policy help protect other life history stages and other natural resource values. These elements include the season of diversion, the framework for permitting onstream dams, and the requirement that all projects located on Class 1 or 2 streams shall bypass at least Q_{WLF}.

Diversions consistent with or functionally equivalent to the Flow Management Objectives can be permitted in the absence of unusual circumstances, provided the diversions also comply with policy provisions governing the season of diversion and onstream dams.

Diversions that do not satisfy the Flow Management Objectives require site-specific analyses to be permitted.

The Management Objectives exist to aid decision-making on individual permits, and permit terms established under this Policy should lead to project operations that approximate stream conditions described in the Objectives. The Policy recognizes that water diversions as permitted may not precisely mirror the Management Objectives in every circumstance, or at every moment of every year; and that there is uncertainty associated with measuring or estimating adherence to the Objectives.

5.3.1. Calculation of Maximum Cumulative Rates of Diversion

Applicants may comply with the cumulative rate of diversion management objectives using either a fixed rate of diversion (e.g., X cfs) or a variable rate of diversion based on a specified percentage of the daily streamflows (e.g., Y% of Q_D).

The Flow Management Objective that limits diversions to those that cause no more than 0.05 ft change in stage when Q_D is between Q_{WLF} and Q_S shall be calculated so that diversions comply with this objective at any flows between Q_{WLF} and Q_S. This means that diversions setting a fixed rate of diversion (X cfs) will be calculated at flows just above Q_{WLF}, and diversions setting a variable rate of diversion (Y% of Q_D) will be calculated at flows just below Q_S.

The Flow Management Objective that limits diversions to those that cause no more than 0.1 ft change in median RCT stage when Q_D exceeds Q_S shall be calculated at flows just above Q_S. The policy recognizes that setting a variable rate of diversion (Y% of Q_D) based on changes in stage at flows immediately higher than Q_S will result in diversions that change stage by greater than 0.1 ft at the median RCT at higher flows.

A daily diversion rate based on the daily unimpaired streamflow (i.e., a variable rate) can be estimated from a site-specific Q – RCT_m rating curve. (See Appendix [Guidance for Estimating Q_{WLF} and Q_S, at bottom].) Although technologically more challenging to construct, maintain, and finance, a variable maximum diversion rate will be able to withdraw more water annually. The variable rate is also useful for estimating the consequences of fill-and-spill reservoirs above the Upper Limit of Spawning Habitat because each reservoir imposes a variable rate on streamflows downstream at the Upper Limit of Spawning Habitat.

5.3.2. Preliminary Regional Estimates of Cumulative Rates of Diversion

In the absence of site specific studies estimating the relationship between diversions and changes in depth, applicants may use the following estimates:

- When $Q_D > Q_S$, diversions shall not exceed [15-20][2] % of Q_D (approximately 0.1 ft change in median RCT depth).

- When Q_D is between Q_{WLF} and Q_S, diversions shall not exceed [10-15][3] % of Q_D (approximately 0.05 ft change in median RCT depth).

5.4. Season of Diversion

The season of diversion is December 15 to March 31, unless a site-specific study demonstrates that a different season is appropriate.

5.5. Onstream Dams

Section __ of this policy contains onstream dam requirements that avoid upstream or downstream additive impacts such as (1) interrupting fish migratory patterns, (2 interrupting downstream movement of gravel, woody debris, or aquatic benthic macroinvertebrates, (3) causing loss of riparian habitat or wetlands, or (4) creating habitat for non-native species.

5.6. Implementation of Flow Management Objectives Above the Upper Limit of Spawning Habitat

Projects above the Upper Limit of Spawning Habitat may satisfy the Flow Management Objectives with one of three different bypass flows, depending on the project's cumulative flow effects: (1) a bypass term requiring a flow sufficient for spawning salmonids (Q_S), (2) a bypass term requiring a flow sufficient to maintain winter baseline flows (Q_{WLF}), or (3) no bypass term.

Projects above Upper Limit of Spawning Habitat may estimate functional equivalence with the Flow Management Objectives using the Cumulative Effects Test defined in section [5.6.4].

[2] The parties are conducting additional analyses to refine this relationship, but expect the number to fall within the range of 15-20%. For present purposes, the text that follows uses 20%.
[3] The parties are conducting additional analyses to refine this relationship, but expect the number to fall within the range of 10-15%. For present purposes, the text that follows uses 10%.

5.6.1. Fill and Spill Projects that Require No Minimum Bypass Term

Projects located on watersheds 0.1 square mile (64 acres) and less that cumulatively satisfy the Flow Management Objectives or provide a functional equivalence as estimated by the Cumulative Effects Test in section [5.6.4] may operate as “fill and spill” reservoirs with no minimum bypass flow.

A. Rationale

In most cases within the policy geographic area, watersheds of 0.1 square mile (64 acres) or less do not produce streamflow of sufficient duration or depth to support aquatic life. The 5% of watershed volume limitation on fill and spill projects with no minimum bypass, combined with the 0.1 square mile (64) acre limit, will protect insect production and other ecological values.

B. Exceptions

Projects located on watersheds 0.1 square mile (64 acres) and less may be required to bypass Q_{WLF} if there is evidence that a Q_{WLF} bypass is required to sustain aquatic life immediately downstream of the diversion.

5.6.2. Projects Required To Bypass Q_{WLF}

All other projects above the Upper Limit of Spawning Habitat that cumulatively satisfy the Flow Management Objectives or provide a functional equivalence as measured by the Cumulative Effects Test in section [5.6.4] shall bypass Q_{WLF}.

5.6.3. Projects Required To Bypass Q_S

All projects above the Upper Limit of Spawning Habitat that do not cumulatively satisfy the Flow Management Objectives and do not provide a functional equivalence as measured by the Cumulative Effects Test in section [5.6.4] shall bypass an amount sufficient to provide a proportionate share of Q_S at the Upper Limit of Spawning Habitat.

5.6.4. Cumulative Effects Test For Projects Above the Upper Limit of Spawning Habitat

Applicants with onstream reservoirs above the Upper Limit of Spawning Habitat may estimate functional equivalence with the Flow Management Objectives using this volume-based cumulative effects test:

- Cumulative depletion of not more than 5% of the seasonal (November 1 to March 31) volume measured downstream where the watershed measures 1 square mile and points of interest below; or
- Cumulative depletion of not more than 10% of the seasonal volume measured at 1 square mile and points of interest below, if reservoirs operating with no bypass collectively deplete no more than 5% average annual volume; or
- A site-specific study demonstrating that the project’s cumulative impacts are consistent with the management objectives.

A. Adjustment of 1 Square Mile Point of Evaluation

If there is evidence that the Upper Limit of Spawning Habitat is significantly higher or significantly lower in the watershed than the 1 square mile point of evaluation, and that the location of the Upper Limit of Spawning Habitat would affect the outcome of the cumulative effects test in section 5.6.4, the applicant shall prepare a site-specific assessment of the Upper Limit of Spawning Habitat. If the Upper Limit of Spawning Habitat is significantly higher or significantly lower in the watershed than 1.0 square mile, the 1 square mile point of evaluation shall be adjusted accordingly.

5.6.5. Channel Maintenance Flows

The Flow Management Objective limiting cumulative diversions so that they do not cause more than 0.1 ft change in depth when Q_D exceeds Q_S will protect channel forming flows.

Projects above Upper Limit of Spawning Habitat that score well enough on the cumulative effects test in section [5.6.4] so that they do not require a Q_S bypass do not require a separate Maximum Cumulative Diversion (MCD) limitation to protect channel forming flows. Their scores on the cumulative effects test indicate that they satisfy (or provide functional equivalence to) the Flow Management Objectives without such a limitation.

Projects above the Upper Limit of Spawning Habitat require a separate Maximum Cumulative Diversion (MCD) limitation only when needed to avoid cumulatively exceeding the objective to divert no more than that which causes a 0.1 ft change in depth when flows exceed Q_S, as calculated at 1 square mile and points of interest below.

A. Adjustment to 1 Square Mile Point of Evaluation

Applicants may substitute a site-specific determination of Upper Limit of Spawning Habitat for the 1 square mile point of evaluation only if site-specific information demonstrates that doing so will not impact channel forming flows in Class 1 streams above Upper Limit of Spawning Habitat.

For example, large watersheds where the Upper Limit of Spawning Habitat is farther downstream than would be expected (because of a waterfall, or a large municipal dam) may have habitat for resident fish or other resources covered by the policy above the Upper Limit of Spawning Habitat, which require channel forming flows.

B. Examples

Projects that satisfy the CET might temporarily divert more than 20% of Q_D when flows exceed Q_S. However, the volume limitation in the CET makes it very unlikely that the diversions would be capturing water at that rate during the high flow events important to channel formation, because at least some of the reservoirs would be full and spilling during a 1.5 year storm event.

Projects that score poorly enough on the CET that they must operate with a bypass flow term set to Q_S do not need an MCD limitation if they comply with the Flow Management Objectives with that condition imposed. For example, projects that cumulatively impound 15% of the drainage area above 1 square mile might require a Q_S bypass, but would satisfy the objective limiting diversions to approximately 20% of Q_D at flows exceeding Q_S objective without a separate MCD limitation.

Projects that do not pass CET and cannot satisfy the Flow Management Objectives simply by adding a Q_S bypass may satisfy the objectives by imposing a separate MCD limitation or by other means (e.g., by diverting water only after reservoirs operated by senior rights holders are full or by entering into an agreement with others to rotate diversions).

5.7. Mode of Bypass

A. Active Management

Onstream reservoirs where the drainage area at the POD is no greater than 1.0 square miles, or 640 acres, may operate with active management of bypass flows, provided that the applicant shall monitor and report rates of flow immediately below the POD as well as diversions and reservoir levels, according to the terms specified in policy section ___ *[monitoring]*.

B. Passive Management

Diversions where the drainage area at the POD exceeds 1.0 square miles should operate with passive management of bypass flows.

5.8. Implementation of Flow Management Objectives Below the Upper Limit of Spawning Habitat

5.8.1. Bypass Flows

Diversions located downstream of the Upper Limit of Spawning Habitat may comply with the Management Objectives in one of two ways.

The first method is the simplest: include a permit term requiring a bypass flow of Q_S.

A second method is possible where the project can limit cumulative diversions when flows are between Q_{WLF} and Q_S to rates that would not change stage by more than 0.05 ft. For these projects, it is also possible to comply with the Management Objectives by establishing a bypass flow of Q_{WLF} and a correspondingly lower cumulative rate of diversion. Because approvals of permits under the method described in this paragraph will make it very difficult for any upstream existing but un-permitted fill and spill reservoir to be processed using the small projects cumulative effects test in 5.6.4 (and their continued operation would create cumulative effects greater than those estimated for the new permit), the State Water Board will consider the upstream projects in the cumulative rate of diversion, to ensure that the projects cumulatively satisfy the Flow Management Objectives. The method described in this paragraph is most viable where there are no upstream diversions.

5.8.2. Maximum Cumulative Diversion

Diversions located below the Upper Limit of Spawning Habitat shall include a Maximum Cumulative Diversion (MCD) rate limitation consistent with the Management Objective limiting diversions to those that cumulatively cause no more than a change in depth of 0.1 ft at the median RCT when flows (Q_D) exceed Q_S, or to 0.05 ft at the median RCT when flows are between Q_{WLF} and Q_S, depending on the method selected for estimating the bypass.

In the absence of site-specific studies, diversions may be limited at a rate of 10% of Q_D (if diverting when flows are between Q_{WLF} and Q_S) or 20% of Q_D (if diverting when flows are above Q_S).

5.8.3. Examples

A project could operate with a cumulative fixed rate of diversion at 20% percent of Q_S (or a different percent based on site-specific studies) and an intake set so that no diversions take place when flows are at Q_S or below.

A project could set a higher fixed rate and a higher bypass flow.

A project could operate with variable-speed pump, or with multiple pumps (i.e., a second pump that operates only at higher flows) so that cumulative diversions total no more than 20% of Q_D at any of the flows above of Q_S, and an intake at Q_S.

5.9. Guidance for Estimating Q_S or Q_{WLF}

The Salmon Spawning Flow (Q_S) or Winter Baseline Flow (Q_{WLF}) may be calculated using provisional regional estimates specified below or site specific studies.

In larger watersheds (i.e., those greater than about 10 square miles), Q_{WLF} will result in deeper flows than Q_S. Where that is true, applicants should substitute the calculation of Q_{WLF} for Q_S where the policy would otherwise call for a calculation of Q_S. The Guidance for Calculating Q_S and Q_{WLF} [see Appendix] is designed for watersheds smaller than 10 square miles; the Policy adopts an interim standard of the February Median for Q_{WLF} in watersheds greater than 10 square miles.

5.9.1. Site Specific Studies

Protocols for calculating Q_S and Q_{WLF} using a site specific study are included as Technical Appendix __ to the policy (see [Guidance for Estimating Q_{WLF} and Q_S, below]). The State Water Board may approve other methodologies for calculating Q_S or Q_{WLF} on a case-by-case basis.

5.9.2. Regional Estimates for Calculating Flow Thresholds

The Policy includes interim formulae for calculating Q_S or Q_{WLF} based on regional estimates using drainage area and average annual runoff. The formulae shall be tested and adjusted based on the results of additional field work and site specific studies.

A. Regional Estimate of Q_S

To be re-calculated by agency staff.

B. Regional Estimate of Q_{WLF}

Applicants may use the February Median flow as an estimate of Q_{WLF}.

5.10. Guidance for Estimating Upper Limit of Spawning Habitat

The Upper Limit of Spawning Habitat for a given stream is the stream reach that includes the uppermost habitat that may support anadromous fish spawning under unimpaired conditions (in normal and above-normal water year types). A protocol for calculating Upper Limit of Spawning Habitat with a site specific study is adopted as a technical appendix to the policy (see ___). For some purposes, such as a site-specific calculation of Q_S, multiple Upper Limits of Spawning Habitats for multiple species may need to be determined in order to assure flows protective of steelhead at one depth and Chinook at a greater depth farther downstream.

[The following sections are out of order, but for now they're together at the end.]

6. Watershed-Based Approaches

7. Stewardship Incentives to Improve Stream Flows

8. Compliance Monitoring, and Reporting

9. Regional Monitoring and Policy Effectiveness Review

10. Enforcement

11. Fish Passage and Screens for Diversions on Class 1 Streams

12. Standards for Processing Permits for Onstream Dams and Reservoirs

13. Small Domestic Use and Livestock Stockpond Registrations

APPENDIX

AB 2121 Joint Recommendations
Guidance for Estimating Q_{WLF} and Q_S

Definitions

The Salmon and Steelhead Spawning and Migration Flow Threshold ("Salmon Spawning Flow" or Q_S) is a streamflow threshold important for managing the protection of two steelhead and salmon life history needs in small North Coast California streams: (1) maintaining natural abundance and availability of spawning habitat; (2) minimizing unnatural adult exposure, stress, vulnerability, and delay during adult spawning migration; and (3) protecting a range of flow below Q_S.

The Winter Low Flow Threshold (Q_{WLF}) is a streamflow threshold important to managing several steelhead and salmon life history needs in small North Coast California streams: (1) maintaining good benthic macroinvertebrate habitat in riffles to foster high stream productivity, (2) preventing redd desiccation and maintaining hyphoreic subsurface flows, (3) sustaining high quality and abundant juvenile salmonid winter rearing habitat, and (4) facilitating smolt out-migration.

Guidance for Estimating Q_{WLF} and Q_S in Small Watersheds 10.0 Square Miles and Less: Proposed Field and Analytical Methodologies

I. Introduction

The Joint Proposal requires defined flow thresholds and diversion rates. Q_S is a threshold encountered on receding storm flows, whereas Q_{WLF} is a post-storm threshold occurring over a wide range of winter flows for wet and dry water years. The "stage-o-graph" of daily riffle depths in Figure 1 demonstrates how the relationship between migrating adult salmon and steelhead (both in the figure scaled to the Y-axis) differs in small streams than large streams (for this purpose, it is better than the more common hydrograph). For only brief periods during the two storms are riffle depths deeper than the adult Chinook salmon and steelhead portrayed. The window-of-opportunity to migrate and spawn is narrow. Both Q_S and our recommended protocol for diverting streamflows above Q_S (functioning as a threshold) were designed to maintain the natural duration, frequency, and timing of this narrow access. In contrast, Q_{WLF} plays a key role in keeping the riffles inundated (note the riffle substrate in Figure 1) to provide productive habitat for benthic macroinvertebrates, incubate redds, and sustain good winter juvenile salmonid rearing habitat.

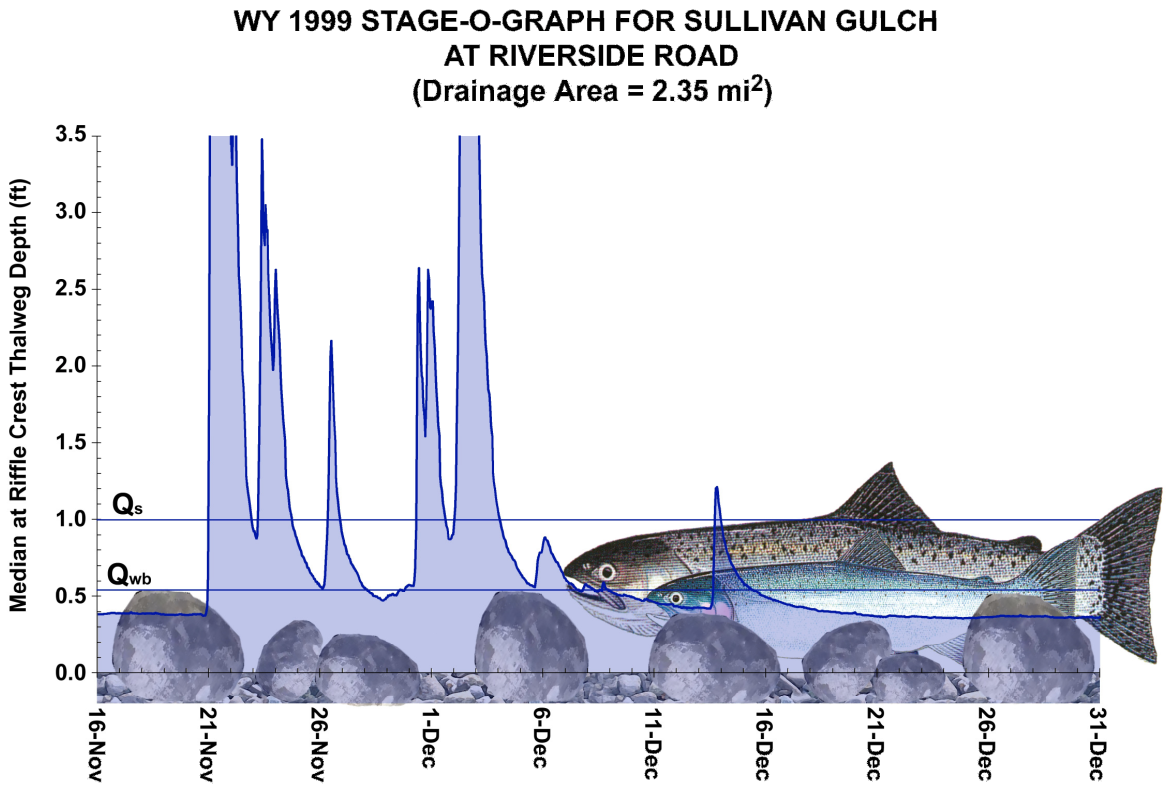

Figure 1. Daily riffle depths (measured at the crest of riffles) between November 16 and December 31 with scaled adult Chinook salmon and steelhead that annually spawn in Sullivan Gulch.

II. The Riffle Crest Thalweg (RCT) as a Reference

The riffle crest elevation is an important hydraulic control, and therefore an important physical stream feature affecting habitat quantity and availability. If all streamflow was abruptly cut-off, the stream's pools would become isolated "tea cups" of standing water separated by dewatered riffles. The water surface elevation of each "tea cup" would be determined by the immediate downstream riffle crest's thalweg elevation, where the "thalweg" is the deepest spot on a channel cross section spanning the riffle crest. Fish biologists and geomorphologists define maximum pool depth at zero streamflow as the "residual" pool depth. During stream surveys, maximum pool depth can be measured independent of the ambient streamflow (by subtracting streamflow depth at the downstream riffle crest from the maximum pool depth).

The median riffle crest thalweg (RCT_m) is used as a physical baseline and reference point for developing the instream flow thresholds and diversion rates in the policy. The riffle crest thalweg is easy to identify and provides a consistent reference point for measuring streamflow depth. The

RCT provides the nexus for recommending diversion rates that will protect salmonid life history needs. The shallowest location for fish passage, tracing the deepest route through a riffle, generally is at the riffle crest's thalweg. It is easy to identify and take a depth measurement at the RCT, and this methodology can be used to provide a consistent streamflow estimate for any given water depth. With this method, each applicant could use a site-specific study protocol, instead of conditions based on regional trends, for bypass streamflows and diversion rates.

Anadromous salmonid habitat availability is highly sensitive to change in RCT depths of 0.2 feet, as illustrated in Figure 2. The methodology described below focuses on establishing rates of diversion that do not reduce depths by more than specified amounts at the Q_{WLF} or Q_S thresholds.

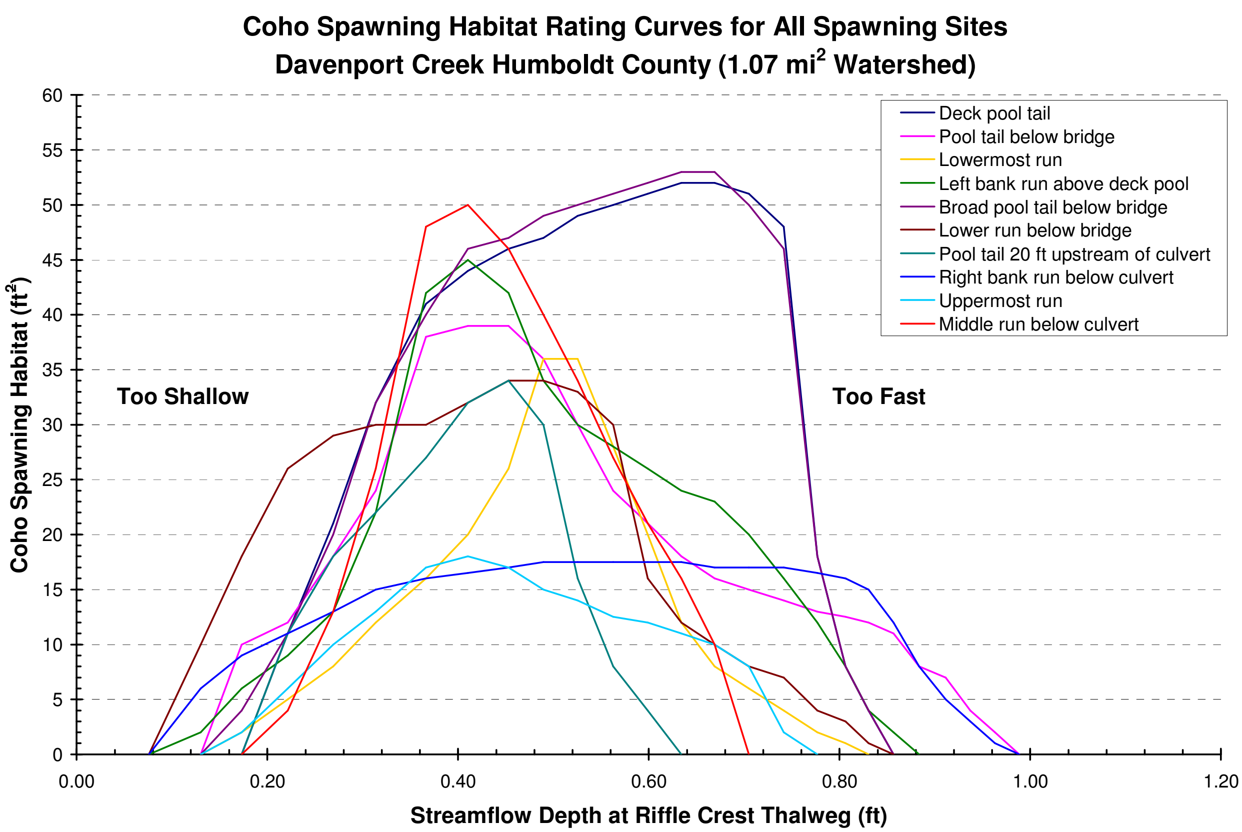

Figure 2. Spawning habitat rating curves for individual spawning locations on Davenport Creek as a function of riffle crest thalweg depth.

RCT Surveys: Establishing the Q – RCT Relationship

The methodology defined here includes a RCT survey. The primary task for the RCT survey is to measure and establish a site-specific quantitative relationship between streamflow and the median RCT depth. This is done so that Q_S or Q_{WLF} can be estimated, and rates of diversion established, for the POD. Identification of the RCT requires minimal training and expertise, but professional guidance at the onset of fieldwork is recommended. Because the RCT depth can vary along the stream channel for a given streamflow, the RCT depth at 15 or more riffle crests should be measured per POD. At each riffle crest, only one measurement at the thalweg need be taken, with a stadia rod or ruler.

A map showing a typical study site is included as Figure 3. As a rule-of-thumb, riffle crests are approximately spaced at an averaged interval of 5 to 7 bankfull channel widths. On Davenport Creek, for example, the average bankfull width is approximately 12 ft. Therefore, an RCT survey would, as an initial estimate before heading to the field, require a (7 widths * 10 ft/width) * 15 RCTs = 1050 ft long channel segment. Each RCT survey must have a measured streamflow; at least 6 to 8 surveys should be planned that will span the range of typical baseflows and receding storm flows.

Figure 3. Davenport Creek panoramic with RCTs identified on the photograph.

Once surveyed at a given streamflow, the RCT depths are ranked to compute the RCT_m depth. Results from an RCT field survey conducted by Humboldt State University students for Sullivan Gulch, a 2.35 mi^2 watershed in Humboldt County, are illustrated in Figure 4. Outlying RCT depths (both shallow and deep) will have minimal effect on the median RCT depth with this large sample size.

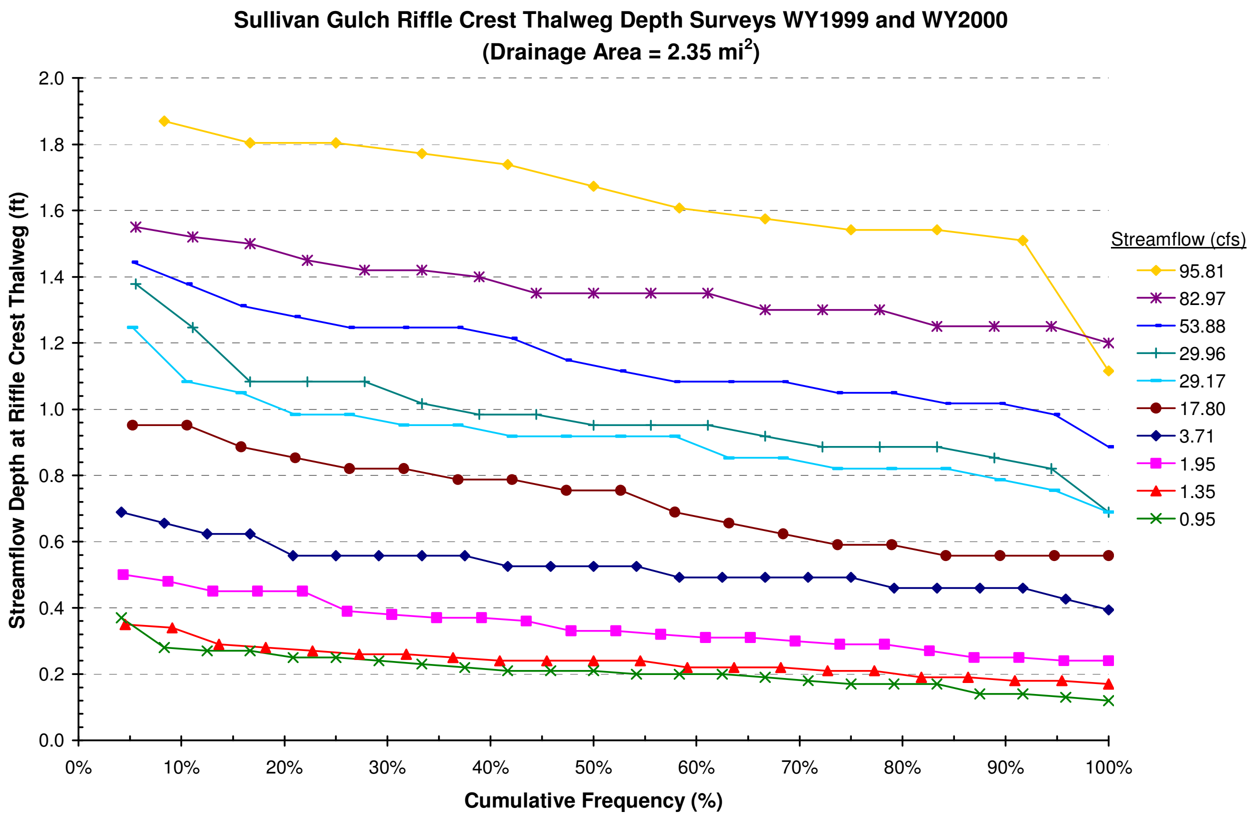

Figure 4. RCT surveys for Sullivan Gulch in Humboldt County.

(Comment: We recommend using of the 50th percentile RCT (RCT_m) rather than a lower percentile RCT depth (e.g., the 10th percentile RCT depth) for constructing a Q - RCT_m curve. One possible objection to this approach is that only one shallow riffle is needed to delay or prevent adult migration. However, the RCT depth survey and construction of a Q - RCT_m curve are not fish passage assessments. Rather, both are meant to establish a reference point, by quantifying the overall hydraulic behavior of a small stream channel. An ever-expanding RCT survey (farther downstream and/or upstream) will eventually encounter "worse" riffles with respect to fish passage. Thus the 10th percentile RCT depth will keep changing with sample size, whereas the median RCT will remain relatively constant. Using either the median or a lower percentile, outlier riffles, culverts, or rockfalls that behave very differently will need to be investigated individually.)

Once RCT depths at multiple streamflows have been surveyed, the median RCT depth can be plotted as a function of streamflow (the Q – RCT_m curve) and fit to a mathematical function. Median RCT depths plotted against streamflow for Sullivan Gulch are illustrated in Figure 5. Protocols for identifying Q_S and Q_{WLF}, and for recommending specific diversion rates, will require this Q – RCT curve.

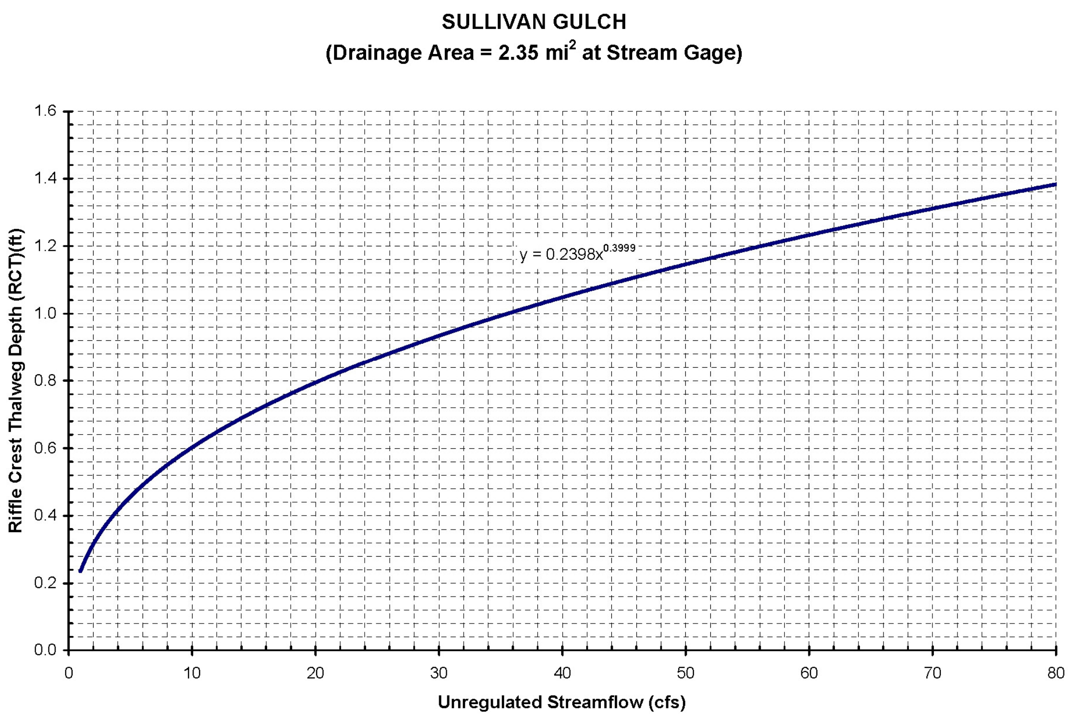

Figure 5. The Q – RCT_m curve for Sullivan Gulch in Humboldt County.

III. The Salmon and Steelhead Spawning and Migration Flow Threshold (Q_S)

The Salmon and Steelhead Spawning and Migration Flow Threshold ("Salmon Spawning Flow" or Q_S) is a streamflow threshold important for protecting two steelhead and salmon life history functions in small North Coast California streams: (1) maintaining natural abundance and availability of spawning habitat; and (2) minimizing unnatural adult exposure, stress, vulnerability, and delay during spawning migration.

The first objective for establishing Q_S is accomplished by positioning Q_S on the right side of the spawning habitat rating curve as described below. Doing so will protect a range of habitat available at different flows. The second objective is accomplished by identifying a maximum diversion rate that will protect streamflows at and above Q_S. Flows at Q_S will cover the backs of migrating fish, which will minimize unnatural adult exposure, stress, vulnerability, and delay during spawning migration.

Methodology Based on Habitat Mapping

The first step for estimating Q_S is to measure the area (ft^2) of spawning habitat over the full range of streamflows so as to understand the relationship between streamflow and spawning habitat abundance. In small North Coast California streams, microhabitat mapping (going by many other names, though all very similar) is well-suited for quantifying spawning habitat.

Habitat suitability criteria (HSC) are the foundation for credibly assessing habitat abundance. Such criteria must define quantifiable hydraulic (depth, velocity), substrate, and cover (e.g., overhanging stream banks, submerged vegetation, large wood) conditions favored by salmonids as highly suitable ("good") habitat. These criteria have been developed for other instream flow methodologies, such as PHABSIM, and are utilized in mapping spawning habitat for steelhead, Chinook salmon, and coho salmon. For example, water depth and mid-column velocities identifying good steelhead habitat for yearling steelhead can have depths ranging from 0.5 ft to 1.5 ft deep and velocities ranging from 0.5 ft/sec to 1.5 ft/sec. Sometimes, the criteria can be developed by underwater observation within the stream being investigated; otherwise, the scientific literature is consulted.

With HSC established (guided by agency fish biologists), fish biologists then go into the field and measure where these criteria collectively exist in the channel for each species life stage being investigated, over a range of pre-determined streamflows. This can be done simply, especially for small streams, using a stadia rod and velocity meters. When a habitat patch (also considered a microhabitat) has been identified, measured, and outlined (now called a habitat "polygon"), the polygon's shape must be reliably transferred onto a basemap or other reference. This basemap can be an aerial photograph with easily distinguished features so biologists can map the polygons onto the basemap. GPS techniques are gaining favor, especially as the technology improves and satellites become more accessible. In small streams, simple still might be better. An approach that triangulates the boundaries of each measured polygon to fixed benchmarks (rebar stakes) using two measuring tapes can precisely transfer the measured polygons into a coordinate system for computing the area of each polygon.

The channel is repeatedly mapped over a pre-determined range of streamflows. Polygon areas are tallied for each streamflow and then plotted as a function of the measured streamflow. This spawning habitat rating curve, with the X-axis = Q (cfs) and the Y-axis = spawning habitat (ft^2), is the basis for estimating Q_S. (See Figure 6.)

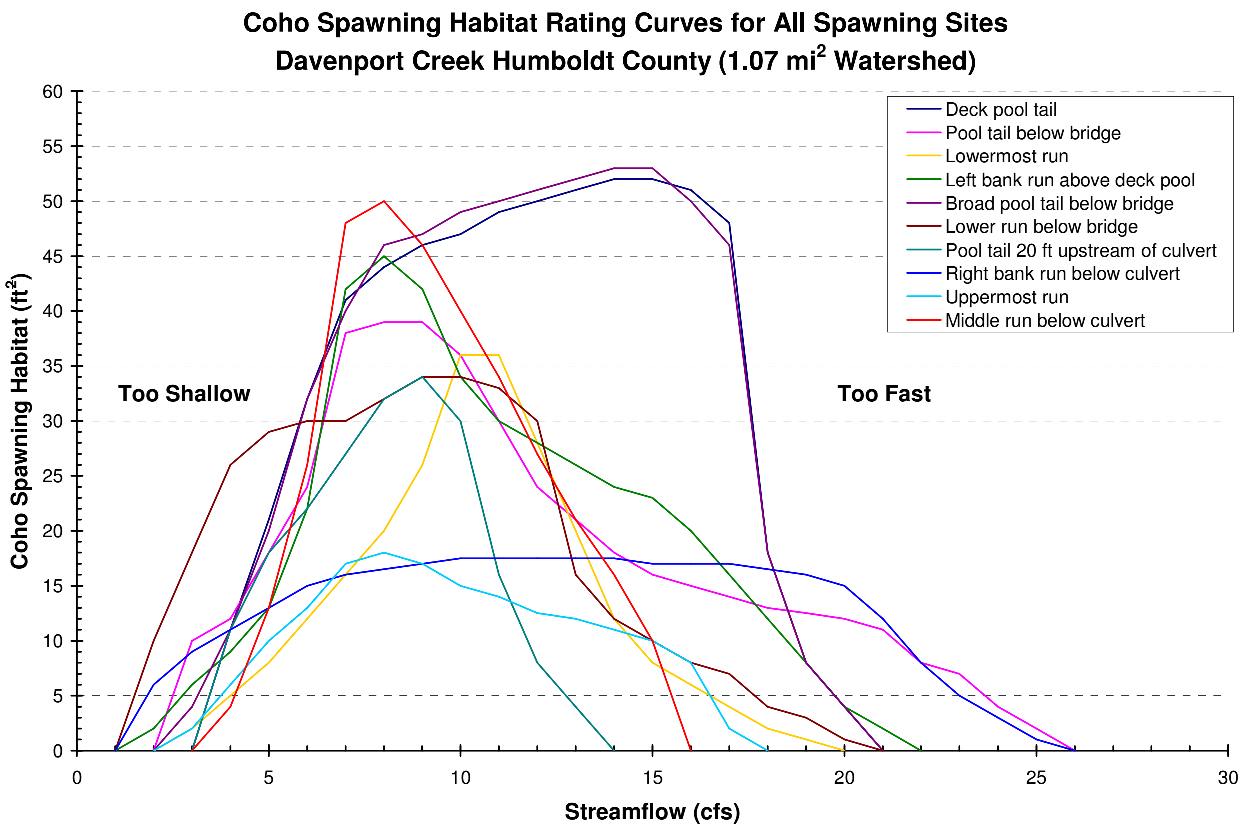

Figure 6. Individual coho spawning habitat rating curves for the 10 spawning sites in Davenport Creek.

Depths of flow at the RCT are used to estimate flows needed for fish passage and migration as well as spawning habitat. Minimum fish depths for passage and migration are assigned to the three primary anadromous species in North Coast California at a level that does not expose the back of a migrating fish. A median riffle crest thalweg (RCT) depth of 0.7 ft deep is considered a conservative minimum depth for inundating an adult steelhead swimming 0.10 ft off the channelbed. A median RCT depth of 0.8 ft deep is considered a conservative minimum depth for inundating an adult coho salmon swimming 0.10 ft off the channelbed. A median riffle crest thalweg depth of 1.0 ft deep is considered a conservative minimum depth for inundating an adult Chinook salmon swimming 0.10 ft off the channelbed.

Habitat Mapping Method Demonstrated by Example

In this example, Bill Trush mapped coho salmon spawning habitat in an approximate 700 ft reach of Davenport Creek (named locally), a tributary of Lindsay Creek within the Mad River watershed of Humboldt County. The creek's drainage area at the stream gauging station is 1.07 mi^2. Q_{AVE} equals 3.42 cfs. Davenport Creek meanders through this reach, and Trush has been observing and measuring coho salmon migration and spawning in Davenport Creek since November 2001. Taking advantage of extensive field observations, as well as using preferred depth, substrate, and velocity criteria, coho spawning habitat was mapped (using a modified head rod to check water velocities) over the full range of streamflows wherever habitat was found.

Davenport Creek is a small stream, with a 7-10 ft wide channel. Streamflows between 3 and 6 cfs provide minimally sufficient depths for spawning, whereas streamflows approaching 22 cfs rapidly become too fast (Figure 7). The window of favorable streamflows for an adult salmon returning to spawn in small North Coastal California streams is narrow most years.

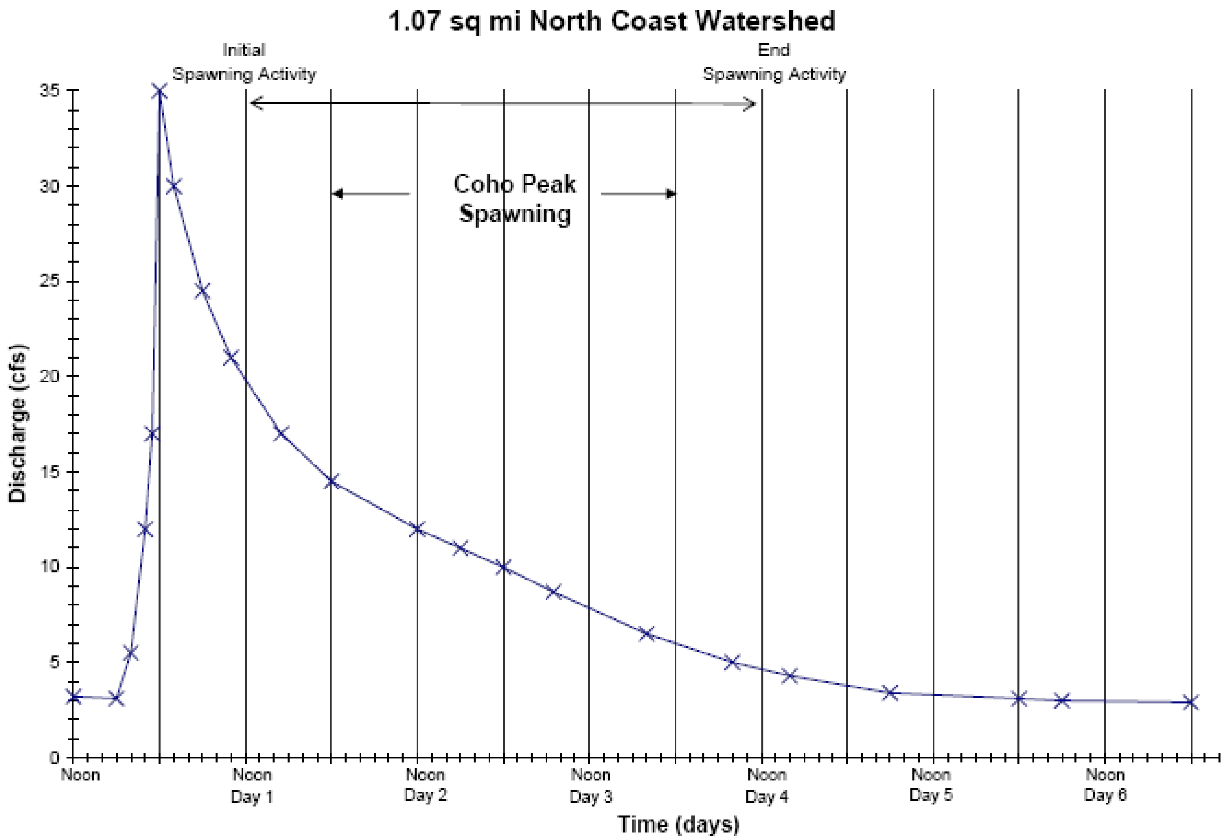

Figure 7. Coho salmon spawning use during a small winter flood.

Coho spawning habitat at 10 channel sites was surveyed to established benchmarks to compute the surface area (ft^2) of each delineated spawning habitat polygon and to document how habitat polygons shifted within each channel site as a function of changing streamflow.

Next, the habitat mapping results are presented by plotting spawning habitat rating curves for each spawning habitat site separately. The 10 individual curves in Figure 6, above, illustrate the hydraulic diversity among the spawning sites that is masked by the composite rating curve (Figure 8). No single rating curve adequately approximates this collective diversity.

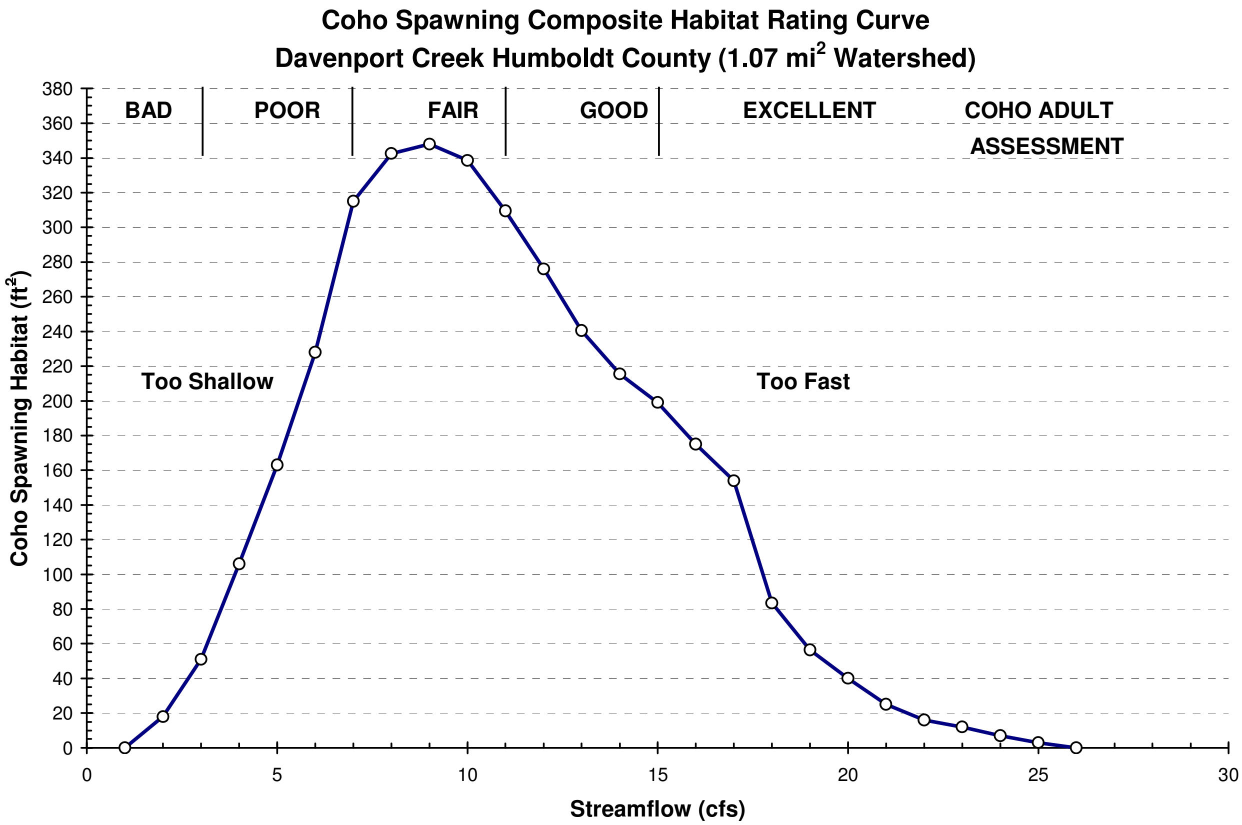

Figure 8. Composite coho salmon spawning habitat rating curve for Davenport Creek.

By contrast, Figure 6, above, highlights the complexity of how channel morphology, streamflow, and fish behavior interact. The Habitat Rating Curves shown in Figure 6 are reproduced below as Figure 9, with Q_S shown. The two biggest curves are for broad pool tails, where channel width is approximately 20% greater than the mean width. In contrast, the site with a pronounced platform at 17 cfs (spanning 7 cfs to 19 cfs) is a long, wide run with a lateral bar along its right bank. The three sites with steep, cone-shaped habitat rating curves peaking between 7 cfs and 9 cfs are short pool tails. Ongoing field monitoring is revealing that redds constructed in these short pool tails tend to scour more easily and often during peak winter flows than redds constructed in the runs. Each spawning site offers a unique redd environment that may or may not promote success (fry emergence) depending on the magnitude, duration, frequency, and timing peak streamflows during egg incubation and alevin development. The variety of individual habitat rating curves, therefore, offers risk management to coho salmon trusting their redds to an unpredictable future.

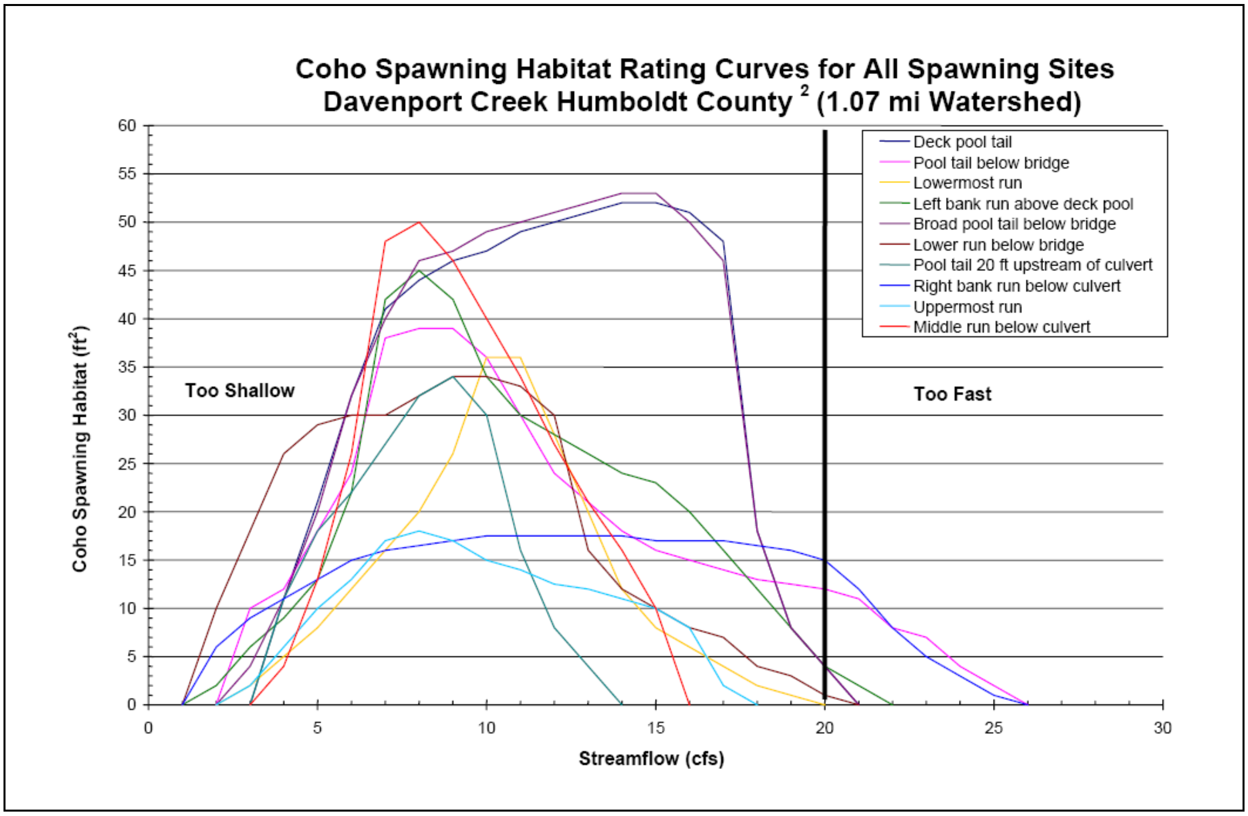

Figure 9. Figure 6. Individual coho spawning habitat rating curves for the 10 spawning sites in Davenport Creek, with Q_S shown.

Q_S could be defined as the highest streamflow that sustains any spawning habitat; Q_S would be 26 cfs. The proposed methodology protects "good" habitat, rather than accounting for the last square foot of spawnable channelbed, by assigning an adjusted estimate for Q_S based on spawnable area. In the Figure, the last habitat occurs at 26 cfs, but a minimum area of 15 ft^2 for a single habitat site would put Q_S at 20 cfs. This methodology excludes more marginal habitat at the highest flows, for example, the "tails" at the far right side of the habitat graph. Another approach for trimming the tails at the far right side of Figure 9 could be to use a percentage of spawnable area.

Our recommended methodology is to set Q_S at a level to account for all good habitat defined as individual sites with at least 15 ft^2 for coho and 10 ft^2 for steelhead. (I.e., increasing flow does not produce additional spawning locations with areas of those sizes.) Therefore, Q_S in this example is 20 cfs.

Interim Method for Estimating Q_S Based on Fish Passage Depth

The proposed protocol for prescribing instream flow thresholds and diversion rates depends on quantifying Q_S. However very few spawning habitat rating curves exist for North Coast California streams especially in small streams with drainage areas less than 5 mi^2. We propose using streamflows that produce the minimum fish depths at the median RCT as a surrogate for Q_S. Combined with ecologically sensitive diversion rates, this protocol should be protective for watersheds up to 10 mi^2. This maximum drainage area may seem small, but almost all water rights applications for the North Coast are on small streams, so a study method that works for those streams is important.

Stage height for Q_S at the RCT_m is estimated by selecting the "fish depth" appropriate to the diversion. If only steelhead spawn in the vicinity of the POD, then Q_S is assigned a RCT_m depth of 0.7 ft. If steelhead and coho salmon spawn in the vicinity of the POD, then Q_S is assigned a RCT depth of 0.8 ft. If all three species are present, Q_S is assigned a depth of 1.0 ft.

This approach requires an assessment of the Upper Limit of Spawning Habitat for each anadromous salmonid species. Where the project is above the Upper Limit of Spawning Habitat but still requires calculation off Q_S (this will happen only where there are large cumulative effects), the methodology directs the studies to the nearest downstream reach of anadromous fish habitat. Where the applicant uses a depth of 0.7 or 0.8 because only steelhead, or steelhead and coho, are present in the vicinity of the POD, but other species are present farther downstream within the same basin, then the applicant shall take steps to ensure that assigning Q_S a depth based only on the most upstream habitat also serves to protect spawning and migration flows for fish farther downstream. (This should be possible using desktop depletion analysis, because in most cases the area of greatest cumulative effect will be nearest the diversion.)

The streamflow magnitude for Q_S is estimated by associating the selected RCT_m depth with streamflow in the Q – RCT curve constructed from the RCT field surveys.

This method will be reviewed and could be adjusted based on the results of site specific studies using the habitat mapping methodology.

Example

For example, Chinook salmon spawn above the stream gage on Sullivan Gulch. Using the Chinook salmon fish depth of 1.0 ft for the RCT_m at Q_S, the estimated streamflow magnitude for Q_S would be 35 cfs at the stream gage in Sullivan Gulch (Figure 5). The microhabitat mapping method resulted in a Q_S of approximately 32 cfs.

Assessment of Unusual Circumstances

Whether using the microhabitat mapping method or the method based on fish depths, the site-specific study must consider unusual circumstances that might exist downstream of the diversion. For example, if a diversion positioned 0.5 mile upstream of a cascade, waterfall, or road crossing that is passable but presents the most obvious limiting point in the vicinity of the diversion, the site-specific study might focus on flows needed for passage at that limiting point.

Initial Regional Estimate

To be re-calculated by SWRCB staff.

IV. The Winter Low Flow Threshold (Q_{WLF})

The Winter Low Flow Threshold (Q_{WLF}) is a streamflow threshold important to managing several steelhead and salmon life history needs in small North Coast California streams: (1) maintaining good benthic macroinvertebrate habitat in riffles to foster high stream productivity, (2) preventing redd desiccation and maintaining hyphoreic subsurface flows, (3) sustaining high quality and abundant juvenile salmonid winter rearing habitat, and (4) facilitating smolt out-migration.

Methodology Based on Habitat Mapping

Productive benthic macroinvertebrate (BMI) habitat is important to rearing healthy salmonid juveniles. An instream flow protocol must recognize this aspect of juvenile habitat to complement the more traditional concern for habitat abundance. Productivity is extremely difficult to measure. As a surrogate for productivity, we propose measuring riffles that provide good physical conditions for productive BMI habitat. For small North Coast California streams, highly productive BMI habitat can be habitat-mapped using the following physical criteria: (1) the median particle size of the rifflebed is inundated (establishing a minimum depth) and (2) the average column velocity is greater than 1.5 ft/sec. The median particle is estimated as the D_{50} from a standard 100 rock-count inventory. A productive BMI habitat – streamflow rating curve can be measured on the stream using habitat mapping. The resulting habitat rating curve would have Q (cfs) on the X-axis and productive BMI habitat (ft^2) on the Y-axis. With no maximum depth or velocity criteria, this BMI habitat rating curve will ramp-up to an asymptote as riffles are inundated bank-to-bank and velocities across the riffle exceed 1.5 ft/sec. All riffle habitats should be habitat-mapped in a channel length at least 30 bankfull widths long. Each riffle within this sample reach should be plotted separately and as one composite (the same as recommended for the spawning habitat rating curves). The recommended winter low flow (Q_{WLF}) would be estimated at the overall asymptote of the BMI habitat rating curves for each riffle assessed.

Similar methodological approaches to quantifying juvenile salmonid rearing habitat and amphibian habitat would appear obvious tasks for developing Q_{WLF}. However, streamflows sustaining good juvenile rearing habitat will range from low streamflows below Q_{WLF} through high streamflows exceeding Q_S. We do not propose that juvenile rearing habitat or amphibian habitat be mapped, though it could be done. The policy presumes that the Q_{WLF} and Q_S thresholds, in combination with the proposed protocols for determining diversion rates, will sustain good juvenile rearing habitat in small North Coast California streams. Flows at Q_{WLF} will maintain good BMI productivity, prevent redd desiccation and maintain hyphoreic subsurface flows. Flows at the Q_{WLF} threshold also support smolt outmigration.

Whenever considering baseflows, water temperature should be integral to an instream flow investigation and protocol. Given the time period in the policy for winter habitat (December 15 through March 31), however, we did not consider water temperature to be a factor of concern in small North Coast California streams.

Interim Methodology Based on Depth

To our knowledge, no BMI habitat rating curve has been constructed for a small North Coast California stream (we have one under construction for Davenport Creek). An interim methodology for estimating Q_{WLF} for small North Coast California streams is to use the streamflow at the median RCT that inundates the dominant particle size of the riffles (quantified as the D_{84} in a 100 rock-count). If the riffle D_{84} is 120 mm (0.39 ft), the streamflow at 0.39 ft on the median RCT – Q curve would be the estimated Q_{WLF}.

This method will be reviewed and could be adjusted based on the results of site specific studies using the habitat mapping methodology.

Initial Regional Estimate

In lieu of doing the rock counts, and until field studies with BMI habitat mapping are completed, Q_{FEB} may be used as a proxy for Q_{WLF} in small North Coast California streams.

This method will be reviewed and could be adjusted based on the results of site specific studies using the habitat mapping methodology.

Example

Initial results for Davenport Creek give a Q_{WLF} of 5.52 cfs based on the D_{84} method (0.3 ft), which is similar to Q_{FEB} (= 4.82 cfs). Differences in stage height at the median RCT among these streamflows are small.

V. Examples of Rate of Diversion Calculations

Diversions can be expressed as a change in water surface depth at the RCT_m. An allowable maximum diversion should cause no more change in depth than determined potentially harmful to migrating adult salmonids and that could impair other ecological processes previously identified (i.e., 0.05' when $Q_{WLF} < Q_D < Q_S$, and 0.1' when $Q_S < Q_D$).

This change in depth is then converted to a diversion rate (cfs) at Q_S using the Q - RCT_m rating curve (Figure 5, above). Note that the percent diversion rate changes with streamflow magnitude. The inter-relationship of diversion rate, to produce a 0.05 or 0.1 ft drop in depth, and the percentage of the unregulated streamflow this rate requires is illustrated in Figure 9 for Davenport Creek and Figure 10 for Sullivan Gulch.

Rates of diversion are set so that the diversion causes no more than 0.05 ft change in depth at any of the flows producing depths between Q_{WLF} and $Q_{S,}$ or so as to cause not more than 0.1 ft change in depth when flows are just above $Q_{S,}$ as described in the policy.

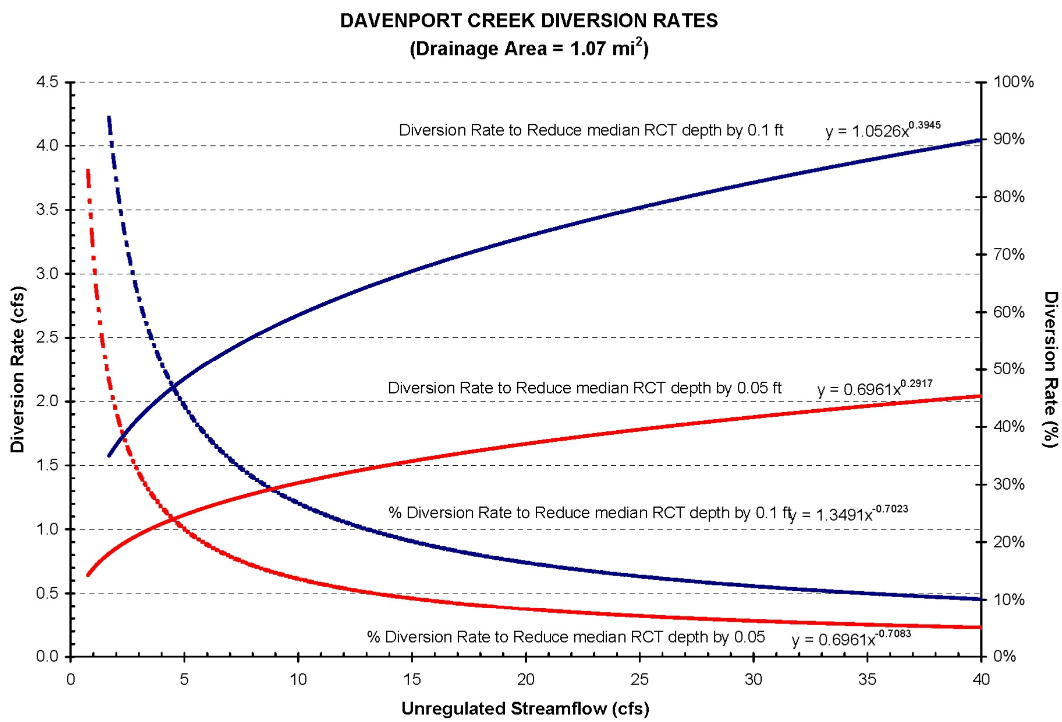

Figure 10. Fixed diversion rates as a function of unregulated streamflows for Davenport Creek at 0.10 ft and 0.05 ft diversion rates.

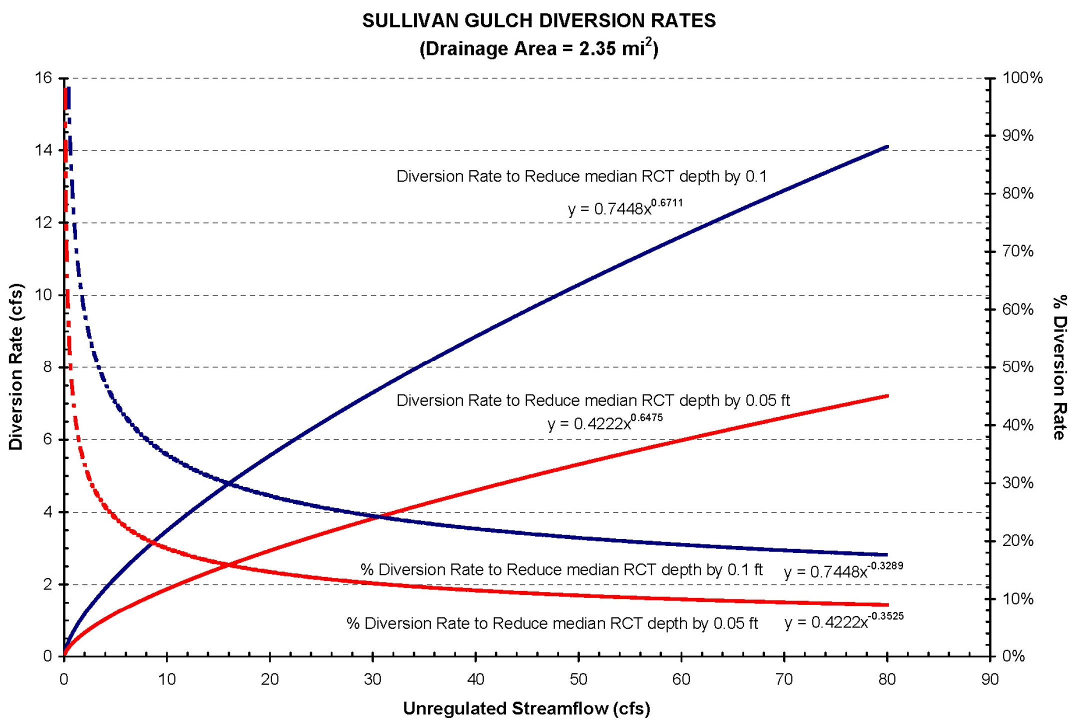

Figure 11. Fixed diversion rates as a function of unregulated streamflows for Sullivan Gulch at 0.10 ft and 0.05 ft diversion rates.