Response to RME and ISRP Comments

Thank you for the opportunity to respond to both the ISRP and RME comments on our Habitat Mitigation Tracking System proposal. We found the comments very helpful. Our response is organized into four sections – Project Specifications, Project Background, Specific Comments and Responses, and Summary. After reviewing the reviewers' comments and all relevant information, we believe the need for habitat mitigation project data and a systematized data collection and reporting system, as described in our proposal, remains paramount.

Project Specifications

Project ID#: 35022

Project Title: Habitat Mitigation Tracking System

Sponsor: Steward and Associates

FY03 Request: $462,131 (No change)

5YR Estimate: $1,372,107 (No change)

Short Description: Assist BPA *and other Action Agencies* in meeting their habitat mitigation obligation and, if appropriate, receiving credit, as specified under RPAs 180 and 183 in the FCRPS Biological Opinion. (Italicized words added)

Response to ISRP Preliminary Comments Needed? Yes

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Project Background

Before addressing the specific issues raised by the reviewers (see **Specific Comments and Responses** below**)**, we would like to briefly recount the circumstances and events that precipitated this proposal. It is important to understand the underlying need and impetus behind this project in order to fully appreciate its potential benefits.

This project was conceived in response to a specific need identified by Steve Waste, Chair of the Federal Habitat Caucus. In discussions with Steve and other FHC members, we determined that the Action Agencies (Bonneville Power Administration, United States Army Corps of Engineers, and the Bureau of Reclamation) lacked a systematic and comprehensive record of the biological benefits of habitat projects that they fund or undertake to fulfill, in part, their salmon recovery and habitat mitigation obligations under the ESA. The agencies have invested substantial time and resources on habitat mitigation, but other than obtaining basic information on project implementation and cost, they have not determined their overall effectiveness. The lack of a mechanism for

collecting information and evaluating and reporting on habitat projects has created inefficiencies and undermined the agencies' ability to carry out their responsibilities as called for by the FCRPS Biological Opinion.

With respect to habitat mitigation, the agencies are obliged to focus attention on priority actions that have potential to significantly improve anadromous fish survival and productivity. These priorities are to be identified through subbasin planning called for in the Columbia River Fish and Wildlife Program; i.e., the systematic evaluation of existing habitat conditions and biological potential at the subbasin scale, followed by identification of specific habitat protection or restoration measures designed to address limiting factors and achieve biological objectives.[1]

Of particular relevance to this proposal, the BiOp directs the Action Agencies and NMFS to work within subbasin planning and appropriation processes to identify, implement, and monitor priority habitat mitigation projects within a systemwide hierarchical program. Specifically, Action 180 calls for regional agencies to work collaboratively on a systemwide monitoring system that permits evaluation of progress toward biological objectives. A draft program including appropriate population and environmental performance measures and standards, experimental designs, data collection protocols, and related information was to be developed by September 2001 and implemented in the spring of 2002.

We understand that the Research, Monitoring and Evaluation (RME) Group has completed a draft template that describes the basic components for monitoring and evaluating the effectiveness of tributary habitat projects (Paulsen et al. 2002). Our perception of the document, which we reviewed and cited extensively in our original proposal, is that while it clearly articulates the need for an overall monitoring program and provides generally useful guidance and criteria for evaluating the effectiveness of habitat projects, it lacks the detail necessary to fully develop and implement a such a program. We concur with the ISRP view of the report, expressed in an accompanying review[2], viz. "…we think its effects will be incrementally positive, but this document does not provide sufficient guidance to ensure generation of the right mix of monitoring proposals, and it does not provide a comprehensive set of criteria for review of such proposals…Revision as a scoping document for planners and administrators is needed to provide clear top-down guidance that actually stipulates overall design specifications to address the need for collecting data to answer the BiOp check-in questions about effectiveness of mitigation actions on salmon survival." The ISRP recommended further

[1] Biological objectives are identified in the Biological Opinion as the desired outcomes of reasonable and prudent alternatives or RPA's. RPA's are meant to result in the attainment of biological performance standards, thereby avoiding jeopardy to listed stocks and the destruction or adverse modification of their critical habitat.

[2] ISRP (2002). Review of March 27, 2002 Draft Guidelines for Action Effectiveness Research Proposals for FCRPS Offsite Mitigation Habitat Measures by C. Paulsen, S. Katz, T. Hillman, A. Giorgi, C. Jordon, M. Newsom, and J. Geiselman.

discussion among potential researchers and data users before attempting to reach consensus on the specific protocols and performance measures to be applied.

We do not mean to disparage the RME report; on the contrary, we want to emphasize its positive aspects, signal our willingness to contribute to the ongoing dialogue, and to assist in the implementation of a basinwide monitoring program. We understand that the habitat projects must be rationally designed and implemented, and that monitoring must yield information that can be used to assess the effect of different types of management actions on fish performance (survival and condition) and habitat condition. As the RME report indicates, well-designed research experiments, replete with controls and adequate replication, are required if the hypothesized effects are to be detected (Paulsen et al. 2002). There is no guarantee that a meaningful response, either in terms of life-stage specific survival or growth, or habitat improvements, will be effected or accurately interpreted. We (the project proponents) have confronted similar challenges in designing population and environmental monitoring programs for hatchery supplementation and municipal activities.[3] We fully appreciate the enormity of the task.

In addition to the requirements of the Biological Opinion and the needs expressed by various agencies, committees, and task forces, impetus for this project also came from the Lower Columbia – Willamette River Technical Recovery Team, to which the project principal investigator (Cleve Steward) and lead biologist (Dr. Tom Backman) are appointed. The TRT was tasked with developing biological (e.g., viable salmonid population) delisting criteria for five listed ESU's and their constituent populations. The TRT recently released a draft report that describes appropriate population abundance and growth rate, diversity, and spatial structure criteria. These criteria refer to habitat-related "factors for decline" and performance standards that are analogous to the biological criteria. For example, the habitat "delisting criteria" proposed by the TRT includes the requirement that "All habitats and habitat attributes that affect the viability of the ESU should be managed to achieve properly functioning conditions. Habitat conditions should be maintained in a non-deteriorating state." The TRT is currently evaluating the potential for using a suite of habitat parameters to index the status and trend of ESU-critical habitats.

The habitat delisting criteria, if met, would be considered partial evidence that a species is no longer considered threatened or in danger of extinction. Note that the thresholds associated with these criteria are not equivalent to the "jeopardy" standards identified in the BiOp. However, because the measures to avoid jeopardy to listed species and the habitat delisting criteria both address habitat-related factors that contributed to the original endangerment of the species, they share a common foundation. For this reason, habitat monitoring protocols should be consistent and results readily interpretable in the context of both jeopardy and delisting determinations.

[3] Please see the experimental design and monitoring protocols described in: Steward, C.R. 1994. Monitoring and Evaluation Plan for the Nez Perce Tribal Hatchery. Report prepared for the Department of Fisheries and Resource Management, Nez Perce Indian Tribe, and the Bonneville Power Administration. 259 pp. + appendices.

Specific Comments and Responses

To insure that the comments of the RME and ISRP are fully considered, we have included the original comments (in standard font) and our associated responses (in italic font) below. If the ISRP or RME addressed more than one issue within a section, we discuss them separately. We numbered our responses to facilitate tracking the comments.

This proposal outlines work designed to ensure that habitat mitigation projects make a positive, measurable contribution towards salmon recovery, that the responsible agency be held accountable for its efforts, and that additional mitigation opportunities and constraints are identified and communicated to fish and wildlife managers and the public.

RME Comment #1:

The RME reviewer stated "this proposal is not RPA 183 relevant because it doesn't address monitoring or implementation of specific projects as identified under RPA 183 of the BIOP. Rather it requests funds to develop a programmatic structure."

Response to RME Comment #1:

We consider this project relevant to both RPA's 180 and 183, although the connection to RPA 180 is the stronger of the two. We intend to work collaboratively with the RME and other stakeholders to develop a monitoring, evaluation, and reporting system for offsite habitat mitigation projects, including protocols for biological and habitat sampling and analysis. We are not proposing to develop these protocols unilaterally. We will work with the RME, the TRTs, and agency representatives to develop and refine the methods and metrics to be used to evaluate habitat mitigation projects, design the database content and structure, and assist in the data collection, interpretation, and reporting of the results.

We propose to follow the implementation and reporting schedule stipulated in the Biological Opinion; enough information will be obtained for a complete evaluation of program effectiveness at the 5- and 8-year check-in points. In this sense, the RME reviewer was correct: we intend to develop a programmatic structure that facilitates evaluation of the effectiveness of individual and grouped habitat projects using the tools, experimental approaches, and performance measures developed by, among others, the RME.

With respect to RPA 183, the experimental (Tier 3) studies will yield information on the adequacy of biological and habitat performance measures and the nature of habitat response – fish survival relationships within different geographical areas, ESUs, and management action categories. Much of the new information will be data collected as the regional RME program is implemented. This information will be used by the RME and others to evaluate and, if necessary, revise the biological objectives, experimental approach, data requirements, and sampling and analytical methods used to determine the

habitat mitigation program's effectiveness. We fully anticipate the need for (and benefit of) such revisions.

The Data Management Subgroup stated unambiguously that our project was relevant to RPA 183. In answering the question "Does the Proposal meet RPA needs?" the Data Management Subgroup noted "The Action Agencies have an urgent need for tracking habitat related projects to meet their obligations under the Biological Opinion. This proposal addresses those obligations directly. The project seems to be designed particularly to address RPA 183 and the evaluation of the benefits of offsite mitigation habitat actions."

RME Comment #2:

"This proposal is weakened by a lack of specific information on what the developed products will look like. For example the proposal includes large-scale quotes of the Paulsen et al (2002) document that describes what projects should look like, but does not identify current habitat projects that it would coordinate."

Response to RME Comment #2:

Addressing the last point first, we quoted the RME report (Paulsen et al. 2002) extensively because 1) it offered the most recent and thorough treatment of habitat project monitoring under the Biological Opinion, and 2) we would like to incorporate, as much as is feasible, the guidance and work of the RME into the basic framework of the habitat mitigation tracking system. The RME report clearly defines the need for such a system, and it offers a basic conceptual framework and strategy for meeting this need, but it lacks the technical detail necessary for us (or anyone, for that matter) to fully comprehend and design a final habitat project monitoring and evaluation (i.e., tracking) system. The ISRP critique of the RME report basically concurs with this assessment.[4]

The RME comment suggests that our proposal lacks detail on "what the developed products will look like", and notes that it "does not identify current habitat projects that it would coordinate." More information on the products (i.e., database, analyses and reports) and the types of projects to be addressed by this project is provided in our responses to the ISRP comments below. We acknowledge the lack of detail in our proposal on the specific habitat parameters that would be used to gauge the effectiveness and impacts of offsite habitat mitigation projects. This was intentional since the specific indicators for evaluating project success have not been developed or agreed upon. We are aware of several matrices of habitat variables and evaluative criteria that have been developed by others to assess habitat status and trend. Examples of these types of matrices (Tables 1 and 2), based loosely on the NMFS Matrix of Pathways and

[4] The ISRP memo noted that the RME "document has lots of marginally defined and undefined terminology. Bureaucratic language of the BiOp is used repeatedly without being described in other, more common words. The document refers the reader to Hillman and Giorgi (2002) for help with terms, etc., but this reference is not listed in the Literature Cited section."

Indicators (NMFS 1996), that we have developed and applied in watershed assessment studies, are presented in Attachment #1.

Our hope is to help further the effort of identifying, standardizing, and applying a subset of biological and habitat indicators that can be used to quantitatively evaluate the success of habitat mitigation projects. It would be pretentious to suggest that we should do this alone, and imprudent to proceed without considering the wealth of information that already exists on the subject.

RME Comment #3:

"Like 35001, 35020 and 35050, [this project] proposes to organize a project management team to track, prioritize, and coordinate projects within the Columbia River Basin. This project has three objectives: 1) develop a framework to track project implementation, 2) develop a system to confer credit on those doing the projects and 3) to develop habitat indicators as surrogates for fish responses. The criteria above indicate that programmatic proposals that lack any supporting intention to do some monitoring will receive low priority. In addition (sic)."

Response to RME Comment #3:

We are not familiar with the aforementioned project proposals, nor have we seen further explanation of why programmatic proposals will receive low priority. However, we would like to point out that we are attempting to provide a bridge and feedback loop between researchers, technicians, managers, and administrators. We would ensure that individuals who are planning to undertake habitat mitigation understand and apply the rationale, statistical design requirements, and methods so that the data they provide will be reliable and relevant, and can be used to answer the BiOp check-in questions about effectiveness of mitigation actions on salmon survival. This "hands on" interaction would help project sponsors improve their implementation and monitoring techniques. Similarly, we intend to solicit, assemble, store, manipulate data so that it is accessible to all potential users, including planners, the project sponsors, and the general public. By "closing the loop" we hope to facilitate information exchange and adaptive management, and, ultimately, to achieve our biological objectives more rapidly.

RME Comment #4:

"This proposal would be strengthened by more detailed information on what habitat improvement projects are currently out there to be monitored. If there were some assessment of current projects, then one might be able to provide some more details within the proposal to allow the reader to know that the proposal sponsors are constructing an appropriate team and that they know what they are getting into."

Response to RME Comment #4:

We have firsthand knowledge of several habitat protection and restoration projects that are funded by BPA, the Washington Statue Salmon Recovery Funding Board, and other

state and federal programs. We have considerable experience in planning, implementing, and administering habitat restoration projects and in reviewing and prioritizing applications for habitat restoration funding.

Project activities are carefully designed and sequenced to facilitate learning among project participants. For example, Objective 1d in our proposal calls for the development of a prototype database and tracking system that will be applied to a limited geographical area during the first year of study. If the basic approach proves sound, or after it is modified appropriately, it will be expanded systemwide. There will be ample opportunity for mid-course corrections; we will remain in close contact with primary users, and provide regular (i.e., semiannual) status updates so that the project can be evaluated on a routine basis.

The project team currently consists of 4 primary personnel; of these, Cleve Steward and Tom Backman are fisheries biologist with extensive habitat experience, Joanmarie Eggert is a geologist with a strong project management background, and Nim Desai is a computer programmer and database developer par excellence. Joanmarie and Nim are employees of EA, Engineering Science and Technology (375 employees) and have successfully developed and managed large, complex environmental databases. Cleve and Tom are employed by Steward and Associates; each individual has over decades of fisheries experience, along with strong ties with agency and tribal personnel and members of the scientific and consulting community. Should the need arise, we would be able to quickly identify and secure additional expertise for the project. We intend to work cooperatively with the agencies so that they get the service and product they want.

ISRP Comment #1:

"The proposal does not state that it will provide a structured hierarchical program for status monitoring. There is some lack of clarity in the proposal. At one level it is described as a project compliance system. On the surface, this is a relatively simple data collection task: was the proposal completed as planned? At the next level the proposal plans to gather information about the success of these projects. This is a much more difficult task, especially since, as the proponents state, the indicators for success have not been developed or agreed upon. These issues need to be clearly resolved."

Response to ISRP Comment #1:

Let us be clear: the project is meant to provide a structured hierarchical framework for habitat mitigation status and effectiveness monitoring. This is a capability that none of the agencies currently possess. The reviewers are correct in noting that the project becomes increasingly complex in moving from one objective to the next. The most immediate need, and the one that defines the basic structure of the database, is relatively straightforward. Our intent is to get this portion of the project up and running as quickly as possible before delving into more complex tasks.

ISRP Comment #2:

"The proposed information system, to be successful needs to be designed to at least reference other project data. While the proposed data collection system is focused on BPA funded projects there are potentially other projects that would need to be considered before the effectiveness of a particular BPA funded project could be evaluated. Stating the provisions for data retention and protection would greatly enhance this proposal."

Response to ISRP Comment #2:

As part of Objective 1a in our original proposal, retention and protection strategies will be developed in consultation with system planners and potential users. The proposed database software is flexible and can incorporate various levels of protection and access. By working with the primary stakeholders we will develop a system that meets their needs, rather than imposing a scheme that does not include their input. Additionally, where the data is housed is totally a decision for the primary stakeholders. We (EA) have experience in both operating and housing similar systems and transferring them to the owner, and training their staff to maintain the system. Furthermore, this is a decision that can be changed as funding, staff, and needs evolve. For the purposes of this proposal and our current understanding of project needs, we have submitted costs for operations and maintenance. This is, of course, negotiable.

ISRP Comment #3:

"Private operation and maintenance of the database implies a long term and ongoing obligation for this service. On one hand the proposal is for private data management while the proposal also claims that the tracking system will reduce the BPA's overall liability. On the surface these claims appear contradictory. More information on coordination with other ongoing projects would alleviate potential for duplication of other work currently in progress…Broadening the project focus to a wider constituency beyond BPA Program Managers, Scientists, and Administrators for needs gathering and evaluation would strengthen the proposal."

Response to ISRP Comment #3:

This comment makes several excellent points. The long-term use and maintenance of the habitat tracking system database will not be restricted a single user. We identified BPA as a likely candidate because Dr. Steve Waste, who indicated that such a tool was desperately needed by the utility, initially approached us. After conferring with the Federal Habitat Caucus, it became clear that the information system should be sufficiently flexible to incorporate similar projects funded by other agencies. As the ISRP commenter noted, project planners and evaluators are more likely to get an accurate assessment of project impacts, and to avoid potential duplication and interagency conflict, if the database were to be broadened to include all relevant habitat mitigation projects. Again, our goal is to work with the Federal Habitat Caucus, the RME, and other stakeholders to design a pilot project that, if successful, could be expanded to include all tributary habitat mitigation projects within the Columbia River basin. We

trust that this stepwise and collaborative approach would appeal to project reviewers and funders.

The apparent contradiction between long-term maintenance and reducing BPA's overall liability is easily resolved. BPA's liability would be reduced only to the extent that it can demonstrate measurable progress towards the biological objectives of the Biological Opinion as a result of the habitat mitigation projects it sponsored. BPA would be obliged to support the development and maintenance of the habitat mitigation tracking system, but as the proposal indicates, potential users will be identified and trained to use the system early on. Our involvement would attenuate over time as the tracking system is refined, users are trained, and biological objectives are attained.

ISRP Comment #4:

"There is no indication of adoption of metadata standards."

Response to ISRP Comment #4:

Metadata are descriptive information about data and information sources, or "data about data". Our intent is to design the habitat mitigation tracking system to leverage proven technologies that support multiple metadata standards. The database design will be compatible with agency systems and will conform to applicable metadata standards such as the Government Information Locator Service (GILS), the Federal Geographic Data Committee (FGDC) Clearinghouse, Data Interchange Format (DIF), Dublin Core, and the U.S. Machine Readable Cataloguing (USMARC) standard used in the library community. We are aware of the incredible value of metadata and how to leverage it. Therefore, careful consideration will be given to adopting metadata standards consistent with the data identified as part of the proposed effort.

ISRP Comment #5:

The ISRP concurred with the RME observation that "…additional information is needed to explain the relationship between this project and other ongoing activities."

Response to ISRP Comment #5:

In our introductory remarks, we provided salient background information that included a discussion of the activities of federal Action Agencies, the RME group, and the TRT relative to the work we propose to undertake. When viewed in light of the biological and habitat objectives of the Biological Opinion and species delisting criteria developed by the TRT, and considering the current lack of a habitat mitigation tracking system, the potential benefits of our proposal stand out.

BPA, for instance, currently uses a crude spreadsheet-based tracking system to monitor the progress of over 500 projects. The existing database does not include biological or habitat information; it is euphemistically described as a project compliance monitoring

system. This project would remedy the current situation by providing technical and administrative assistance to project participants, and by recommending a systematic, standardized set of monitoring protocols for evaluating project success.

We expect to interact on a regular basis with habitat project developers, the Federal Habitat Caucus, the RME group, and the various Technical Recovery Teams. We are inclined to work directly with the users to design the system to meet their needs and to assure that it is properly utilized. For instance, the database would be structured to capture all the information needed to support annual reporting requirements of the Action Agencies. We have purposely avoided selecting or adapting an "off-the-shelf" model so that the output will be meet their specific needs.

Summary

In conclusion, we believe that our project has several positive aspects that recommend it as a worthwhile, scientifically sound, and timely undertaking.

1. The project addresses a core set of habitat project status and effectiveness monitoring needs identified in the Biological Opinion and by regional agencies charged with its implementation. Although recent planning in this area, notably by the RME group, appears promising, these needs have not been fulfilled to date, and the program will not meet its stated objectives.

2. The project focuses specifically on off-site habitat mitigation projects in Columbia River tributaries, and therefore remains manageable and tightly focused in scope. The relevant habitat mitigation actions include: 1) screening irrigation diversions; 2) removing blockages; 3) reducing sediment; 4) improving water quality; 5) enhancing nutrients; 6) restoring instream flows; 7) restoring riparian function; and 8) restoring stream complexity (Paulsen et al. 2002). We recognize that the number of projects subsumed under these categories is extensive, and that the objectives, outcomes, and monitoring requirements are varied and complex. The habitat action categories may not represent the best grouping criterion (blocking variable) for analytical purposes. Moreover, the biological responses to the actions, influenced as they are by myriad and interacting environmental factors and processes, will be highly complex, unpredictable, and in some cases, immeasurable. Nevertheless, we are confident that the biological benefits of the projects can be generally ascertained within the specified time and at a reasonable cost using a small, but powerful suite of performance measures and standards.

   We propose to work closely with established research and advisory groups, and with habitat project proponents themselves, to ensure that the information solicited on habitat projects and the types of analyses and reports generated are consistent and broadly supported. Our approach is to work with stakeholder to develop the "look and feel" of the database, and to obtain the requisite data.

Objective 1a in our proposal is designed to get this information early in the process in order to develop a project-specific model.

3. The project is both scalable and adaptable to ongoing planning processes and constraints. We recognize that it would be counterproductive to develop an alternate tracking methodology that conflicts with prevailing scientific opinion and management guidance. Our hope is to work closely with the RME, habitat mitigation project leaders, Technical Recovery Team, and other relevant entities to ensure that the methodology, metrics, tools, outputs of the project gain wide acceptance and provide maximum benefit. By working with key stakeholders, we will ensure that the habitat mitigation tracking system is tailored to meet the diverse needs of the various user groups and administrators, and can be used to gauge success at project, categorical, and programmatic levels. We have already made significant strides in developing and refining this project with the help of NMFS, TRT, and Action Agency representatives and consultants.

4. This proposed project would not add another layer to the Council's Fish and Wildlife Program. It is designed to answer the question: "Did the project(s) have the desired effect on listed species or their habitat?" This data management, analysis, and reporting system will inform other actions contemplated by the Biological Opinion and salmon recovery planners. The database structure is flexible and can easily be structured to incorporate data from habitat mitigation projects of different geographical and institutional origins. Although our preliminary discussions have been with BPA personnel, we can accommodate the needs of other stakeholders.

5. This project is intended to provide a logical framework and architecture for information gained by effectiveness monitoring and experimental studies contemplated in Actions 180 and 183, respectively. Much of the work in these areas has yet to be defined and initiated; however, the basic data requirements, database structure, and reporting capabilities can be identified. If necessary, the habitat mitigation tracking system can be modified in the future to accommodate changes in data and analytical requirements.

We hope our response to comments provided by the RME and ISRP groups demonstrate the soundness and quality of our proposal. If additional information is desired, we will be happy to provide it. We look forward to meeting with the CBFWA reviewers on September 25th to discuss further the merits of our proposal.

Attachment 1

Table 1. Example of habitat indicators/performance measures and standards (e.g., PFC) that could be used to evaluate habitat mitigation projects.[5]

Environmental Indicators	Functional Value	Properly Functioning Condition	Current Conditions	Limiting Factors
Hydrology				
Peak and Base Flow				
Drainage Network Increase				
Water Quality				
Temperature				
Sediment				
Chemical Contaminants and Nutrients				
Structural Habitat				
Substrate				
Large Woody Debris (LWD)				
Refugia				
Channel Conditions				
Gradient				
Width to Depth Ratio				
Pool Frequency				
Pool Quality				
Streambank Conditions				
Off-Channel Habitat				
Fish Passage				
Connectivity with off-channel habitats				
Barriers				
Riparian Conditions				
Watershed Conditions				
Road Densities and Locations				
Disturbance Histories				

[5] These tables are meant to illustrate the basic concept of habitat performance measures and standards; they do not represent the set of indicators to be used in the Habitat Mitigation Tracking Project.

Table 2. Example of habitat resource objectives, indicators, measurement parameters, and properly functioning condition standards derived for basin hydrology.

RESOURCE OBJECTIVES	KEY INDICATORS	MEASUREMENT PARAMETERS	PROPERLY FUNCTIONING CONDITION
Maintain runoff patterns that are typical of the reach, watershed and river system.	Basin hydrology	Precipitation Snow accumulation Evapotranspiration Hydrologic response Water use/ withdrawal	Statistically significant deviation from natural levels. Percentage of basin that is hydrologically mature
Prevent excess water delivery to areas at high risk of mass wasting and erosion	Mode of runoff	Direct runoff Subsurface flow Overland flow Conduit flow	Change in delivery mode
Maintain flows throughout the year to provide sufficient spawning, incubation, and rearing habitat.	Streamflow	Water yield	Statistically significant deviation (increase) from natural levels
		Peak flow	No more than 10% change (increase) from reference condition
		Base flow	No more than 10% change (increase) from reference condition
		Flow timing	Flood and drought recurrence intervals Significant change in the shape of the normal hydrograph Percentage of stream meeting seasonal flow requirements of salmonids