

Draft
Columbia River Basin
Monitoring, Evaluation,
Research, and Reporting
(MERR) Plan



Executive Summary

This Monitoring, Evaluation, Research and Reporting Plan (MERR Plan) ensures the Council's Columbia River Basin Fish and Wildlife Program (Program) goals, objectives, and actions are monitored, evaluated, and reported in a manner that allows assessment and reporting of Program progress. To facilitate Program assessment and reporting, the MERR Plan consists of a Strategic Plan, Implementation Framework, and Implementation Strategies for anadromous fish, resident fish, and wildlife.

The Strategic Plan focuses on the Council's research, monitoring, evaluation (RME) and reporting needs at the policy level. The Strategic Plan sets forth the purpose and expectations for RME and reporting implemented through the Program.

The Implementation Framework contains existing, modified and new processes for prioritizing and implementing RME and reporting in the Program. The Implementation Framework describes how the various components of RME can be used to adaptively manage the Program and guides the development of standardized Implementation Strategies.

The three Implementation Strategies, attached as separate appendices, provides additional guidance in prioritizing and implementing RME actions and reporting. The Implementation Strategies will be developed with regional partners, and will consider integration of regional products.

Upon adoption by the Council, the MERR Plan will provide expectations for, and guidance on, how RME and reporting are conducted under the Program. This guidance will assist the Council and other partners in the Basin with:

- Prioritizing implementation of the Program's RME actions and projects;
- Reducing duplication of RME efforts by facilitating communication and coordination among project proponents and funding agencies within the Basin;
- Adaptively managing the Program;
- Reporting on Program progress for accountability purposes; and
- Providing guidance for the Independent Science Review Panel's review of projects and of the Program.

The MERR Plan is intended to adapt over time in concert with the evolving Program.

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1) Background

In 1980, the Pacific Northwest Electric Power Planning and Conservation Act (Act) charged the Northwest Power and Conservation Council (Council) with developing a program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by the development, operation, and management of hydroelectric projects on the Columbia River and its tributaries (Basin).

Today, the Council's *Columbia River Basin Fish and Wildlife Program* (Program) is one of the largest regional efforts to recover, rebuild, and mitigate impacts of hydropower dams on fish and wildlife. As a planning, policy-making and reviewing body, the Council is responsible for developing and monitoring the Program. Bonneville Power Administration's (Bonneville) hydropower ratepayers fund implementation of the Program; federal, state, and tribal fish and wildlife managers and others implement Program¹ actions².

The Council has a responsibility to the region to assure that this ratepayer-funded Program is implemented in a cost-effective and efficient manner. The Council also has a responsibility to ensure the Program is implemented so as to achieve the desired protection, mitigation, and enhancement of the Basin's fish, wildlife, and habitat characteristics. Hence, the Program recommends implementation of research, monitoring, and evaluation (RME) actions that can enhance the Program's effectiveness and assess the Council's progress towards meeting its responsibilities.

The Council has developed this Monitoring, Evaluation, Research and Reporting Plan (MERR Plan) to partially meet its responsibility under the Act as well as to address the 2009 Program's call for (1) emphasizing the scientific review of new and ongoing actions; (2) increasing requirements for reporting of results and accountability; (3) emphasizing adaptive management as a way to solve uncertainties; (4) renewing the push to develop a better set of quantitative objectives for the Program; (5) committing to a periodic and systematic exchange of science and policy information; and (6) expanding the monitoring and evaluation framework with a commitment to use the information to make better decisions and report frequently on Program progress.

While past Programs have included some guidance for RME actions and reporting, these have not been sufficient to guide limited resources to the Council's highest priorities. The MERR Plan seeks to address this need by: 1) providing information for Council management and policy decisions; 2) assessing the Council's progress towards meeting Program objectives; 3) aiding in prioritizing critical research uncertainties; 4) assuring that the appropriate level of monitoring

¹The Program is funded by Bonneville Power Administration's hydropower ratepayers. In addition to Bonneville other federal agencies, such as the US Army Corps of Engineers and the US Bureau of Reclamation, are also called upon within the Program to implement Program actions.

² In the MERR Plan, the term action(s) refers to RME action implemented by project proponents, such as those addressing a research uncertainty, status and trend monitoring, and actions effectiveness monitoring.

effort is applied for Program actions; and 5) assisting the Council in deciding which actions will likely benefit species and habitat the most.

The three parts of the MERR Plan are:

- *Strategic Plan* – Reflects the overall mission and expectations of the Fish and Wildlife Program for RME and reporting. The Strategic Plan provides policy guidance to assist in allocation of resources during Program implementation of RME and reporting actions. Guidance provided in the Strategic Plan consists of existing as well as new policies developed for the MERR Plan.
- *Implementation Framework* – Based on the policy guidance provided in the Strategic Plan, the Implementation Framework provides direction for focusing and conducting RME and reporting. It also guides the development of the more specific Implementation Strategies.
- *Implementation Strategies* – Provide more specific guidance for what and how RME and reporting will be conducted for anadromous fish, resident fish, wildlife and their habitat. These strategies are to be collaboratively developed with the region's experts and managers, and are to be appended to the MERR Plan. The strategies should assure adequate coordination at the subbasin and basin-wide level to facilitate aggregation of data for assessing and reporting Program progress, including an assessment of the needs of other processes relevant to the Program such as assessments for biological opinions.

The MERR Plan is intended to evolve over time in concert with the Program. To make possible this evolution there are numerous feedback connections within and between the MERR Plan, Columbia River Basin Research Plan (Research Plan), and the Program (Figure 1). These feedback loops allow the Council to guide the Program, MERR Plan and Research Plan based on information gathered and evaluated from implemented actions. The evaluation and reporting conducted under the MERR Plan is vital for adaptive management of the Program and Research Plan because this facilitates identifying aspects that could be improved or that would benefit from more RME efforts.

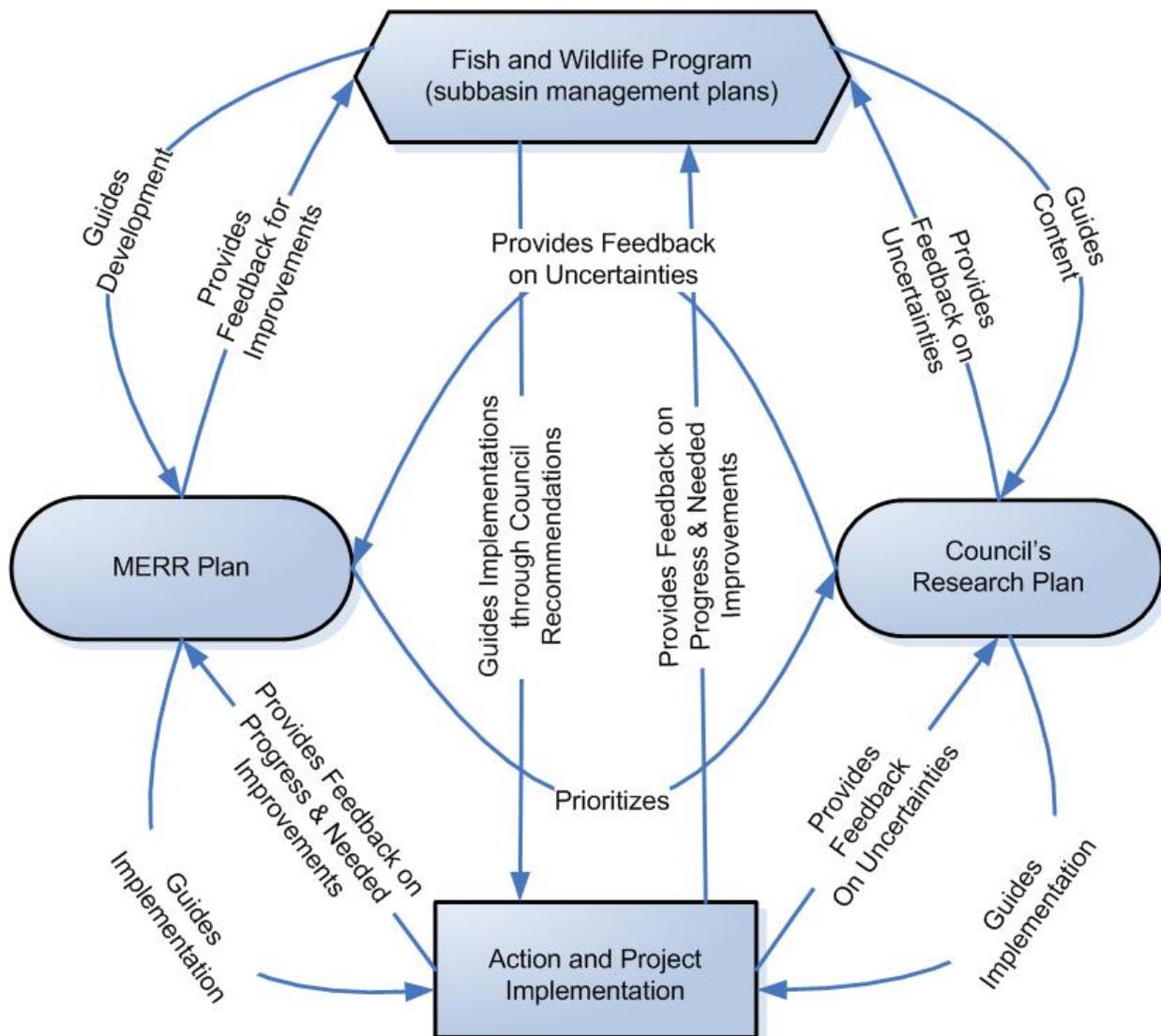


Figure 1: Illustrates the connections among the Fish and Wildlife Program, the MERR Plan, the Council's Research Plan, and Council recommendations for implementation of actions and projects. The Program guides the development of the MERR Plan and Council recommendations of actions and projects to implement as well as the identification of critical Program research uncertainties. The MERR Plan in turn provides guidance on prioritizing and conducting RME and reporting. The Research Plan guides research conducted through the Program and is influenced by the MERR Plan with respect to prioritization of research uncertainties. Adaptive management of the Program and the implemented actions and projects occurs through several paths including: (1) identifying aspects in the MERR Plan, Research Plan, and Program to be improved based on the evaluation and reporting of collected data from actions and projects; (2) feedback on changes to improve RME and reporting of Program actions and projects under the MERR Plan which in turn may result in changes in the Program; and (3) increasing understanding about existing and new research uncertainties which may influence the Program's research priorities.

2) Strategic Plan for Monitoring, Evaluation, Research and Reporting

The Strategic Plan for Monitoring, Evaluation, Research and Reporting (Strategic Plan), reflects the overall goal and expectations of the Fish and Wildlife Program and summarizes existing and new policy guidance to assist in the allocation of resources for implementation of Program RME and reporting actions.

2.1) Goal

To design and operate RME and reporting under the Fish and Wildlife Program in an efficient, integrated, cost-effective manner by focusing on biological and ecosystem priorities, addressing key management questions, identifying priority data gaps, and by eliminating redundant RME efforts.

2.2) Expectations

The Council expects that the MERR Plan will:

- Provide sufficient information to guide management and policy decisions;
- Enhance timeliness, quality and quantity of information for a given level of effort by encouraging collaboration and coordination among entities in the Basin;
- Reduce duplication of RME efforts by facilitating communication and coordination among project proponents and funding agencies within the Basin;
- Identify priority data gaps;
- Resolve and prioritize research uncertainties critical for the Program;
- Ensure implemented projects comply with contractual agreements, meet implementation criteria, and are performing as intended;
- Track status and trends of priority species and habitat characteristics as well as factors affecting them;
- Evaluate and report on the effectiveness of actions in protecting, mitigating, and enhancing the Basin's fish and wildlife resources;
- Facilitate sharing and reporting of RME information with the public in an easily accessible and understandable manner; and,
- Ensure that RME actions are integrated with relevant plans and guidance documents such as biological opinions and recovery plans.

Meeting some of these expectations requires that the Council has a clear understanding of RME and reporting expectations of other policy-decision makers in the Basin such as NOAA-Fisheries. For this reason, having the other policy-decision makers in the Basin identify their RME priorities and desired level of certainty is important. By explicitly stating expectations, this will aid integration of the Council's RME with other plans and guidance documents and facilitate collaboration and coordination among entities.

2.3) Policy Guidance

Existing fish, wildlife, and habitat RME efforts in the Basin are highly complex and expansive in scope and detail. Given limited resources and competing needs of fish, wildlife, and habitats the Council has developed policy guidance for the MERR Plan based on existing and new policies. The following policies will ensure that appropriate RME and reporting is being conducted:

- Apply information gathered from the Implementation Framework and its Implementation Strategies to adaptively manage the Program, Research Plan, and MERR Plan;
- Regularly evaluate, such as every 5 years, RME and reporting approaches detailed in the MERR Plan to assess whether the best approaches for informing Council decisions are being utilized;
- Vigilantly review on-going and proposed RME actions and projects to avoid duplication of effort;
- Implement RME actions that are measurable and which yield statistically reliable results within a reasonable timeframe;
- Apply the best available science and sound scientific principles when implementing RME actions;
- Consider the amount of certainty or confidence needed to inform policy decisions. Where appropriate, base decisions on a preponderance of evidence standard³ versus the 95-percent confidence level;
- Utilize an effort-risk analysis⁴ approach to determine whether resolving a research uncertainty is a high or low priority;
- Adopt measurable and quantitative biological objectives and performance standards⁵ for the Program where feasible;
- Assure that the Program's biological objectives and performance standards are being addressed by the Program's RME actions and projects;

3 Preponderance of evidence standard does not require a 95 percent level of certainty. The standard is met if the proposition is more likely to be true than not true. Effectively, the standard is satisfied if there is greater than 50 percent chance that the proposition is true. The actual percentage may be higher if the risk of being wrong is great, e.g., may result in extirpation of a species.

4 The effort-risk analysis approach is a newly adopted approach for the Implementation Framework. In an effort-risk analysis approach, as applied to Research under the Program, the effort needed to resolve a particular research uncertainty is balanced with the risk of making an erroneous policy decisions with negative repercussions for fish and wildlife. This is a similar concept to the more familiar cost-risk analysis approach, but the term effort-risk analysis is used to emphasize that effort, consisting of labor, time, and other resources, are assessed and not only cost.

5 In the MERR Plan, objectives identify the strategies or implementation steps to attain an identified goal. Objectives are specific and measurable. They include implementation, biological and environmental objectives. Performance standard consists of the target value or condition against which progress or achievements may be compared such as progress in meeting a particular objective. Performance standard may also be synonymous with the following terms: benchmark, reference point, targets and threshold.

- Preferentially collect or identify data appropriate for basinwide evaluation and reporting of the Implementation Framework's priority species and habitat characteristics;
- Require that actions implemented under the Program have a monitoring component that is appropriate in terms of scale and effort level;
- All research and monitoring conducted must apply scientifically sound study design and analyses, use protocols approved by the Council,⁶ be based on sound scientific principles, have measurable, quantitative biological objectives, and collect or identify data appropriate for measuring progress towards their biological objectives.
- All monitoring projects are required to have effective and efficient monitoring and evaluation tasks appropriate for the projects' objectives; identify who will do the monitoring and reporting and on what schedule; incorporate independent scientific review, and provide a budget for the monitoring and evaluation work;
- To the extent practicable, ensure that actions conducting status and trend monitoring and action effectiveness monitoring are designed to assess at the highest meaningful scale, such as suites of projects, population scale, and subbasin-scale;
- All Program funded RME data need to be readily accessible and in an agreed-upon electronic format. RME data, its metadata and relevant reports should be available annually, as well as within six months of completing a significant phase of any research project or within six months of project completion.

The above 14 policy guidance items are discussed in more detail in the Implementation Framework.

3) Implementation Framework for Research, Monitoring, Evaluation, and Reporting

3.1) Purpose

The Implementation Framework for Research, Monitoring, Evaluation, and Reporting (Implementation Framework) explains linkages among the RME and reporting components, details how the Council will prioritize RME actions, and describes approaches for conducting RME and reporting through the Program. The Implementation Framework also describes how information will be made available and reported so as to facilitate adaptive management of the

⁶ Examples of study design and analyses include: Roni, P., editor. 2005. Monitoring stream and watershed mitigation. American Fisheries Society, Bethesda, Maryland; Downes, B. J., L. A. Barmuta, P. G. Fairweather, D. P. Faith, M. J. Keough, P. S. Lake, B. D. Mapstone, and G. P. Quinn. 2002. Monitoring Ecological Impacts: Concepts and Practice in Flowing Water. Cambridge University Press, New York, New York. As of the date of adoption of the 2009 Program amendment, the Council had adopted the following methods and protocols: Northwest Environmental Data Network's Best Practices for Reporting Location and Time Related Data; Pacific Northwest Aquatic Monitoring Partnership's (PNAMP) Methods for Collection and Analysis of Benthic Macroinvertebrate Assemblages in Wadeable Streams of the Pacific Northwest; and PNAMP's Salmonid Field Protocol Handbook.

Program, Research Plan, and MERR Plan. To ensure compatibility of RME conducted for fish and wildlife, the Framework provides guidelines for developing standardized basinwide Implementation Strategies. These Implementation Strategies align with the Council's expectations for RME and reporting of anadromous fish, resident fish, and wildlife.

3.2) Structure

The Implementation Framework is a basinwide approach to RME and reporting that is guided by the Strategic Plan and that is realized through Implementation Strategies (Figure 2).

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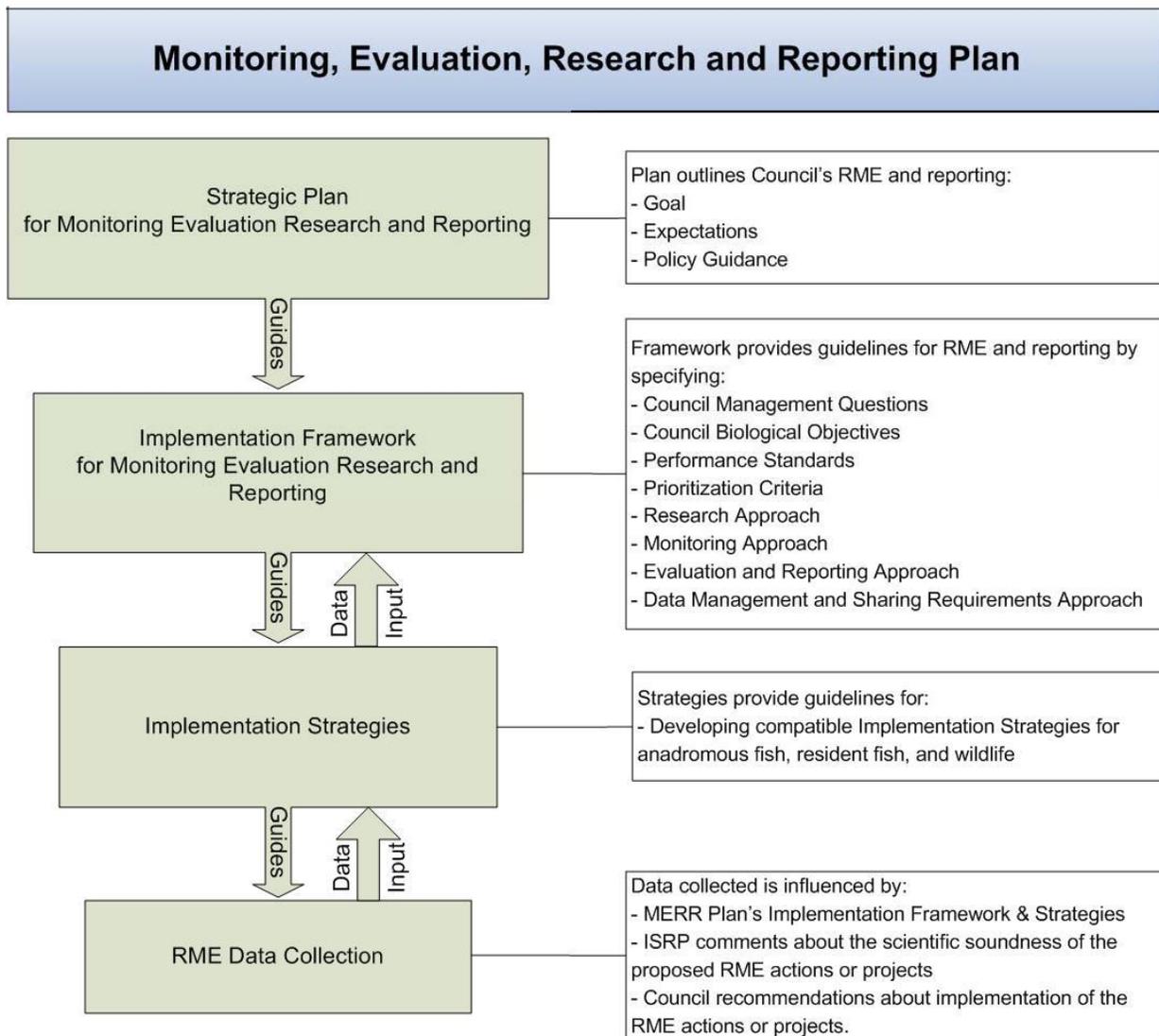


Figure 2: Depicts relationship between the three parts of the MERR Plan: Strategic Plan, MERR Implementation Framework and Implementation Strategies. A description of the main components of each part is provided in the white boxes. The bottom left beige box *RME Data Collection* illustrates that the Implementation Framework guides the collection of Program RME data. This RME data then feeds back through the Implementation Strategies to provide the information needed to assess and improve Program progress towards meeting biological objectives. The bottom right white box indicates that the Implementation Framework, Implementation Strategies, ISRP review, and Council recommendations influence what Program RME data is collected. The RME data gathered can influence the evolution of all three components of the Plan, and the MERR Plan can then influence the other components illustrated in Figure 1.

The Implementation Framework follows the Strategic Plan in focusing and providing effective and efficient approaches for Program RME and reporting. Specifically, the Implementation Framework:

1. Focuses Program research, monitoring, evaluation and reporting by:
 - Incorporating the Program’s basinwide management questions, biological objectives, and performance standards;
 - Providing basinwide criteria for prioritizing Program RME actions; and,
 - Identifying priority species and habitat characteristics;
2. Applies effective and efficient approaches for conducting Program research, monitoring, evaluation and reporting, by:
 - Prioritizing critical research uncertainties;
 - Guiding monitoring type and effort to be implemented on Program actions;
 - Providing processes for evaluating and reporting on Program progress;
 - Describing requirements for data management and sharing; and
 - Providing an outline for developing standardized anadromous fish, resident fish, and wildlife Implementation Strategies.

In the sections that follow, the guidance and processes used to focus and conduct RME and reporting are explained.

3.3) Focusing Program Research, Monitoring, Evaluation and Reporting

3.3.1) Management Questions

Research, monitoring, and evaluation actions implemented through the Program should assist the Council in answering one or more of the Council’s nine basinwide management questions.⁷ All RME actions, therefore, must contribute data towards answering one or more of these questions.

These management questions are intended to help the Council evaluate whether the Program, as implemented, is fulfilling its charge under the Act. Although posed as ‘yes’ or ‘no’ questions, these questions are complex and require substantial investments in resources to determine where we are in the spectrum between the potential ‘yes’ and ‘no’ answer (Figure 3). As the Program is implemented, the Council seeks to move towards answering questions 1-2 and 5-9 in the affirmative, and to have sufficient information to decisively answer questions 3 and 4.

⁷ The Council approved these questions as a working list in October 2009. The list of questions and associated indicators are listed in Appendix 3 and are also available online at <http://www.nwcouncil.org/fw/program/hli/Default.htm> (January 2010).

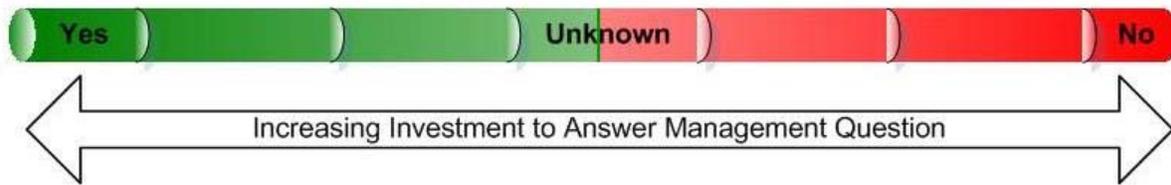


Figure 3: The answer to a management question may lie anywhere along this spectrum depending on the current level of understanding of the question’s topic. With additional resource investments the Council may enhance its understanding of the question topic and attain a more decisive ‘yes’ or ‘no’ answer.

The nine management questions that the Council seeks to answer are:

1. Are Columbia River Basin fish and wildlife abundant, diverse, productive, spatially distributed, and sustainable?
2. Are Columbia River Basin ecosystems healthy?
3. Are ocean conditions affecting Columbia River Basin anadromous fish?
4. Is climate change affecting fish and wildlife in the Columbia River Basin?
5. Are fish, wildlife and their habitat responding to the implemented actions as anticipated?
6. Are Council Program actions coordinated within the Program and with other programs?
7. Are mainstem hydrosystem operations and system configuration improvements meeting the Council Fish and Wildlife Program’s survival and passage objectives?
8. Is harvest consistent with the Council Fish and Wildlife Program’s vision?
9. Does artificial production complement resident and anadromous fish recovery and harvest goals within the Columbia River Basin?

3.3.2) Biological Objectives

The Program contains numerous quantitative and qualitative biological objectives requiring research to resolve uncertainties and monitoring to assess action implementation, action effectiveness and the status and trends of Basin fish, wildlife, and habitat characteristics. Achieving the Program’s biological objectives is a shared responsibility among the Basin’s federal, tribal, and state fish and wildlife managers.

The Council has identified a subset of the Program's biological objectives as higher priorities for the MERR Plan (Appendix 1). The biological objectives are listed in Appendix 1 to facilitate updating as they are further developed. These higher priority biological objectives were selected⁸ in order to address habitat diversity, biological diversity, physical processes, biological processes,⁹ assessment needs, management question 1, 2, and 5, and the Implementation Framework's priority fish, wildlife and habitat characteristics discussed below.

As the Program's biological objectives are developed further, they should aid in prioritizing RME and reporting actions for implementation through the Program, because these actions should provide data needed to assess progress towards the biological objectives. This subset of higher priority biological objectives will evolve as the Council further develops the Program's biological objectives.¹⁰

3.3.3) Performance Standards

Assessing progress towards answering management questions and meeting biological objectives requires clear and realistic performance standards. Performance standards should:¹¹

- Be based on the best available science;
- Be capable of being measured, in a reasonable timeframe, for a reasonable level of effort;
- Relate directly to the biological change intended; and
- Be linked to the Program's biological objectives.

⁸ The selection criteria for the Program's biological objectives were developed for the Implementation Framework.

⁹ Physical processes create diverse habitat conditions. Biological processes operate at several spatial scales and enable species to persist in a variable habitat by fostering behavioral and physiological flexibility needed to adapt to changes (Williams 2005, Page 90).

¹⁰ In the 2009 Program, the Council committed to assessing the value for the Program of having quantitative biological objectives at the basinwide level, or at any level above the subbasin and population level. If determined to be useful in certain categories, the Council will work with federal and state fish and wildlife agencies and tribes, Bonneville, and others to develop a set of quantitative objectives for amendment into the Program. The Council also committed to reviewing whether its quantitative objectives for salmon and steelhead run size and return rates, which also serve as performance standards as described below, should continue to be used as quantitative basinwide biological objectives for the Program (Appendix 2). This process is described on page 13 of the Program under the section titled Further Development of Biological Objectives available at <http://www.nwcouncil.org/library/2009/2009-09.pdf> (January 2010).

¹¹ The guidelines provided for performance standards in this section are newly developed for the Implementation Framework. In the MERR Plan, a "performance standard" is defined as the target value or condition against which progress or achievements may be compared such as progress in meeting a particular objective. The term "performance standard" may also be synonymous with the following terms: benchmark, reference point, targets and threshold.

As the Council assesses the need for, and further develops, quantitative objectives for the Program, this process will also result in changing or further developing performance standards for assessing Program progress. As a starting point, the Council will decide whether additional performance standards are needed to assess the higher priority objectives in Appendix 1. When assessing existing performance standards and considering adoption of new quantitative performance standards, the Council will consider the measurable performance standards contained in relevant biological opinions and recovery plans, as well as those used by state and tribal managers. This process of evaluating existing standards and assessing the need for additional standards will occur during or soon after completion of the Council's process for further developing biological objectives, described above.

Basinwide performance standards adopted by the Council may take a variety of forms depending on the objective(s) they address, such as changes in survival, physical or qualitative changes, and task accomplishments. Biological and physical performance standards should reflect the dynamic state of the system and not be limited to a fixed target number; whereas performance standards for task accomplishments can be more static using a fixed target number, such as achieving fish screens on a certain percentage of irrigation diversions. The standards adopted by the Council will respond to new information as needed and will serve as benchmarks, not ceilings, for actions.

If progress towards achieving these performance standards falls significantly short then the Council may revisit all or part of the Program to determine what needs to be changed to make progress.

Currently, the 2009 Program contains quantified basinwide performance standards only for anadromous salmon and steelhead.¹² These standards provide a starting point for assessing progress towards addressing the nine management questions. The measurable performance standards for salmonids currently consist of eleven performance standards grouped under three main topics: (1) run size and return rates; (2) dam passage survival; and, (3) reach survival (Appendix 2).

3.3.4) Prioritization Criteria

There are limited resources available for implementing RME actions. This limitation necessitates the Council prioritize RME actions and reduce duplication of effort in the Basin. The Council has adopted broad criteria, subdivided into four tiers, to provide guidance for implementation of Program RME actions.

¹² Performance standards stated in subbasin plans, although part of the Program, are not included in the Implementation Framework. Additionally, performance standards alluded to in the Program but not specifically listed in the Program are also not included, e.g., biological performance standards for listed species set forth in the biological opinions or provided in documents. Only quantitative performance standards specifically stated in the Program are included in the Implementation Framework. The performance standards not included in the Implementation Framework should be considered for inclusion under the appropriate Implementation Strategies.

Each of these criteria is important; however, preference will be given to actions meeting multiple criteria. If actions meet only one criterion, then actions meeting a first or second tier criterion will be preferred over actions meeting a criterion from the third or fourth tiers.

The four tiers of criteria are as follows:¹³

First Tier Criteria - Contribution to Program Progress

Informs Policy and Management Decisions – RME actions evaluating the Program’s progress in answering Council management questions, meeting basinwide biological objectives, and contributing to performance standards, as well as contributing to the Council’s reporting requirements.

Addresses a Critical Research Uncertainty – RME actions addressing or contributing to resolving uncertainties that are prioritized by the Council as most critical to achieving the Program goal, biological objectives and performance standards.

Has Broad Application – RME actions that have broad applications such as extrapolating results to similar ecosystems, species, or populations in the Basin.

Second Tier Criteria - Feasibility

Reasonable Timeframe to Produce Results – RME actions that are likely to produce useful results within a reasonable timeframe, such as five- to 10-years or a few salmonid generations.

Feasible – RME actions that have a high likelihood of success.

Causes No Harm – RME actions posing no appreciable risk to biological diversity.

Third Tier Criteria - Efficiency

Coordinated Monitoring Effort – RME data collection is coordinated among similar or complementary RME actions, and collected data are shared.

Related to Other Research – RME actions that take into consideration on-going RME actions in the watershed, depend on other RME actions, build on ongoing related work, and does not negatively impact the other actions.

Fourth Tier Criteria - Cost Savings

Cost share – cost share is not required, but is a consideration when assessing projects implementing RME actions.

Cost – when comparing RME actions that intend to produce about the same information, cost will be a consideration.

¹³ The four criteria tiers and their criteria are newly developed for the Implementation Framework.

One of the Program’s primary strategies for monitoring and evaluation is to “identify priority fish, wildlife, and ecosystem elements of the Program that can be monitored in a cost-effective manner, evaluate the monitoring data and adaptively manage the Program based on results.”¹⁴

The diverse number of focal species listed under the subbasin plans necessitates identifying a subset of priority species to facilitate assessment of the Program at the broadest scale feasible, such as on a basinwide level. The species listed as priorities in this MERR Plan are species that the Council either wants to restore and conserve or to monitor due to their potential negative impact on other species and habitat characteristics of interest to the Council (Appendix 4). It is also important to note that the list of priority species does not reduce the importance of focal species at the subbasin scale.

The selection of priority species and habitat characteristics is based on species and characteristics stated in the Program, High Level Indicators, Fish and Wildlife Program Indicators (Appendix 3); focal wildlife species targeted by project proponents; and input from Council staff. The list of priority fish, wildlife, and habitat characteristics may change with improved understanding of better species and habitat characteristics to monitor.

Implementation Strategies developed for resident fish, anadromous fish, and wildlife will at a minimum focus on the listed priority species and habitat characteristics. This list will also assist in prioritizing RME actions and ensuring that basinwide Program assessment is feasible for at least the listed priority species and habitat characteristic. The Implementation Strategies contained in this framework, however, are not limited to this list and thus can include additional critical species and habitat characteristics, such as subbasin management plans’ focal species.

3.4) Approaches for Program Research, Monitoring, Evaluation and Reporting

3.4.1) Research Approach

Research of critical uncertainties, such as factors limiting abundance and condition of fish and wildlife, increases the Council’s and others’ understanding of fish, wildlife and their habitats. Enhancing the Council’s understanding should lead to better decisions about which actions to recommend for implementation through the Program.

The abundance of fish and wildlife research uncertainties related to the Program’s implementation requires prioritization by the Council in order to make research recommendations that will provide the greatest benefit to the Council’s Program. As stated in the

¹⁴ 2009 Columbia River Fish and Wildlife Program, page 24. Available: <http://www.nwcouncil.org/library/2009/2009-09.pdf> (January 2010).

Program, the Council will focus on those areas where results can be generated or tools developed to better inform management decisions and to more efficiently deploy Program resources. With this focus, the Council will periodically update its Columbia River Basin Research Plan (Research Plan)¹⁵ in collaboration with the Independent Scientific Advisory Board (ISAB)¹⁶, Independent Scientific Review Panel (ISRP)¹⁷ and regional partners.

The Council recognizes that prioritizing research uncertainties is a challenge, but one that is best undertaken by informed decision makers. The Council strives to meet this challenge by using science to frame the risk and uncertainty associated with different research topics. The Council can then compare the risks and uncertainties associated with the different research topics when prioritizing them.

To prioritize among Program related research uncertainties, the Council will implement an effort-risk analysis approach starting in 2011 (Figure 4).¹⁸ Using this approach, the Council will weigh the effort (resources and time) necessary to resolve a research uncertainty for the Program against the risk involved in making a policy decision based on the current level of understanding, or certainty, associated with the research uncertainty.

15 The Council's Columbia River Basin Research Plan consists of a nine-year strategy with implementation plans updated every three-years. The current version is available <http://www.nwcouncil.org/library/2006/2006-3.htm> (January 2010).

16 For more information on the ISAB see <http://www.nwcouncil.org/fw/isab/Default.htm> (January 2010).

17 For more information on the ISRP see <http://www.nwcouncil.org/fw/isrp/Default.htm> (January 2010).

18 The effort-risk analysis approach is a newly adopted approach for the Implementation Framework. In an effort-risk analysis approach, as applied to Research under the Program, the effort needed to resolve a particular research uncertainty is balanced with the risk of making an erroneous policy decisions with negative repercussions for fish and wildlife. This is a similar concept to the more familiar cost-risk analysis approach, but the term effort-risk analysis is used to emphasize that effort, consisting of labor, time, and other resources, are assessed and not only cost.

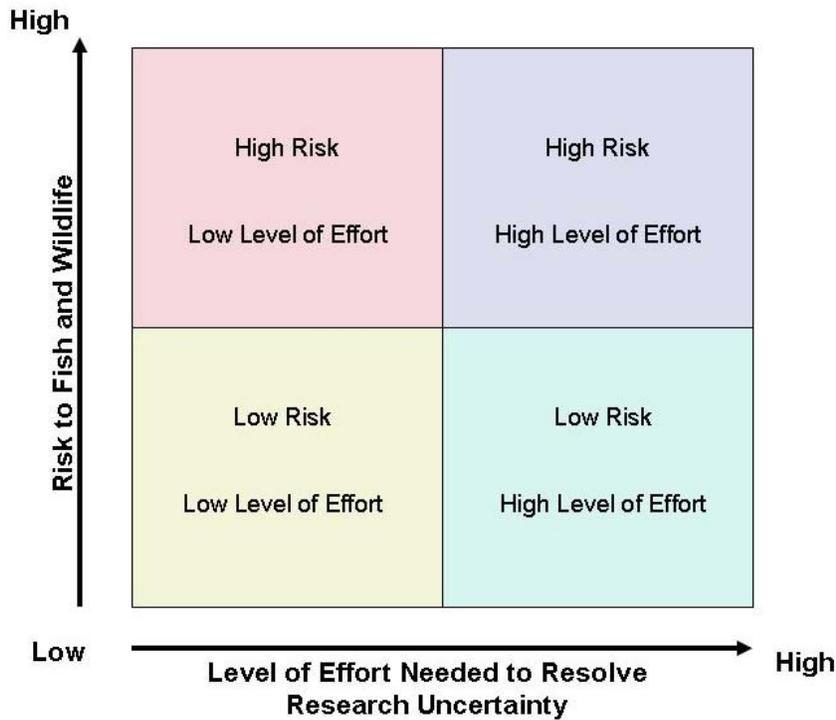


Figure 4: Prioritizing research uncertainties of importance to the Council’s Program by weighing the risk of negative impacts on fish and wildlife by making an erroneous policy decision based on the current state of knowledge against the level of effort needed to resolve the research uncertainty.

To inform its prioritization decision, the Council requests the ISAB conduct a Comparative Risk Analysis and a Feasibility Assessment¹⁹ for the research uncertainties listed in the Research Plan. The outcome of this analysis and assessment will be incorporated in future revisions of the Research Plan. The Council will use the analysis and assessment to prioritize research when considering project development and funding recommendations. The Feasibility Assessment and the Comparative Risk Analysis are described below.

The Feasibility Assessment is based on the ISAB’s best professional judgment as to the amount of effort needed to resolve a given uncertainty. The Comparative Risk Analysis is conducted by the ISAB using the comparative risk²⁰ tool that the ISAB determines best suited for this purpose.

19 The Comparative Risk Analysis and Feasibility Assessments are two new processes developed for the Implementation Framework. The incorporation of the analysis and assessment into the Research Plan is also a new idea introduced through the Implementation Framework.

20 Risk analysis tools such as the Programmatic Comparative Risk Analysis, Comparative Risk Analysis of Alternatives, Risk Tradeoff Analysis and Risk Ranking, as well as others are discussed in Hofstetter, P, J.C. Bare,

Footnote continued on next page

The Comparative Risk Analysis²¹ should provide the Council with information as to which research uncertainty(ies) may be most critical to making policy and management decisions.

All research conducted through the Program must be consistent with the Council's Research Plan and align with Council priorities. Further, all research actions recommended by the Council will be based on sound scientific principles, have measurable, quantitative biological objectives, and collect or identify data appropriate for measuring the biological outcomes identified in their objectives. Lastly, all research must apply scientifically sound study design and analyses²² as well as protocols approved by the Council.²³

3.4.2) Monitoring Approach

Monitoring is necessary to track progress towards meeting Program objectives and to adaptively manage Program implementation. Monitoring is also necessary to provide the public, Congress and governors with an accurate assessment of what the Program has accomplished to date and what work remains to be done.

The Program requires all actions and projects to have some level of monitoring. In certain situations, as described below, aspects of monitoring for a particular action implemented under the Program can be conducted separately from the implementation of the action, such as having another entity or project collect the required status and trend and action effectiveness monitoring data. In these situations, the relationship between implementing the action and conducting the related monitoring must be clearly identified for all projects involved.

J.K. Hammitt, P.A. Murphy, and G.E. Rice. 2002. Tools for Comparative Analysis of Alternatives: Competing or Complementary Perspectives. *Risk Analysis* 22(5): 833-851.

21 For examples of risk analysis, see (1) http://www.scorecard.org/comp-risk/def/comprisk_explanation.html (December 2009); (2) Hofstetter, P, J.C. Bare, J.K. Hammitt, P.A. Murphy, and G.E. Rice. 2002. Tools for Comparative Analysis of Alternatives: Competing or Complementary Perspectives. *Risk Analysis* 22(5): 833-851; (3) Willis, H.H., M. L. DeKay, M. G. Morgan, H.K. Florig, and P. S. Fischbeck. 2004. Ecological Risk Ranking: Development and Evaluation of a Method for Improving Public Participation in Environmental Decision Making. *Risk Analysis* 24(2):363-378; (4) U.S. EPA. 1987. Unfinished Business: A Comparative Assessment of Environmental Problems. Washington, DC: EPA Office of Policy Analysis; (5) U.S. EPA. 1990. Reducing Risk: Setting Priorities and Strategies for Environmental Protection. Report number SAB-EC-90-021. Washington, DC: EPA Science Advisory Board; (6) U.S. EPA. 1993. Guidebook to Comparing Risks and Setting Environmental Priorities. Report number EPA 230-B-93-003. Washington, DC: EPA Office of Policy, Planning, and Evaluation.

22 Examples of study design and analyses include: Roni, P., editor. 2005. Monitoring stream and watershed mitigation. American Fisheries Society, Bethesda, Maryland; Downes, B. J., L. A. Barmuta, P. G. Fairweather, D. P. Faith, M. J. Keough, P. S. Lake, B. D. Mapstone, and G. P. Quinn. 2002. Monitoring Ecological Impacts: Concepts and Practice in Flowing Water. Cambridge University Press, New York, New York.

23 As of the date of adoption of the 2009 Program amendment, the Council had adopted the following methods and protocols: Northwest Environmental Data Network's Best Practices for Reporting Location and Time Related Data; Pacific Northwest Aquatic Monitoring Partnership's (PNAMP) Methods for Collection and Analysis of Benthic Macroinvertebrate Assemblages in Wadeable Streams of the Pacific Northwest; and PNAMP's Salmonid Field Protocol Handbook.

For purposes of this Implementation Framework, monitoring is grouped into three types that are further described and defined in the subsections below:

1. Compliance, Implementation and Performance Monitoring;
2. Status and Trend Monitoring; and,
3. Action Effectiveness Monitoring.

The monitoring type(s) and the level of monitoring effort applied to any given action depends on the objectives and on the information required (Table 1). For example, compliance, implementation, and performance monitoring are applied to all actions and consist of a low level of monitoring effort, where effort is equal to resources used such as time and labor. In contrast, action effectiveness monitoring, consisting of a high level of monitoring effort, is applied to a subset of actions given the correspondingly greater effort required.

Table 1: Types of monitoring

Monitoring Type	Purpose	Scale and Effort Level
Compliance, Implementation, and Performance	Are contractual obligations fulfilled, set criteria met, and the action and project performing as intended?	<ul style="list-style-type: none"> •Conducted at project scale. •Low level of monitoring effort in terms of data collection.
Status and Trend	How are species and habitats faring in the Basin?	<ul style="list-style-type: none"> •Conducted at subbasin or other scale of relevance, e.g., ESU and watershed. •Moderate level of monitoring effort in terms of data collection.
Action Effectiveness	Are Program actions having desired biological and environmental impacts?	<ul style="list-style-type: none"> •Conducted at watershed or reach scale. •High level of monitoring effort in terms of data collection.

In determining whether an action requires low, moderate, or a high level of monitoring effort²⁴ the Council will consider, and encourage the ISRP to similarly consider, the action’s risk level. For example, actions that have a high risk of negatively impacting fish and wildlife or have a high risk of not achieving their intended outcome require a higher level of monitoring effort than lower risk actions. The level of effort needed to conduct monitoring for actions with a given risk level is illustrated in Figure 5.

²⁴ The level of effort refers to the amount of resources required to conduct the monitoring and evaluation. Resources include time, labor, and cost associated with the monitoring effort.

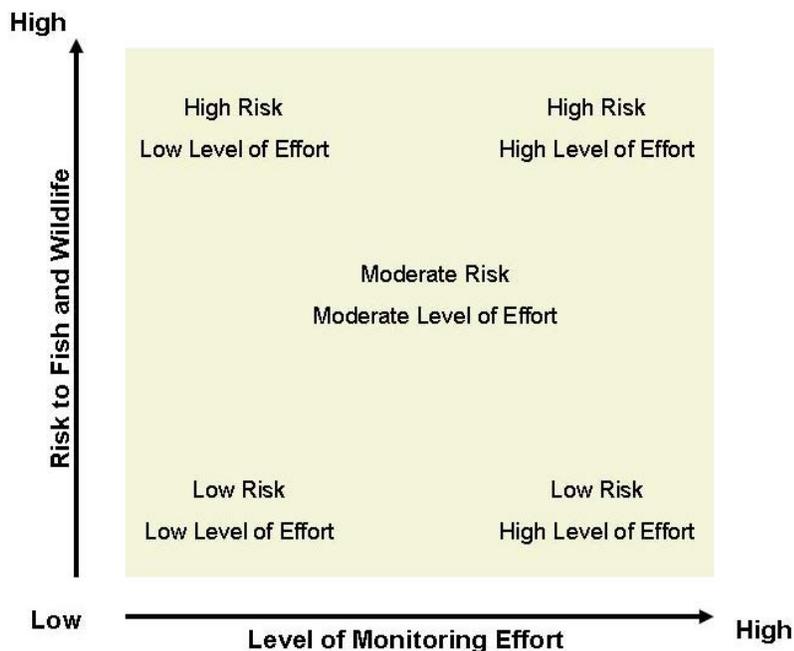


Figure 5: The level of monitoring effort necessary for actions perceived as having high or low risk of either failing to achieve their intended impact or of having detrimental impacts to fish and wildlife.

As the case with Program recommended research actions, all monitoring will be based on sound scientific principles, have measurable, quantitative biological objectives, and collect or identify data appropriate for measuring progress towards these biological objectives. Additionally, all monitoring conducted through the Program will apply scientifically sound study design and analyses and will use protocols approved by the Council.²⁵ Lastly, these actions are required to have effective and efficient monitoring and evaluation tasks appropriate for assessing progress towards meeting the objectives of the project implementing the actions; identify who will do the monitoring and reporting and on what schedule; incorporate independent scientific review, and provide a budget for the monitoring and evaluation work.

²⁵ Examples of study design and analyses include: Roni, P., editor. 2005. Monitoring stream and watershed mitigation. American Fisheries Society, Bethesda, Maryland; Downes, B. J., L. A. Barmuta, P. G. Fairweather, D. P. Faith, M. J. Keough, P. S. Lake, B. D. Mapstone, and G. P. Quinn. 2002. Monitoring Ecological Impacts: Concepts and Practice in Flowing Water. Cambridge University Press, New York, New York. As of the date of adoption of the 2009 Program amendment, the Council had adopted the following methods and protocols: Northwest Environmental Data Network's Best Practices for Reporting Location and Time Related Data; Pacific Northwest Aquatic Monitoring Partnership's (PNAMP) Methods for Collection and Analysis of Benthic Macroinvertebrate Assemblages in Wadeable Streams of the Pacific Northwest; and PNAMP's Salmonid Field Protocol Handbook.

Compliance, Implementation, and Performance Monitoring

All actions and projects implemented through the Program must conduct compliance, implementation, and performance monitoring. Compliance monitoring assists the Council and Bonneville in determining whether actions are meeting set criteria. Implementation monitoring assists parties in determining whether actions have been implemented as contracted. Performance monitoring assesses whether actions are performing as intended in terms of biological and physical impacts. Performance monitoring evaluates impacts at the action and project level, not at the watershed, population, or species scale.

Compliance, implementation and performance monitoring are essential to maintain Program accountability. Performance monitoring also is critical for adaptively managing the Program at the action and project level. If an action or project fails to perform as intended, the Council may recommend modifying or terminating the action or project as necessary.

The processes used to gather information necessary to conduct compliance, implementation, and performance monitoring consists of an expanded version of the existing process used by project proponents as well as two new processes to be used by Bonneville and the ISRP. The following explains the three processes used to gather the data for compliance, implementation and performance monitoring under the Program:

1. Project proponents annually collect the data necessary to document compliance, implementation, and performance monitoring. The information is provided as stipulated in their contract with Bonneville, such as submitting data to the PISCES database. This process is currently being used, although some modifications may be necessary to collect additional data needed for performance monitoring.
2. Bonneville, on an annual basis, verifies that Program actions and projects are implemented as stipulated in the contracts. This evaluation will annually review a selected subset of projects to verify the information reported in PISCES database as well as to gather additional information required. This process will be implemented starting in 2011.
3. The ISRP assesses whether actions and projects are having the intended biological and physical impact at the project level.²⁶ The ISRP will accomplish this by annually assessing a selected subset of Program projects to determine whether performance

²⁶ The ISRP assessment of performance, as described in the third process for compliance, implementation and performance monitoring examines whether project actions are having the intended biological and physical impacts. The ISRP assessment for this type of monitoring does not extend to evaluating population level effectiveness of project actions, called action effectiveness. For example, the ISRP assessment may assess whether a re-vegetated riparian zone has vegetation growing but will not necessarily determine whether re-vegetating the riparian zone increases fish productivity. Monitoring performance is critical for adaptively managing the Program at the action or project level. If an action or project is failing to meet its intended outcome, it can be modified or terminated as deemed reasonable by the Council.

expectations, as stated in the most recent project proposals, have been met. This process will be implemented starting in 2011.

The compliance and implementation data needed for the first two processes generally consist of information that project proponents already collect for reporting in Bonneville's PISCES database. For the third process, a few additional performance measures²⁷ (also referred to as metrics) are needed to assess whether the actions are having the intended biological and physical impacts at the action and project level. The Implementation Strategies, described later, will provide guidance on the various performance measures used to evaluate individual project performance. By reporting on common performance measures this will facilitate evaluation of a particular action's performance at the action and/or project level by combining information from similar actions and from multiple projects, as appropriate. These performance measures should be selected from the ISRP review of metrics report.²⁸

The information gathered for these three processes will be made available through the appropriate Bonneville database and Council website, and will be consulted as needed during the Council's project review process.

Status and Trend Monitoring

Status monitoring characterizes existing or undisturbed conditions which can be used as a baseline for future comparisons. Trend monitoring measures specified parameters at predetermined time or space intervals in order to assess long-term or large-scale trends.

The Council requires project proponents to collaborate on the collection of status and trend data to enable data sharing and to facilitate determination of status and trend(s) at the highest meaningful unit, e.g., evolutionarily significant unit for salmon.

The Council gives higher priority to status and trend monitoring related to:

- Basinwide status and trend data for priority species and habitat characteristics;
- Assessing performance in terms of achieving intended biological and physical impacts at the action and project level; and
- Assessing effectiveness of Program implemented actions.

As knowledge and technology advances more effective methods and tools for conducting broad-scale monitoring may become available. To assure that the most effective and efficient monitoring methods and tools are employed under the Program, the Council requests that either

²⁷ Performance measures - are typically associated with specific data collection and/or analysis protocols and define data in standard units of measurement. The term performance measures is synonymous with the term metric.

²⁸ See metrics suggested in ISRP 2006 Retrospective Report (ISRP 2007-1) and the ISRP 2008 Metrics review that provides guidance on project reporting metrics for the Columbia River Basin Fish and Wildlife Program (ISRP 2008-7), available at <http://www.nwcouncil.org/library/> (January 2010).

the ISAB and/or the ISRP periodically review these methods and tools, such as landscape level and remote sensing monitoring tools, to evaluate their applicability to the Program's status and trend monitoring.

Action Effectiveness Monitoring

Action effectiveness monitoring²⁹ evaluates the cause and effect relationship between an action and its direct biological effect, such as effect on populations. Effectiveness monitoring evaluates the effectiveness of a single action, similar actions implemented across several locations, or a diversity of actions implemented in a specific location in achieving the desired biological result.

The Council needs to be confident that actions implemented through the Program are having the intended biological impacts. To achieve this, the Council can recommend implementation of actions with proven effectiveness, such as actions strongly supported by relevant peer reviewed studies, or the Council can support RME work necessary to determine the effectiveness of these actions.

Resources available for implementing the Program are limited. Action effectiveness monitoring should therefore concentrate on actions implemented through the Program and should focus on assessing the highest relevant level of response, such as at the population-level response. In addition, when detection of the effectiveness of an action requires a long-term commitment, implementation on a large scale, and a high level of sampling intensity, the effectiveness of the action should be evaluated using an intensively monitored watershed.³⁰ An intensively monitored watershed is also the preferred approach if combining data from separate reach-scale level projects could result in consuming more resources or an inability to detect the impact.

To reduce duplication of efforts in situations where adequate information is available to assess an action's effectiveness the Council will:

- Require project proponents to provide a convincing argument to the ISRP on whether or not the proposed action requires action effectiveness monitoring to demonstrate its effect. This requirement should aid in preventing duplication of existing work by having project proponents provide strong evidence that information supporting the effectiveness of an action is not available. The ISRP will comment on whether the argument is adequate to substantiate whether an action requires action effectiveness monitoring or not. This is an elaboration on existing ISRP review process;

29 Action Effectiveness Monitoring as used in this document is synonymous with "validation or intensive monitoring" as used in the Washington Comprehensive Monitoring Strategy for Watershed Health and Salmon Recovery. Available at: http://www.rco.wa.gov/documents/srfb/Monitoring/Comprehensive_Strategy_Vol_2.pdf (January 2010).

30 An intensively monitored watershed is a watershed in which actions are implemented in a sufficient amount to produce a large enough change that is detected at the watershed scale or population level.

- Request that for certain actions the ISAB review peer-reviewed publications, technical publications, and, where feasible, compile information from compatible actions and/or projects implemented through the Program to summarize current support for the effectiveness of an action or lack of effectiveness. This is a new process developed for the MERR Plan; and,
- Submit to the ISAB and ISRP the findings from collaborative partnerships (discussed below) to comment on their contribution towards substantiating the effectiveness of an action. This also is a new process for the MERR Plan.

Collaborative partnerships among entities conducting action effectiveness monitoring will assist in managing the long-term and resource intensive investment necessary to accomplish this work. The Council and Bonneville seek to engage in collaborative partnerships with other monitoring programs in the Basin interested in assessing the effectiveness of actions of common interest (e.g., Washington Salmon Recovery Funding Board, NOAA Fisheries, and the Oregon Watershed Enhancement Board).

Collaborative partnerships should use information gathered from existing actions and projects, such as from a combination of multiple reach-scale actions and projects, or data collected through an intensively monitored watershed to assess the effectiveness of actions of common interest. To better aggregate data from multiple actions and/ projects the Council strongly suggests project proponents use the same monitoring protocols to gather effectiveness data or otherwise ensure that data collected is compatible across actions and projects.

If alignment of effectiveness monitoring protocols or gathering of compatible data across multiple actions and projects is not feasible, then project proponents will be asked to collaborate with an independent party. For example, this may consist of employing a consultant, who will collect data from existing actions and projects throughout the basin to assess the effectiveness of an action.³¹ In addition, if it is more efficient to gather effectiveness data by employing an independent party then that approach should be used even if the project proponents are able to provide compatible data for the assessment.

As information is gathered on the effectiveness an action, the Council may periodically assess whether sufficient information is available to inform a Council decision as to whether an action has proven effective. In making that assessment the Council will use a preponderance of evidence³² standard to evaluate the existing information. The Council will rely on the information provided by the ISAB for the second and third process listed above, specifically the

31 Examples of how an independent consultant can collect data from existing projects to assess action effectiveness can be found in the monitoring programs of the Washington Salmon Recovery Funding Board and the Oregon Watershed Enhancement Board monitoring programs.

32 Preponderance of evidence standard does not require a 95 percent level of certainty. The standard is met if the proposition is more likely to be true than not true. Effectively, the standard is satisfied if there is greater than 50 percent chance that the proposition is true. The actual percentage may be higher if the risk of being wrong is great, e.g., may result in extirpation of a species.

ISAB review of publications and the ISRP and ISAB review of collaborative partnerships' findings. The decision of whether or not existing information on an action's effectiveness meets the preponderance of evidence standard is guided by the Council's determination that the action:

Meets Preponderance of Evidence Standard for Proving or Disproving Effectiveness of Actions

- Effectiveness of an action is thoroughly established, generally accepted, good peer-reviewed empirical evidence in its favor;
- Strong weight of evidence in support of the effectiveness of an action, but not fully conclusive;
- Misleading or demonstrably wrong; based on good evidence to the contrary.

Does Not Meet Preponderance of Evidence Standard for Proving or Disproving Effectiveness of Actions

- Theoretical support with some evidence from experiments or observations for action effectiveness;
- Speculative; little empirical support for action effectiveness.

Actions for which effectiveness monitoring is not being conducted will require project proponents to provide support for the effectiveness of these actions from peer-reviewed studies or refer to other ongoing work that does provide an assessment of the effectiveness of these actions.

As with status and trend monitoring, the Council requests that the ISAB, and ISRP as appropriate, periodically evaluate new methods and tools that may enhance the action effectiveness monitoring conducted through the Program.

3.4.3) Evaluation and Reporting Approach

Research and monitoring information collected through the Program must be evaluated and reported in order to adaptively manage the Program. This evaluation keeps the Council informed on the status of the Program's implementation which facilitates informed decision-making for improving the Program. For example, understanding what the Program has accomplished so far, what future work still needs to be done, and what lessons have been learned, allows for adaptive management of the Program by guiding action and project implementation, policy decisions, and future revisions of the Program.

The purpose of this Evaluation and Reporting Approach is to improve the effectiveness of the overall Program and of specific program actions, as well as to promote Program accountability by providing information on the status of Program implementation and progress made towards meeting basinwide biological objectives.

The Evaluation and Reporting Approach consists of several processes, some of which have been in place for several years (i.e., Program and Project Review, Science Policy Exchange, High Level Indicators, Fish and Wildlife Program Indicators), others are modifications to existing processes (i.e., Proponent Exchange), and others are new processes (i.e., Program Synopsis).

Program Review, Project Review, and Proponent Exchange

The Program as well as the actions and projects funded through the Program currently benefit from the comments of the ISRP. The ISRP evaluates and makes recommendations for improvements of the Program, actions, and projects. The ISRP reviews individual projects funded through the Program for their scientific soundness, as well as specific categories of projects, such as RME projects, for their contribution to the Program's objectives. On an annual basis, the ISRP also reviews the Program's overall scientific merit and comments on areas needing improvement. The Council expects the ISRP to consider and incorporate the guidance provided in the three parts of the MERR Plan during its project review and program review process.

To optimize the benefits gained from past project review interactions between ISRP and project proponents, the Council will begin facilitating, after 2010, an interactive exchange referred to as Proponent Exchange. The Proponent Exchange could be similar in format to the annual review convened by the Yakama Nation and Nez Perce Tribe for fish related projects.³³

The Proponent Exchange provides a forum for the intellectual and scientific exchange of information among project proponents and will help inform Council decisions. The format for the presentations will follow ISRP and Council Staff guidelines to assure that the issue of interest is adequately covered.³⁴ As feasible, Proponent Exchange presentations should provide an analysis that applies information from compatible projects to convey a holistic view of accomplishments and discuss implications for policy and management decisions. The Proponent Exchange is intended to:

- Keep ISRP members apprised of project status through project proponents' presentations of their project's biological findings;
- Provide an opportunity to detect emerging RME needs;
- Encourage collaboration among project proponents by facilitating formation of collegial ties;
- Identify redundancies in efforts, and opportunities for sharing of work and information;
- Allow for informal peer review of projects; and,
- Inform Council policy decisions.

33 The references are to the 2009 Symposium on Salmon Supplementation given by the Nez Perce Tribe Department of fisheries Resource Management and the 2009 Yakima Basin Science and Management Conference co-sponsored by Central Washington University, Bonneville Power Administration, Yakima/Klickitat Fisheries Project, Bureau of Reclamation, and the Yakima Basin Fish & Wildlife Recovery Board.

34 A potential format for the presentations may consist of: Project Overview; Project Implementation and Performance Monitoring Results; Status and Trends and Action Effectiveness Monitoring Results; Adaptive Management; and Question and Comment Period.

The Proponent Exchange may be convened for projects identified by the Council and the ISRP in connection with a project review process or as part of a Science-Policy Exchange (described below). The occurrence of Proponent Exchanges is not intended to preclude the ISRP from engaging in additional interactions with project proponents, such as through site visits.

The ISAB also contributes to improving the Program's and projects' RME and reporting components by providing scientific comments on issues of interest. The ISRP collaborates with the ISAB in reviewing scientific issues such as the Council's High Level Indicators and fish tagging technologies used in the Basin. The Council encourages the continued collaboration between ISRP and ISAB on topics benefiting from their combined comments.

Science-Policy Exchange

The 2009 Program established the Science-Policy Exchange (Policy Exchange) to assist the Council in developing policies related to science and technology for use in implementing the Program.³⁵ Policy Exchanges can inform policy decisions on RME by providing an opportunity for Council members to receive transparent and technically sound evaluations of RME results and participate in discussions about the implications for policy decisions. Policy Exchanges can thus play an important role in evaluating current needs in the Basin and can guide future RME actions as well as specific Council recommendations for action and project implementation.

The Council works with the ISAB and others to identify topics of interest for the Policy Exchange. The information shared, such as through presentations, during the Policy Exchange will be available on the Council website. Within six months of the conclusion of the Policy Exchange, Council staff, with input from the ISAB and ISRP will synthesize relevant information gathered during the Policy Exchange into policy statements for Council consideration or into suggestions for modifying the Council's Program, the Research Plan, and MERR Plan.

High Level Indicators and Fish and Wildlife Program Indicators

To communicate the Program's progress to Congress, Governors, and the public, the Council approved two lists of indicators,³⁶ a list of High Level Indicators (HLI) and a list of Fish and Wildlife Program Indicators (FWI), which are related to the Council's management questions (Appendix 3). The indicators were selected as a means of conveying a complex message in a simple and useful manner. HLIs summarize the information believed to be of most interest to Congress and Pacific Northwest Governors. FWIs summarize a broader spectrum of information believed to be of interest to Columbia River Basin Fish and Wildlife managers and the public.

35 Examples of two past Science-Policy Exchanges are the 2007 Science Policy Exchange (Available at: <http://www.nwcouncil.org/fw/program/2008amend/spe/Default.asp>) and the 2009 Columbia River Estuary Science Policy Exchange (Available at: <http://www.nwcouncil.org/fw/program/2009spe/default.asp>).

36 The Council adopted two lists of indicators, High Level Indicators and Fish and Wildlife Program Indicators, during October 2009. Available <http://www.nwcouncil.org/fw/program/hli/Default.htm> (January 2010).

The lists of indicators are not static; rather these lists are intended to evolve over time. The data incorporated by the indicators are obtained from numerous sources throughout the Basin, not just Program-funded data, in order to provide the broadest and most accurate overview of the Basin's fish, wildlife, and habitat characteristics (i.e., Biological Indicators). Hence, the Biological Indicators also reflect the work and progress made by other fish and wildlife entities in the Basin. The remaining indicators, Implementation Indicators, report on specific actions implemented through the Program.

The indicators provide the Council with information on issues that may require policy decisions and highlight aspects of the Program that should be modified to improve the Program's effectiveness. For example, if an indicator suggests that a specific RME action is, or group of actions are, not contributing to progress made towards the relevant objectives and performance standard then the Council may decide to recommend a modification or termination of that action or group of actions.

The Council, starting in 2010, will report on the status of the Program's HLI in its annual report to Congress. The FWI will be reported through the Columbia River Basin Fish and Wildlife Authority's Status of the Resource. Relevant Council performance standards used to track progress towards the Program's objectives will also be used to provide context for information reported through the HLI and FWI such as how close an indicator's value is to the desired performance standard.

Program Synopsis

The Program Synopsis (Synopsis) provides the Council and ISRP with a visual snapshot of the Program's implementation and progress in protecting, mitigating and enhancing fish and wildlife. The Synopsis facilitates viewing how past and current projects have and are contributing to addressing basinwide needs, such as limiting factors. Additionally, the Synopsis incorporates the actions detailed in the Council's Multi-Year Action Plans which outlines the proposed next-steps in the Program's implementation. The Synopsis is to be depicted as a dynamic map starting in 2011.

The information conveyed through the Synopsis aids in detecting shortcomings in Program implementation that may be addressed through modifications in project recommendations, Council policy, or through Program amendments. For example, the Synopsis helps the Council identify specific Program areas that can be improved, such as whether certain factors, species, and habitats in specific areas of the basin need more targeted effort or whether an evaluation is necessary to ascertain why progress has not been made over a period of time. Additionally, the Synopsis may facilitate identification of priority data gaps and redundant monitoring as well as efficiencies to be gained by coordinating data collection and data sharing amongst projects. Lastly, this information also will assist the ISRP in evaluating the Program and recommending improvement.

The content of the Synopsis reflects the information needed to inform Council decisions and to facilitate ISRP evaluation of the Program. The general type of information needed to guide implementation and adaptive management of the Program consists of:

- Knowledge of the desired condition for species and habitat characteristics. This should be a condition that is deemed feasible to attain given the Basin's expected potential;
- Information on the current condition for species and habitat characteristics in the Basin;
- Identification of factors currently inhibiting or which have the potential to inhibit achievement of the desired condition for species and habitat characteristics. These factors include limiting factors identified in subbasin management plans;
- Identification of the type of actions that will mitigate the factors inhibiting progress towards achieving the desired condition for species and habitat characteristics;
- Status of implementation of the above actions, whether completed, in-progress, or planned for future implementation such as actions identified in the Council's Multi-Year Action Plans; and,
- Evaluation of progress made in addressing the inhibiting factors and achieving the desired condition for species and habitat characteristics.

To obtain a basinwide overview of the type of information described above, data from Bonneville funded projects as well as information from non-Bonneville funded work is required. Some of the information included in the Synopsis may rely on expert judgment until quantitative data are available; whereas other data can be obtained from fish and wildlife managers, Bonneville's TAURUS³⁷ database, and the Council's Multi-year Action Plans.³⁸

As a start the following information will be included in the first iteration of the Synopsis:

- Up-to-date status of priority species and habitat characteristics in the Basin;
- Summary of the progress made in addressing factors of concern, such as limiting factors;
- Needs to be addressed, such as subbasin management plans' limiting factors; and,
- Program projects addressing the above needs, including past, current, and proposed projects.

Bonneville, the Program's primary funding agency for implementing the Program, will gather the information for the Synopsis. Bonneville will present this information in a dynamic web-

37 TAURUS is an interactive website that provides the public access to the workings of Bonneville's Fish and Wildlife restoration program. Taurus also enables Bonneville and its regional partners to manage the program's activities and accomplishments, and to define, evaluate, fund, and review portfolios of projects. TAURUS is available at www.cbfish.org.

38 The development and purpose of the Council's Multi-Year Action Plans are described in the 2009 Program (pages 59-61) section titled Implementing Measures Recommended for 2008-2018. The Program is available online at <http://www.nwcouncil.org/library/2009/2009-09.pdf> (January 2010). In brief, the Multi-Year Action Plans provide information on the existing and proposed actions to be implemented to address a specific limiting factor. This information is one component of the data that will be used in the Synopsis to assist the Council in assessing Program progress.

based map, such as through Bonneville's TAURUS database or Columbia River Basin Fish and Wildlife Authorities' Status of the Resources.

3.4.4) Data Management and Sharing Requirements Approach

All Program RME data must be made readily accessible and provided in an agreed-upon electronic format. Per the 2009 Program, RME data and metadata must be compiled, analyzed, and reported annually as well as within six months of project completion.³⁹

To facilitate monitoring of the Program's progress towards achieving basinwide biological objectives, project proponents must make information that is necessary to report on the following five topics available publicly:

1. The Council's High Level Indicators;
2. The Council's Fish and Wildlife Program Indicators;
3. NOAA Fisheries' Viable Salmonid Parameters;
4. Effectiveness data for actions implemented through the Program; and
5. Biological opinion reporting needs.

Currently, there are online databases that provide access to some of the data described above but improvements are needed to enhance the scope and speed of data transfer to online databases. There is work being done in the Basin to address this need. Several entities in the Basin are working on products that will facilitate the data management and sharing of monitoring data.⁴⁰ As these products emerge, the Council will evaluate them and consider incorporating them within the Implementation Framework as appropriate. Presently, to facilitate combining RME data from multiple sources the Council requires that project proponents document, preferably by following basin-wide accepted standards,:

- Where, what and how RME data will be stored and how to access it;
- RME data using common terminology;
- Metadata (documentation of data) for RME data collected or derived by analysis;
- RME study designs and methods;⁴¹
- RME metrics collected and indicators derived; and,
- RME data validation, quality assurance and quality control procedures.

³⁹ 2009 Columbia Basin Fish and Wildlife Program pages 25-26 available at <http://www.nwcouncil.org/library/2009/2009-09/> (January 2010).

⁴⁰ Pacific Northwest Aquatic Monitoring Partnership (PNAMP) is developing tools to facilitate data management and sharing. Project proponents should consult PNAMP products and apply them as relevant. The PNAMP products related to data management and sharing products are available online at www.pnamp.org.

⁴¹ Standards for reporting designs and methods as well as a list of designs and methods used in the Columbia River Basin is available through protocol library and editor tools such as on the PNAMP website available at <http://www.pnamp.org/PLib>.

The Council strongly encourages Bonneville to continue collaborating with managers to assure that needed improvements are made for reporting data of interest.⁴² The Council also requests that Bonneville assist project proponents in reporting data for the five topics identified above by providing a common database platform such as the TAURUS database. The Council also asks that Bonneville investigate ways to facilitate sharing of project implementation and biological data among with other entities funding fish, wildlife, and habitat actions in the Basin. A voluntary exchange of implementation data will enhance all parties' understanding of the location of fish, wildlife and habitat actions underway in the Basin, will allow for a more accurate assessment of cumulative impacts, and identification of unintended impacts among projects funded by different entities.

3.4.5) Standardized Approach for Implementation Strategies

The Implementation Strategies will provide more specific guidance on implementation of RME and reporting in the Program. RME and reporting differs greatly in approach for anadromous fish, resident fish, and wildlife and their habitat, therefore, these will be addressed in three separate strategies. The Council recognize that actions taken to protect, mitigate, and enhance one species or its habitat may impact other species and their habitats. The Implementation Strategies, although set forth in three separate appendices, will take into account the ecosystem linkages between them during their development.

The Implementation Strategies should provide sufficient guidance to assure that the data sharing and aggregating necessary for evaluating and reporting on the Program occurs. The Implementation Strategies must also provide guidance sufficient to ensure the assessment needs of other processes recognized by the Program are met, such as assessments for biological opinions. Given the diversity of the Basins' ecosystem and fish and wildlife management approaches, it is unrealistic to expect that one RME and reporting approach will work for all. The Implementation Strategies will therefore be flexible enough to address this diversity while ensuring that the ultimate goal of data sharing and aggregating at the desired level is met.

The Council requires that entities implementing RME and reporting actions under the Program coordinate with each other at the appropriate scale, such as evolutionary significant units, or at the subbasin or basin-wide level. The Council also requires that entities implementing actions through the Program coordinate with other entities implementing actions for other fish and wildlife programs. This coordination will help eliminate redundancies and maximize gains from invested resources.

Implementation Strategies address the three categories that form the focus of the Fish and Wildlife Program: anadromous fish, resident fish, and wildlife. Within each strategy, the impact

⁴² Bonneville is working with the PNAMP's Data Management Leadership Team and others to develop a Regional Data Management - RM&E Strategy Implementation Road Map for reporting FCRPS Biological Opinion RM&E data.

of: 1) mainstem, tributary, estuary and ocean habitat; 2) hydrosystem passage and operations; 3) harvest; and 4) artificial production will be considered. These four broad categories of impacts encompass numerous other impacts that will be addressed in more detail in each strategy, such as impacts from predators, invasive species, climate change, and toxins.

To ensure consistency and compatibility, each Implementation Strategies will consist of the following six components:

1. Management Questions and Indicators⁴³
2. Objectives and Performance Standards⁴⁴
3. Prioritization Criteria
4. Research Needs
 - Priorities
 - Standards for Data Quality, including precision and accuracy
 - Preferred Performance Measure⁴⁵ and Protocols
 - Preferred Study Designs and Statistical Analysis
5. Monitoring Needs
 - Priorities
 - Standards for Data Quality, including precision and accuracy
 - Preferred Performance Measure and Protocols
 - Preferred Study Designs and Statistical Analysis
6. Data Management, Data Sharing and Reporting

Additional guidelines to be applied in developing the Implementation Strategies include:

- Align with the guidance provided in the Program and in this MERR Plan;
- Incorporate, as appropriate, information from ISRP and ISAB reports,⁴⁶ RME products collaboratively developed by the region, and other sources of expertise, such as those listed in Appendix 5;

43 An indicator is defined, in the MERR Plan, as a surrogate for variables informing status and condition and trend of a resource representing ecological processes; or as a measured or derived variable defined at different hierarchical scales based on metric(s) collected in the field, from remote sensing, models or other raw data sources. The term “indicator” may be synonymous with the term “derived variable”.

44 In the MERR Plan, objectives identify the strategies or implementation steps to attain an identified goal. Objectives are specific and measurable. They include implementation, biological and environmental objectives. Performance standard consists of the target value or condition against which progress or achievements may be compared such as progress in meeting a particular objective. Performance standard may also be synonymous with the following terms: benchmark, reference point, targets and threshold.

45 For the 2009 Program and the MERR Plan, performance measures are defined as metrics that are monitored and evaluated relative to performance standards (benchmarks) and performance targets (longer-term goals) to assess progress of actions and inform future decisions. Metrics are typically associated with specific data collection and/or analysis protocols and define data in standard units of measurement. Metrics differ from indicators in the sense that they are directly measured and used in deriving the HLIs.

46 ISAB and ISRP reports are accessible on the Council’s website at <http://www.nwcouncil.org/library/Default.htm>. Consult Appendix 5.

- Provide guidance on the preferred study designs and performance measures (also called metrics) to be measure for monitoring by building primarily on ISRP⁴⁷ and ISAB recommendations as well as considering input from other regional experts (Appendix 5);
- Emphasize a rigorous application of the scientific method central to adaptive management versus a passive approach to learning when conducting research or monitoring;
- Balance using a species versus an ecosystem approach based on the RME and reporting actions and needs;
- Coordinate with action implementation project proponents to assure adequate levels of actions are implemented to enable effectiveness evaluation;
- Align the management questions and indicators with those of the Implementation Framework; and,
- Utilize the biological objectives, performance standards and prioritization criteria identified in the Implementation Framework to guide development of Implementation Strategies objectives, standards and prioritization criteria.

Development of Implementation Strategies begins following adoption of the MERR Plan, and will be accomplished through a collaborative process involving the Council and its regional partners. The Council anticipates completion of the Implementation Strategies by 2011.

Implementation Strategies are intended to be living documents that can be easily updated as new information becomes available. For example, the Council anticipates that future reports from the ISAB, the ISRP, and others in the region will continue to play a prominent role in influencing the Implementation Strategies. For this reason, the Implementation Strategies are set forth in appendices to facilitate revisions as necessary (Appendices 6-8). The Council is aware, however, that as the Implementation Strategies evolve, the Implementation Framework itself may need revision to properly reflect commonalties across the three Implementation Strategies.

47 For example consult the ISRP 2006 Retrospective Report, the ISRP 2008 Metric Review, and Appendix 5.

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5) Appendices

Appendix 1: 2009 Columbia River Basin Fish and Wildlife Program's Higher Priority and Non-Prioritized Biological Objectives.

The Council's prioritization of a subset of objectives as higher for the MERR Plan is suggested to provide additional guidance in the implementation of the Program's RME actions.

These biological objectives were selected based on how they addressed:

- Habitat and biological diversity, physical and biological processes;⁴⁸
- Council's management question 1, 2, 5, and 7;
- Implementation Framework's priority fish, wildlife and habitat characteristics; and,
- Assessment needs, such as resident fish and wildlife losses.

Council's Higher Priority Biological Objectives

Higher Priority – All Fish, Wildlife, and Habitat

- Expand the complexity and range of habitats to allow for greater life history and species diversity.
- Maintain and restore healthy ecosystems and watersheds that preserve functional links among ecosystem elements to ensure the continued persistence, health, and diversity of all species including game fish species, non-game fish species, and other organisms.
- Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands. Enhance the connections between rivers and their floodplains, side channels, and riparian zones.
- Manage mainstem riparian areas to protect aquatic conditions and form a transition to floodplain terrestrial areas and side channels.
- Identify, protect, enhance, and restore the functions of alluvial river reaches.
- Decrease the disparity between water temperatures and the naturally occurring regimes of temperatures throughout the Basin.
- Where feasible, reconnect protected and enhanced tributary habitats to protected and enhanced habitats, especially in areas with productive populations.
- Allow for biological diversity to increase among and within populations and species to increase ecological resilience to environmental variability.
- Where feasible, support patterns of water flow that more closely approximate natural hydrographic patterns in terms of quantity, quality, and fluctuation. Ensure that any changes in water management are premised upon and proportionate to scientifically demonstrated fish and wildlife benefits.

⁴⁸ Physical processes create diverse habitat conditions. Biological processes operate at several spatial scales and enable species to persist in a variable habitat by fostering behavioral and physiological flexibility needed to adapt to changes. (Williams 2005, Page 90).

- Identify, protect, enhance, restore, and connect ecosystem functions in the Columbia River estuary and near-shore ocean discharge plume as affected by actions within the Columbia River mainstem.
- Habitat restoration work to reconnect ecosystem functions such as removal or lowering of dikes and levees that block access to habitat or installation of fish-friendly tide gates, protection or restoration of riparian areas and off-channel habitat, and removal of pile dikes.

Higher Priority – Anadromous Fish

- Restore the widest possible set of healthy, naturally reproducing and sustaining populations of salmon and steelhead in each relevant ecological province.
- Implement actions to stabilize and improve Columbia River white sturgeon and to recover listed Kootenai River white sturgeon.
- Implement actions to stabilize and improve burbot populations in the Upper Columbia region.
- Within 100 years, achieve population characteristics that, while fluctuating due to natural variability, represent on average full mitigation for losses of anadromous fish.
- Restore lamprey passage and habitat in the mainstem and in tributaries that historically supported spawning lamprey populations. Attain self-sustaining and harvestable populations of lamprey throughout their historical range. Mitigate for lost lamprey production in areas where restoration of habitat or passage is not feasible.
- Identify and protect habitat areas and ecological functions that are relatively productive for spawning, resting, rearing, and migrating salmon and steelhead in the mainstem.
- Restore and enhance habitat areas that connect to productive areas to support expansion of productive populations and to connect weaker and stronger populations so as to restore more natural population structures.
- Protect, enhance, restore, and connect freshwater habitat in the mainstem and tributaries for the life history stages of naturally spawning anadromous and resident salmonids.
- Continue evaluation of salmon and steelhead migration and survival rates in the lower Columbia River, the estuary, and the marine environment.
- Halt declining trends in Columbia River Basin salmon and steelhead populations, especially those that originate above Bonneville Dam. Increasing total adult salmon and steelhead runs to an average of 5 million annually by 2025 in a manner that emphasizes the populations that originate above Bonneville Dam and supports tribal and non-tribal harvest.
- Significantly improve the smolt-to-adult return rates (SARs) for Columbia River Basin salmon and steelhead, resulting in productivity well into the range of positive population replacement. Achieving smolt-to-adult return rates in the 2-6 percent range (minimum 2 percent; average 4 percent) for listed Snake River and upper Columbia salmon and steelhead.

Higher Priority – Resident Fish

- Complete the assessments of resident fish losses resulting from the development and operation of the hydrosystem, when and where there is agreement on the appropriate

methodology and prioritization of an assessment.

- Protect and expand habitat and ecosystem functions in order to increase the abundance, productivity, and life history diversity of resident fish at least to the extent that resident fish have been affected by the development and operation of the hydrosystem.
- Achieve within 100 years population characteristics of resident fish species that represent on average full mitigation for losses of resident fish.

Higher Priority – Wildlife

- Complete mitigation to address the assessed losses caused by construction of the hydrosystem facilities and the resulting inundation of land. Where appropriate prioritization exists and agreements exist on the methodology, complete wildlife loss assessments for losses caused by operation of the hydropower projects.
- Maintain the values and characteristics of existing, restored and created habitat.
- Monitor and evaluate habitat and species responses to mitigation actions.

Council's Non-Prioritized Biological Objectives

Non-Prioritized – All Fish, Wildlife, and Habitat

- Manage human activities to minimize artificial selection or the loss of life history traits.
- Frame habitat restoration in the context of measured trends in water quantity and quality.
- Allow for seasonal fluctuations in flow. Reduce large and rapid short-term fluctuations.
- Long-term effectiveness monitoring for various types of habitat restoration projects in the estuary.

Non-Prioritized – Anadromous Fish

- More clearly determine what delayed differential survival effects (D-value), if any, occur due to transport operations, such as adverse effects on homing behavior, and address other ISAB recommendations.
- Prioritize funding research that more accurately measures the effect of improved inriver migration compared to transportation and the comparative rate of adult returns to the spawning grounds of transported and inriver migrants.
- The action agencies should evaluate the effectiveness of focused pikeminnow removals at The Dalles and John Day dams and implement as warranted.
- To the extent possible, use stored water to manage water temperatures downstream from storage reservoirs where temperature benefits from releases can be shown to provide improved fish survival.
- Manage for Variability - variations in ocean conditions and regional climate play a large role in the survival of anadromous fish and other species in the Columbia River Basin. Management actions should strive to help those species accommodate a variety of ocean

conditions by providing a wide range of life history strategies.

- Evaluate the relationship of transported juvenile fish and adult fish straying into the John Day and Deschutes rivers and other lower Columbia River tributaries, particularly the straying rates of transported hatchery fish.
- Conduct a transportation study that targets Snake River fall Chinook, including investigation and identification of key early life history characteristics for both yearling and subyearling life histories.
- Evaluate the impact of flow regulation, dredging, and water quality on estuary-area habitat and better understand the relationship between estuary ecology and near-shore plume characteristics and salmon and steelhead productivity, abundance, and diversity

Non-Prioritized – Resident Fish

- Restore and increase the abundance of native resident fish species throughout their historic ranges when original habitat conditions exist or can be feasibly restored or improved.
- Develop and increase opportunities for consumptive and nonconsumptive resident fisheries for native, introduced, wild, and hatchery-reared stocks that are compatible with the continued persistence of native resident fish species and their restoration to near their historic abundance.
- When full mitigation by improving the abundance of native fish species is not feasible, manage non-native fish to maximize use of available existing and improved habitats, while complementing state and local regulations, in order to provide a subsistence- and sport-fishing resource, without adversely affecting native fish populations.

Non-Prioritized - Wildlife

- Develop and implement habitat acquisition and enhancement projects to fully mitigate for identified losses.
- Coordinate habitat restoration and acquisition activities throughout the Basin with fish mitigation and restoration efforts to promote terrestrial and aquatic area connectivity.

Appendix 2: Council 2009 Program's Quantitative Performance Standards

The 2009 Program specifies 11 performance standards that are quantitative in nature and consist of three main categories: Run Size and Return Rates; Dam Passage Survival; and Reach Survival. These performance standards are:

Run Size and Return Rates

- Average total run size of adult salmon and steelhead, emphasizing populations originating above Bonneville Dam, of 5 million annually by 2025.
- Smolt-to-adult return rates in the 2-6 percent range (minimum 2 percent; average 4 percent) for listed Snake River and upper Columbia salmon and steelhead.

Dam Passage Survival⁴⁹

- Average dam passage survival across Snake River and Lower Columbia River dams for juvenile spring Chinook and steelhead is 96%.
- Average dam passage survival across all dams for Snake River subyearling Chinook is 93%.

Reach Survival⁵⁰

- Adult Snake River Fall Chinook survival performance standard for the reach between the Bonneville Dam and the Lower Granite Dam is 81.2%.
- Adult Snake River Spring-Summer Chinook survival performance standard for the reach between the Bonneville Dam and the Lower Granite Dam is 91.0%.
- Adult Snake River Sockeye survival performance standard for the reach between the Bonneville Dam and the Lower Granite Dam is, until standards are developed, assumed met if the adult Snake River spring/summer Chinook salmon and steelhead performance standards of 91.0% and 90.1%, respectively, are met for the same reach.
- Adult steelhead survival performance standard for the reach between the Bonneville Dam and the Lower Granite Dam is 90.1%.

⁴⁹ The Dam Passage Survival and Reach Survival performance standards were adopted as part of the Program's Mainstem Monitoring and Evaluation Section. See footnote 18 on page 53 of the Columbia River Basin Fish and Wildlife Program - 2009 Amendments (Council Document 2009-09). Available: <http://www.nwcouncil.org/library/2009/2009-09.pdf>

⁵⁰ See footnote above.

- Adult Upper Columbia River Spring Chinook survival performance standard for the reach between the Bonneville Dam and the McNary Dam is 90.1%.
- Adult Upper Columbia River steelhead survival performance standard for the reach between the Bonneville Dam and the McNary Dam is 84.5%.
- Adult Middle Columbia River steelhead survival performance standard, specific reach variable, until standards are developed, assumed met if the adult Snake River steelhead performance standard of 90.1% is met for the reach between Bonneville Dam and Lower Granite Dam.

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Appendix 3: Council's Management Questions and Associated High Level Indicators and Fish and Wildlife Program Indicators

During the October 2009 Council meeting⁵¹, the Council adopted a working list of management questions and associated High Level Indicators and Fish and Wildlife Indicators to facilitate communicating Program progress to Congress, Pacific Northwest Governors, Fish and Wildlife managers, and the public. Below are the nine management questions in bolded text. Under each management question is listed the associated High Level Indicator and the Fish and Wildlife Indicators.

Biological Indicators

Are Columbia River Basin fish and wildlife abundant, diverse, productive, spatially distributed, and sustainable?

High Level Indicator

- Abundance of Fish and Wildlife

Fish and Wildlife Program Indicators

- Abundance of salmon and steelhead in the Columbia River Basin.
- Abundance of pacific lamprey and sturgeon in the Columbia River Basin.
- Smolt-Adult return rates for ESA listed salmon and steelhead in the Columbia River Basin.
- Abundance of focal resident fish species in the Columbia River Basin.
- Wildlife species abundance and diversity in the Columbia River Basin.
- ESA listed or non-listed status and trend of fish and wildlife in the Columbia River Basin.

Are Columbia River Basin ecosystems healthy?

High Level Indicator

- Ecosystem Health

Fish and Wildlife Program Indicators

- Watershed Health for fish and wildlife.
- Non-native species distribution.

Are ocean conditions affecting Columbia River Basin anadromous fish?

High Level Indicator

- Ecosystem Health

Fish and Wildlife Program Indicators

- Ocean Condition.

⁵¹ The Council adopted two lists of indicators, High Level Indicators and Fish and Wildlife Program Indicators, during October 2009. Available <http://www.nwcouncil.org/fw/program/hli/Default.htm> (January 2010).

Is climate change affecting fish and wildlife in the Columbia River Basin?

High Level Indicator

- Ecosystem Health

Fish and Wildlife Program Indicators

- Climate Change (to be developed).

Are the actions implemented by the Council Fish and Wildlife Program having the expected biological effect on fish and wildlife and their habitat?

High Level Indicator

- Abundance of Fish and Wildlife

Fish and Wildlife Program Indicators

- Production of wild fish related to habitat improvement actions.
- Predation on fish in the Columbia River Basin.

Implementation Indicators

Are Council program actions coordinated within the program and with other programs?

High Level Indicator

- Council Action

Fish and Wildlife Program Indicators

- Wildlife habitat units acquired relative to loss by dam.
- Number of instream fish passage improvements.
- Potential maximum additional miles of fish habitat made accessible.
- Amount of water conserved by conservation activities and water transactions for instream use.
- Amount of land protected for fish and wildlife.
- Amount of land receiving actions aimed at improving habitat for fish and wildlife.
- Managing predation on adult and juvenile fish.
- Define indicator for successful occurrence of Resident fish substitution to replace anadromous fish species loss due to hydrosystem.
- Define an indicator for: Progress in implementing action to address subbasin plan objectives and needs (limiting factors, priority reaches, etc).
- Coordination of Council Fish and Wildlife Program with other fish and wildlife entities, activities, and programs in the Basin.

Are mainstem hydro operations meeting the Council Fish and Wildlife Program's survival and passage objectives?

High Level Indicator

- Hydrosystem Survival & Passage

Fish and Wildlife Program Indicators

- Salmon and steelhead juvenile survival through Federal Columbia River Power System's dams.
- Salmon and steelhead adult survival through Federal Columbia River Power System's dams.

Is harvest consistent with the Council fish and wildlife program's vision?

High Level Indicator

- Council Action

Fish and Wildlife Program Indicators

- Harvest numbers and rates per year for salmon, steelhead, sturgeon, and resident fisheries.
- Contribution of Council's Fish and Wildlife program funded hatcheries to Columbia River Basin and Ocean fisheries.

Does artificial production complement resident and anadromous recovery and harvest goals within the Columbia River Basin?

High Level Indicator

- Council Action

Fish and Wildlife Program Indicators

- Implementation of artificial production recommendations supported by the Council Fish and Wildlife Program's.
- Abundance of hatchery parr/smolts released complement abundance of wild parr/smolts in-stream.

Appendix 4: Priority Species and Habitat Characteristics

The selection of priority species and habitat characteristics was based on those stated in the Program, High Level and Fish and Wildlife Program Indicators (Appendix 3), wildlife focal species predominately targeted by the Program's project proponents, and input from Council staff.

The actual list of priority fish, wildlife, and habitat characteristics may change with improved understanding of better species and habitat characteristics to monitor. The selected priority species and habitat characteristics are:

Fish Species		
<ul style="list-style-type: none"> • Bull Trout • Burbot • Chinook • Coho • Cutthroat Trout (western subspecies) 	<ul style="list-style-type: none"> • Pacific Lamprey • Rainbow Trout (reband subspecies) • Kokanee • Northern Pikeminnow 	<ul style="list-style-type: none"> • Sockeye • Steelhead • White sturgeon
Wildlife Species		
<ul style="list-style-type: none"> • American Beaver • American Mink • Bald Eagle • Black Bear • Black-capped Chickadee • California Sea Lion 	<ul style="list-style-type: none"> • Caspian Tern • Double Crested Cormorants • Elk • Great Blue Heron • Mallard Duck • Mule Deer 	<ul style="list-style-type: none"> • Ruffed Grouse • Sharptail Grouse • Sage Grouse • Stellar Sea Lion • White-tailed deer • Yellow Warbler
Habitat Characteristics		
<ul style="list-style-type: none"> • Floodplain • Instream 	<ul style="list-style-type: none"> • Hyporheic • Riparian 	<ul style="list-style-type: none"> • Wetlands • Uplands

Appendix 5: Suggested Documents to Consider during Development of Implementation Strategies

Below is a list of documents that should be considered during the development of the implementation strategies. This list is not all inclusive, therefore information from other relevant documents should be consulted as needed.

Anadromous Fish, Resident Fish, and Wildlife

1. Bisbal, G.A. 2001. Conceptual Design of Monitoring and Evaluation Plans for Fish and Wildlife in the Columbia River Ecosystem. *Environmental Management* 28(4):433-453
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Anadromous Fish

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Appendix 6: Anadromous Fish Implementation Strategy (to be developed)

This strategy is in development. The strategy will incorporate, as appropriate, the content of the Anadromous Fish Monitoring Sub-Framework developed during the 2009 Collaborative Columbia River Basin Monitoring and Evaluation Workshops as well as information from relevant regional products (Appendix 5). The Anadromous Fish Monitoring Sub-Framework includes tributary VSP, tributary habitat effectiveness and hatchery effectiveness for salmon and steelhead. Components for other anadromous fish, as well as for the ocean, estuary, mainstem components of the Program need to be developed through a regional approach and may incorporate aspects of the RME AA-NOAA-NPCC-BPA FCRPS Biological Opinion RPA workgroups' report.

Appendix 7: Resident Fish Implementation Strategy (to be developed)

This strategy is in development. A regional approach will be used to assist Council development of this strategy. This strategy will incorporate information from relevant regional products as appropriate (Appendix 5).

Appendix 8: Wildlife Implementation Strategy (to be developed)

This strategy is in development. A regional approach will be used to assist Council development of this strategy. It will incorporate, as appropriate, the content regional products such as the FCRPS Wildlife Mitigation Monitoring and Evaluation Framework being developed by the Wildlife Advisory Committee of CBFWA (Appendix 5).