

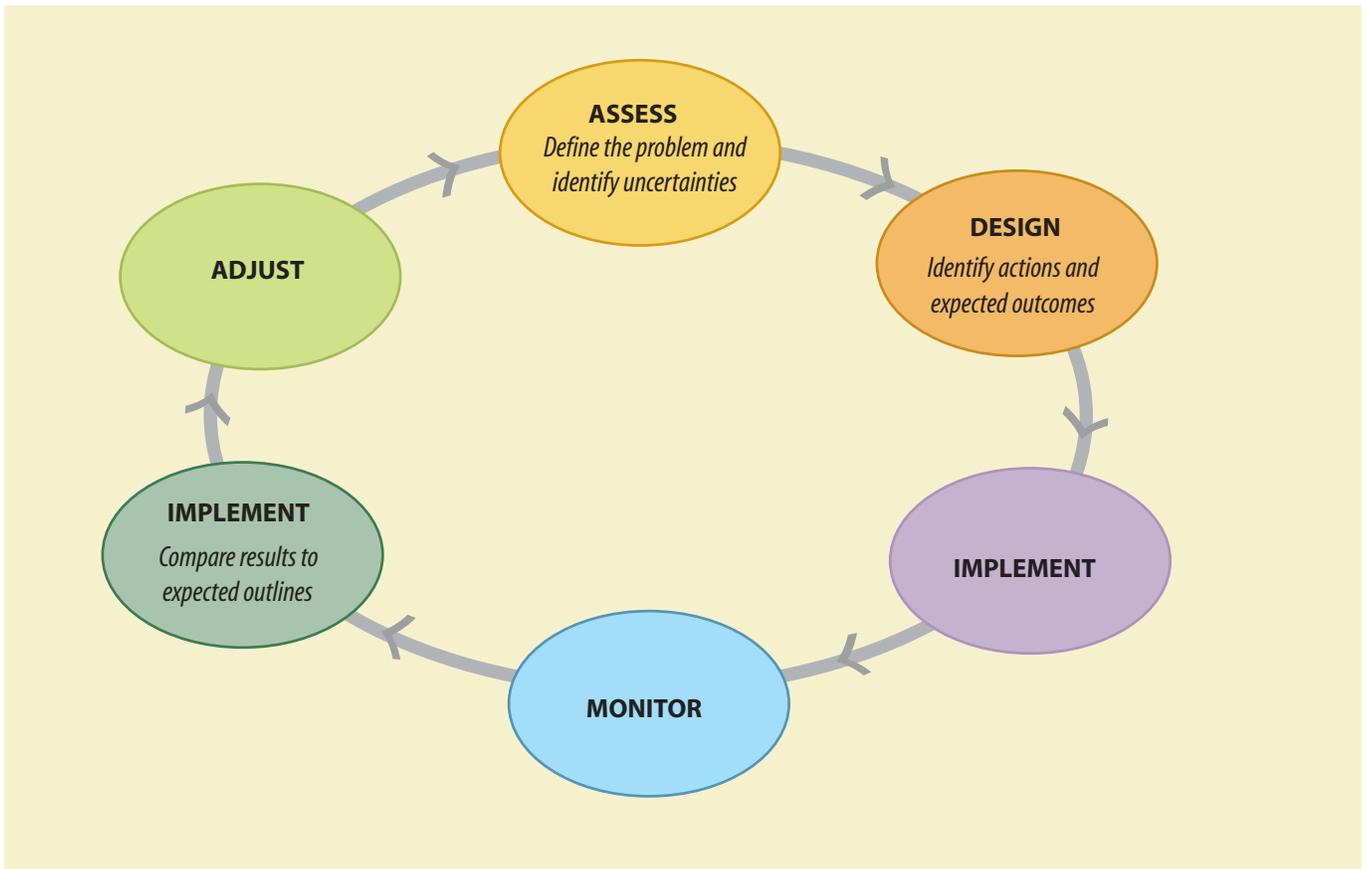
9.1 INTRODUCTION

The Habitat Plan is meant to guide local actions over the next 10 years to move habitat conditions in the Green/Duwamish and Central Puget Sound Watershed (Water Resource Inventory Area 9 [WRIA 9]) towards conditions that will support salmon recovery. The Plan reflects the best available information at the time of completion, but there is still much to be learned through Plan implementation efforts.¹

Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of projects and programs (Marmorek 2003). Adaptive management embodies a simple imperative: policies and actions are experiments – learn from them (Lee 1993).

Adaptive management recognizes that uncertainty and unexpected changes are inherent in managing complex ecological systems. Adaptive management is a problem-solving approach to address this uncertainty that relies on six steps (see Figure 9-1): 1) assessment, 2) design, 3) implementation, 4) monitoring, 5) evaluation, and 6) adjustment. Assessment involves defining the problem, selecting indicators, and assessing alternative management actions. Design involves the development of a management experiment and the identification of expected outcomes for the different actions. Implementation of actions follows within the context of learning from expected action outcomes. Monitoring is carried out to determine the effectiveness of the actions in meeting the goals or outcomes. Data from monitoring are evaluated and compared to expected outcomes and results are interpreted to analyze unexpected outcomes. Decision makers adjust goals and/or actions in response to new information to more effectively address Plan goals.

FIGURE 9-1: Six Steps of Adaptive Management



1. An aspect of adaptive management and monitoring are scientific studies that tell us more about the watershed. A list of possible studies for the WRIA 9 Watershed is found in Appendix J.

9.2 ADAPTIVE MANAGEMENT

Adaptive management is an integral component of implementation. An adaptive management framework includes an institutional structure that, in combination with monitoring and evaluation, can be used to judge progress in achieving Plan goals and objectives. The framework also explicitly lays out how information from monitoring and evaluation efforts will guide decisions about future strategies and actions.

The adaptive management literature identifies the basic elements of an adaptive management based program to implement a plan such as this Habitat Plan. The draft platform statement on implementation from the Shared Strategy Summit (dated January 20, 2005) also identifies the necessary elements of an adaptive management plan for Puget Sound salmon recovery plans that are quite similar to the components included in the WRIA 9 Technical Strategy (2003). Using these background materials, the basic elements of an adaptive management program for WRIA 9 can be summarized as follows:

1. **Goals:** What goals for salmon does the WRIA 9 Habitat Plan aim to achieve?
2. **Hypotheses:** What are the hypotheses regarding life stages that are thought to be limiting recovery of the salmon populations in WRIA 9?
3. **Strategies:** What habitat, hatchery, and harvest strategies will be used to address the primary factors hypothesized to be limiting recovery of WRIA 9 salmon populations?
4. **Actions:** What specific actions are included in the WRIA 9 Plan to implement the strategies and achieve objectives?
5. **Measures:** What metrics will be used to indicate population status and the effectiveness of actions aimed at improving the population status?
6. **Communication and Decision Making:** How will key people be made aware of the results of actions on salmon?
7. **Institutional Structure:** What is the institutional structure that supports the implementation of the Habitat Plan and clearly defines roles and responsibilities for each element?
8. **Resources:** What are the resources necessary to carry out each element of the Habitat Plan over the necessary time period and geographic area?
9. **Commitments:** What commitments will key players provide that are necessary for Habitat Plan implementation?

Passive Versus Active Adaptive Management

Literature about adaptive management notes that there are two key options for implementation: passive or active. “Passive” adaptive management is a more formal approach where historical information is used to select the best alternative management actions. Ecosystem response to the action(s) is observed and the action is adapted accordingly. A major drawback of passive adaptive management is that it confounds (mixes together) environmental and anthropogenic (human-caused) effects because replicates and controls are not utilized. This often leads to conflict over whether ecological responses are due to environmental or anthropogenic effects.

“Active” adaptive management is a systematic process of modeling, experimentation, and monitoring to compare the outcomes of alternative management actions (Farr 2000). Here, multiple management actions are applied to the landscape following a rigorous experimental design that allows scientists and managers to compare ecosystem response to alternative management actions. Through experimental design, active adaptive management accelerates the rate of learning about managed ecosystems, allowing managers to select more effective actions and reduce the economic and ecological cost of resource management. In active adaptive management, managers design actions to discriminate between alternative approaches, and thus reveal the “best” management action.

Both passive and active adaptive management require careful implementation, monitoring, evaluation of results, and adjustment of objectives and practices. Active adaptive management usually allows more reliable interpretation of results, leads to more rapid learning, and is recommended for implementation in WRIA 9 wherever feasible. It also leads to more certainty that actions are leading to desired or expected outcomes.



Adaptive management requires careful planning to ensure that monitoring provides useful data for future management decisions.

Recognizing Uncertainty in Plan Implementation

Despite significant efforts to assess and evaluate salmonid populations and to develop a plan of action to protect, restore, rehabilitate or substitute aquatic habitats, considerable uncertainty still exists in determining the effectiveness of these collective actions. If this uncertainty is acknowledged and understood to be a consequence of the inherent complexity of the ecological systems being addressed, it is possible to plan for it in monitoring and adaptive management efforts. These uncertainties originate in the unpredictability of the response of salmonids to habitat management actions, the limits of existing analytical techniques to accurately describe the response, and the varying and often long time frames necessary for data collection and monitoring efforts to measure the response (WRIA 8 2004). If this uncertainty is recognized, it is possible to capitalize on it in adaptive management and monitoring efforts by turning new knowledge into more effective actions in the future. Actions that carry the greatest uncertainty, but also great potential for benefits, should receive emphasis in monitoring and adaptive management efforts.

WRIA 9 Adaptive Management Plan Elements

Using the basic elements of an adaptive management program noted above as a framework, the summary responses to the organizing questions for WRIA 9 are presented below. More detail is presented in the WRIA 9 Strategic Assessment (King County Department of Natural Resources and Parks et al. 2004).

Goals: What goals for salmon does the WRIA 9 Habitat Plan aim to achieve?

The overall goal for WRIA 9 (Steering Committee 2002) is to protect, rehabilitate, and enhance habitat to support viable salmonid populations in response to the Endangered Species Act listing of Chinook salmon and bull trout using an ecosystem approach. This approach will also benefit other non-listed aquatic species. More detail on other goals and objectives are presented in Chapter 4 - Section 4.3.

The recommended preliminary long-term population target for Chinook salmon is 27,000 spawning adults (King County Department of Natural Resources and Parks et al. 2004). Refinement of the planning target will occur as additional analyses are completed. Increasing productivity of the natural origin recruit population is the short-term priority goal, with the intent of maintaining or improving the current adult recruits per spawner ratio of 2.3. The longer-term goal is to enhance the spatial structure of the Chinook population because of the significant losses in spatial structure that have occurred over time. With improvements to spatial structure, greater diversity, particularly with respect to life history trajectories, will also follow. Addressing spatial structure and diversity is a long-term process, but it should begin now. An important objective will be to expand the spawning aggregations for natural origin recruits by increasing the number of suitable habitat patches for successful spawning. The existing life history trajectories should be conserved and the opportunity for expression of historical life history trajectories should be enhanced. More detail on the goals for the viable salmonid population (VSP) parameters are presented in the Strategic Assessment (King County Department of Natural Resources and Parks et al. 2004). Habitat targets have also been developed for the five subwatersheds to support a viable Chinook population. More detail on these targets can be found in Chapter 4 - Section 4.6.



Juvenile salmonid survival studies have provided information on life stages limiting survival. Shown here is a screw trap for juvenile capture in Kent. 2003 photo.

Hypotheses: What are the hypotheses regarding life stages that are thought to be limiting recovery of the salmon populations in WRIA 9?

It is hypothesized that Duwamish estuary transition zone habitat; Middle and Lower Green River, Duwamish estuarine, and marine nearshore rearing habitat; and Middle Green and upper Lower Green spawning habitat are the most limiting habitats affecting Chinook recovery in the WRIA 9 watershed. WRIA-wide, the primary factors hypothesized to be contributing to the reduced quantity and quality of rearing and spawning habitat include shoreline armoring (conservation hypothesis All-6), instream flows (All-4), and riparian zone conditions (All-2). (See Chapter 4 – Section 4.5 for information on the conservation hypotheses.) In the five subwatersheds (Figure 1-1), Chinook salmon access above the dams (conservation hypothesis UG-1), natural sediment recruitment in the Upper and Middle Green (UG-4, MG-3), habitat that provides refugia (side channels, off channels, and tributary access) and habitat complexity over a range of flow conditions and at a variety of locations (Duw-4, LG-1, MG-1), preserving/restoring habitat in lower Newaukum and Soos creeks (MG-4), expanding and enhancing the estuary, particularly shallow subtidal and intertidal habitats, the transition zone, and natural sediment process (Duw-1, Duw-3, Duw-5), and protecting and restoring nearshore sediment transport and shallow water habitat (Near-3, Near-2) are key factors to be addressed. Finally, improving harvest practices to target hatchery salmon and release naturally-produced salmon (conservation hypothesis NH-1) and modifying hatchery practices (NH-2) are seen as important actions to support and achieve

recovery. It is important to recognize that these hypotheses represent habitat conditions that are believed necessary to achieve a viable salmon population. Throughout implementation, monitoring, and evaluation, these hypotheses can be tested and refined to reflect improved understanding of habitat conditions and population response.

Strategies: What habitat, hatchery, and harvest strategies will be used to address the primary factors hypothesized to be limiting recovery of WRIA 9 salmon populations?

The WRIA 9 Plan is designed to increase rearing and spawning habitat in the fresh water areas of the watershed and rearing habitat in the estuary and marine nearshore. Habitat management strategies in fresh water environments include protecting or restoring natural channel geomorphology, sediment recruitment, off-channel habitats, tributary habitats and inaccessible mainstem segments, refugia, riparian areas, water quality, and water quantity. In marine and estuarine nearshore areas, strategies focus on shallow water habitats, riparian areas, sediment recruitment, habitat formation and maintenance, migrational passage, water quality, sediment quality, pocket estuaries, water quantity (including springs and seeps), submerged aquatic vegetation, beaches and backshore, and salt marshes. More detail on these strategies is presented in Chapter 5, Habitat Management Strategies and Policies.

In planning for rearing habitat for juvenile salmonids in the Middle and Lower Green River, Duwamish estuary, and marine nearshore, it is important to take into account the habitat needs of both hatchery and natural origin salmon. This includes habitat capacity and availability of prey, particularly as related to potential competition between hatchery and natural origin (wild) fish. Several strategies are being considered for management of hatchery effects, including timing of hatchery releases and management of the hatchery broodstock. Under an integrated approach, the goal would be to reduce hatchery origin recruit escapement to the spawning grounds to 30% or less (for perspective, under a segregated approach, the goal would be 5% or less).

Harvest strategies also could be altered to maximize the catch of hatchery fish and minimize catch of natural origin recruits. A strategy to employ live capture techniques to harvest hatchery salmon and release natural salmon would reduce mortality of

naturally-produced salmon while providing the opportunity to harvest a greater percentage of hatchery fish. This also would reduce straying of hatchery fish to the spawning grounds.

Actions: What specific actions are included in the WRIA 9 Plan to implement the strategies and achieve objectives?

Freshwater projects include levee setbacks, construction of side channel and off channel habitat, floodplain connections, large woody debris placement and gravel supplementation, riparian revegetation, and improved management of water quantity and quality. Estuarine projects include revetment setbacks, creation of shallow water habitat, vegetation rehabilitation, improvement of water quality, and noxious weed control. Marine nearshore projects include creation or rehabilitation of small pocket beaches, shallow water habitats, tidal embayments, and salt marshes, improved access for salmonids to tributaries, encouragement of soft armoring of shorelines (where armoring is absolutely necessary), and improved management of septic systems. Habitat protection using a variety of techniques is also recommended to protect existing functioning habitat. See Chapter 7 for more detail on proposed WRIA 9 actions.

Measures: What metrics will be used to indicate population status and the effectiveness of actions aimed at improving the population status? What data will be collected to track progress in the metrics over time?

Indicators of changes in population and habitat conditions could be measured as follows (more detail is found in Section 9.4 below, Table 9-1, and Table 5-1:

1. Determine if the priority viable salmonid population (VSP) parameters (productivity and spatial structure) are increasing during the first 10 years of implementation. Measures could include the following:

Productivity:

- Otoliths² studies to find contributions of life history types to adult returns; and
- Smolt trapping at river mile 34.5 (Washington State Department of Fish and Wildlife) and perhaps lower downstream combined with adult numbers on the spawning grounds to estimate lambda values, which measure the growth rate of the population.

Spatial Structure:

- Spawning surveys to determine if spawning aggregations are expanding;
 - Juvenile outmigration to gauge whether the timing and percentage of fry/fingerlings outmigrants changes with better quality habitat and changes in flow management; and
 - Utilization of rearing habitats by juvenile salmonids in the river, estuary, and marine nearshore (expensive and highly variable).
2. Determine if water quality is improving for critical parameters (e.g., temperature, dissolved oxygen) and reaches (e.g., key spawning and rearing areas of the Middle and Lower Green River, and tributaries);
 3. Determine if flow conditions have improved in terms of meeting instream flow targets (e.g., conservation flows from the Howard Hanson Dam Additional Water Storage Project, achieving more natural flow regimes);
 4. Determine the change in specific habitat types identified in the Necessary Future Conditions analysis (e.g., estuarine wetland habitat, braided channels, side channels, shallow channel edge habitat, large woody debris jams, in-channel pools). (Specific information on targets for hypothesized Necessary Future Conditions can be found in Chapter 4-Section 4.5); and
 5. Implementation monitoring to determine whether projects and programs are being implemented per the Plan and whether projects are accomplishing the anticipated results from a biological standpoint. Focus should be on actions where the uncertainty of outcomes and potential for benefits is greatest.

2. A bone-like structure found in the inner ear of fish. Otoliths record daily rings that are correlated with fish growth. The increase in Strontium in otoliths can be used to estimate entry to brackish marine waters.

Communication and Decision Making:

How will key people be made aware of the results of actions on salmon?

How will the increase in understanding of how the freshwater nearshore ecosystems work affect decisions about strategies and actions in the WRIA 9 plan?

The WRIA 9 Steering Committee, Forum, Planning Work Group, and Technical Committee or their successors, and the citizens and landowners of the watershed will be the target of communication efforts. The Steering Committee, Forum, and member jurisdictions (cities in WRIA 9, King County) will be the primary decision makers with respect to implementation of actions related to habitat. Any entity involved in implementation of actions will also be making decisions about its roles and responsibilities in implementation. The co-managers — Washington State Department of Fish and Wildlife, Muckleshoot Indian Tribe and other tribal interests — will be the primary decision makers with respect to hatchery and harvest issues.

Ongoing communication with external parties about progress toward the Plan goals will be essential to ensure success. Clear messages and accurate information about the results of habitat actions will help maintain the support of funding entities, elected officials, and citizens. Consideration should be given to communication at both the local jurisdictional and WRIA-wide levels. The Public Outreach Work Group or its successor will help support and carry out the communication efforts.

Institutional Structure: What is the institutional structure that supports the implementation of the Habitat Plan and clearly defines roles and responsibilities for each element?

The institutional structure consists primarily of the WRIA 9 Steering Committee, a multi-stakeholder group that includes representation from local, state, and federal governments, businesses, and environmental and community groups, and the WRIA 9 Forum, a caucus of local governments represented by elected officials from the 17 member jurisdictions. These groups or their successors will be responsible for overseeing implementation of the WRIA 9 Habitat Plan. Implementation of individual on-the-ground projects will vary and could be carried out by the private property landowner, local government, a Tribe,

state or federal agency, non-profit group, or some combination of partners. Guidance on successful adaptive management efforts recommends involvement from the following types of groups: managers, ecological experts, stakeholders, biometricians, policy makers, and operational staff.

Many adaptive management efforts also note the importance of having an independent science group involved in the process that is not subservient to the management group. This group may be involved in monitoring decisions, review of data and interpretation, and formal peer review (either integrated into the process or in review of draft documents). Other guidance emanating from decision support systems efforts suggests the importance of “integrators” who can communicate and work with decision makers, stakeholders, and technical experts. This guidance should be considered in the development of an institutional structure to oversee Plan implementation, including adaptive management and monitoring. The institutional structure for implementation is expected to be developed and refined in late 2005-early 2006.

Resources: What are the resources necessary to carry out each element of the Habitat Plan over the necessary time period and geographic area?

An estimate of the resources to carry out Plan implementation over the next 10 years can be found in Chapter 8 and Volume II - Appendix I. The components of the adaptive management and monitoring program are still being developed and the costs are not yet completely known. Some coarse level detail on specific monitoring program elements are contained in Table 9-1. More detailed information will be available when the monitoring and adaptive management plans are further refined and additional information is available from local jurisdictions, resource agencies, and others. Resources are expected to come from a combination of local, state, and federal sources, together with some funding from private resources, non-profits, and other non-governmental organizations.

Commitments: What commitments will key players provide that are necessary for Habitat Plan implementation?

The implementing entities will be making commitments in conjunction with ratification of the WRIA 9 Plan after approval by the WRIA 9 Steering Committee and Forum (see Chapter 8 for further discussion). Those making the commitments are expected to be local governments that are members of the Forum and

other implementing entities that could include state and federal agencies, businesses, non-governmental organizations, and other groups. These commitments will become clearer by the end of 2005. Separate commitments related to hatcheries and harvest will be the purview of the co-managers as noted above and will be integrated into the Plan with the assistance of the Washington State Department of Fish and Wildlife.

It is expected that local jurisdictions will work with federal and state governments to negotiate potential benefits and assurances for different levels of commitment. Making greater commitments may well result in greater potential assurances, but it is recognized that this will need to be worked out at both the local and regional Puget Sound levels.

Further Refinement of the WRIA 9 Adaptive Management Plan

The WRIA 9 adaptive management plan is still evolving. It is expected to be discussed and further developed in late 2005-early 2006 as part of the early implementation of the Plan.

9.3 MONITORING

Monitoring allows measurement and evaluation of the success of actions aimed at protecting, restoring, and rehabilitating habitat. Benefits of monitoring include:

- Providing certainty that money is spent effectively on priority actions;
- Showing that the actions are achieving desired objectives; and
- Assessing progress towards WRIA goals for habitat and populations.

For monitoring to fulfill its key role in the context of adaptive management, on-the-ground projects must be planned within the context of a monitoring experiment (Ralph and Poole 2002). Specifically, the monitoring experiment must test hypotheses about the effects of particular management actions.

It is only through monitoring data that federal agencies will be able to come to a de-listing decision based on the recovery of Chinook salmon and bull trout populations. However, this level of monitoring and decision making has not been carried out before in WRIA 9.

Funding for this component of the Plan is currently uncertain. Leadership will be required at both the policy and technical levels to implement this essential element of adaptive management.

9.4 TYPES OF MONITORING

The Independent Science Panel (2000) recommended three different types of monitoring to support salmon recovery efforts in Washington State, which have been adapted for application in WRIA 9:

1. **Implementation Monitoring** – confirms that management actions (e.g., projects, programs, guidance) were implemented. (Did proponents implement the project as proposed?);
2. **Effectiveness Monitoring** – monitors the status and trends of habitat characteristics to assess whether desired performance objectives are being achieved. (Did the management actions result in improved habitat conditions?). Effectiveness monitoring can occur at two levels:
 - **direct** (Are specific project actions achieving anticipated outcomes?) and
 - **cumulative** (Is the sum of all actions within a study area or segment achieving the anticipated outcomes?); and
3. **Validation Monitoring** – confirms that management actions and restoration projects produced the desired change in population conditions and status. (Do all actions taken together support the overall recovery of the Green River Chinook population in terms of the viable salmonid population parameters?).

Ralph and Poole (2002) recommend designing monitoring experiments in a hierarchical fashion to elucidate responses at different spatial scales. Applied to WRIA 9, this would include three distinct spatial scales:

1. Site scale, encompassing a single management or restoration project;
2. Segment scale, encompassing specific stream/riparian, floodplain, and hillslope complexes (segments were identified for the Green/Duwamish River mainstem and the marine nearshore in the Strategic Assessment [King County Department of Natural Resources and Parks et al. 2004]); and
3. Watershed or WRIA scale.

At each spatial scale, there should be a monitoring purpose, monitoring questions and objectives, appropriate monitoring variables, and design criteria to aid selection of individual sampling sites.

Monitoring will be integral to Plan implementation for WRIA 9. The information generated should provide specific information to inform decisions based on management questions or hypothesis testing and be available in a timely manner for use by decision makers. Monitoring is particularly critical when dealing with complex issues involving salmon conservation because resources are limited, accountability is important, and uncertainty is sometimes high due to lack of basic understanding of relationships between habitat and population response or the effectiveness of proposed or implemented actions. Linking monitoring to actions of highest importance or related to greatest uncertainty provides decision makers with data that can: 1) help provide certainty that money is spent on the most critical actions; 2) show that actions are achieving objectives; and 3) describe progress towards goals (WRIA 8 2005).

Implementation Monitoring

Implementation monitoring is necessary to track which management actions have been implemented, including basic information (e.g., who, what, where, cost). It is anticipated to be a relatively simple checklist summary that includes the type of action, the specific objectives of the action, the reach or segment affected, the focus of the action (e.g., length of levee or revetment setback, area of riparian zone re-vegetated, area of off-channel habitat created), the anticipated outcomes of the action, and the costs. Information should be developed by implementing entities, but use common definitions and standard forms, and then compiled at the WRIA level.

To support this type of implementation monitoring, the WRIA 9 Forum of local governments should coordinate among its members and work with local, state, tribal, and federal agencies; businesses; community and environmental groups, and other organizations to report annually on steps taken to implement the Habitat Plan. This type of monitoring was recommended in the Near-Term Action Agenda (Kulzer (Ed.) 2002). Following its recommendation, annual reports were compiled to record habitat actions taken in WRIA 9 in 2002 and 2003 (these are posted at the WRIA 9

website at <http://dnr.metrokc.gov/Wrias/9/NTAA.htm>). Such reports should contribute to a sense of accountability because they help measure the extent to which local governments and other partners actually carry out the recommendations of the Habitat Plan.

The template for tracking implementation monitoring information will be completed upon approval of the WRIA 9 Plan and could be adapted from the tracking form used for the Near-Term Action Agenda.

Effectiveness Monitoring

Effectiveness monitoring provides the basis for determining whether action outcomes are achieved and how project and program designs can be improved for future implementation. Monitoring objectives, approaches, and protocols related to monitoring specific project types have been developed by Washington State (Johnson et al. 2001) and could be applied in WRIA 9. Direct effectiveness monitoring will occur at the project or site scale, while cumulative effectiveness monitoring will occur at the segment or watershed scale. Draft priorities for effectiveness monitoring will be proposed by the WRIA 9 Technical Committee and reviewed by the Steering Committee. Specific monitoring plans will be developed upon completion of the WRIA 9 Plan and prioritization of actions for implementation.

Preliminary recommendations for direct and cumulative effectiveness monitoring are summarized in Table 9-1. This table includes information about the monitoring questions, type of monitoring, and parameters.

Validation Monitoring

Validation monitoring is used to confirm that management actions produce the desired change in population conditions and status at the overall population level. For WRIA 9, this is primarily the Green River Chinook population in terms of the four viable salmonid population parameters: abundance, productivity, spatial structure and diversity. A second part of validation monitoring will be carried out at the Evolutionarily Significant Unit level for Puget Sound Chinook and the constituent 22 populations. The validation monitoring approach will be developed in cooperation with the region upon completion of the Puget Sound Salmon Recovery Plan.

Proposed WRIA 9 Monitoring Recommendations

WRIA 9 does not currently fund a comprehensive monitoring program. Through grants from the King Conservation District and Salmon Recovery Funding Board and through resources from local jurisdictions and resource agencies, the WRIA has partially funded a combination of salmonid studies, habitat inventories, and water quantity and quality assessments in the watershed. There also have been extensive technical data generated by individual jurisdictions and resource agencies in WRIA 9 including spawner surveys, smolt trapping, and additional habitat studies carried out by Washington State Department of Fish and Wildlife and the U.S. Army Corps of Engineers.

A sustained monitoring effort will need to be well designed to address the range of monitoring elements. It will probably be funded by a combination of local, state, and federal sources. Preliminary recommendations for monitoring in WRIA 9 to achieve the goals noted above — providing certainty that money is spent effectively on priority actions, showing that the actions are achieving desired objectives, and assessing progress towards WRIA goals for habitat and populations — are presented in Table 9-1. The table includes information on:

- Types of monitoring (including monitoring questions);
- Recommended monitoring;
- Status of existing monitoring;
- Planning level cost estimates; and
- Tasks for coordination during Plan implementation.

Coordination of Monitoring Between Agencies

Monitoring is being carried out by many jurisdictions, resource agencies, and independent parties. It is critical that this monitoring be coordinated to reduce duplication and redundancy, increase the effective use of resources in scientific studies and monitoring, and yield the greatest amount of information to inform decision making. This coordination should occur at both the WRIA level and the regional (Puget Sound) level. It will also be important to ensure greater consistency between efforts by developing common protocols, coordinating training, having common quality assurance and control programs, and coordinating data management and analyses.

Integration of Monitoring Efforts

In the further planning and implementation of WRIA 9 monitoring efforts, opportunities should be examined to integrate environmental monitoring efforts to achieve efficiencies in responding to both the Endangered Species Act (ESA) and Clean Water Act requirements. This could include National Pollutant Discharge Elimination System (NPDES), Total Maximum Daily Load (TMDL), and ESA-related monitoring activities. Opportunities for coordination include water quantity, water quality, land cover information, and possibly habitat measures. These options should be fully explored and evaluated in the context of negotiations related to monitoring with regional, state, and federal partners.

TABLE 9-1: WRIA 9 Proposed Monitoring Recommendations

(Please see separate file (11x17"))