

# WRIA 1 Long Term Monitoring Program – Strategy for Implementation

## Section 1-

### Introduction

The June 2005 WRIA 1 Watershed Management Plan includes a recommended action of developing and implementing a WRIA 1 Long Term Monitoring Program (LTMP). This document outlines the strategy for implementing the recommended action.

An effective long-term comprehensive monitoring program is essential to measuring progress and success of actions implemented as part of the WRIA 1 Watershed Management Project. It is also important to informing additional recommendations or adjustments to the WRIA 1 Watershed Management Project that may occur under Adaptive Management.

As part of the WRIA 1 LTMP strategy, the WRIA 1 Instream Flow/Fish Habitat Technical Team and the WRIA 1 Salmonid Recovery Steering Committee are collaborating on a habitat monitoring methodology. Elements of the methodology will be incorporated into the WRIA 1 LTMP as part of Adaptive Management.

A comprehensive and viable monitoring program requires long-term funding commitments. Generally, however, tribal, federal, state, and local government funding for monitoring activities is limited and of short duration. The WRIA 1 LTMP strategy recognizes that to maximize limited resources, monitoring activities need to be planned and conducted in partnership with other agencies and organizations. These partnerships also provide for coordination with other WRIA 1 programs such as the WRIA 1 Salmon Recovery and with other entities involved in monitoring activities in WRIA 1. The partnerships may take the form of funding contributions, staff for implementing monitoring activities, and/or agreeing to long-term commitments to implement specific monitoring activities.

The WRIA 1 LTMP strategy purpose and approach is outlined in Section 2. Section 3 of this document identifies the goals and objectives upon which the WRIA 1 strategy is based. The elements of the WRIA 1 LTMP strategy, including approaches for integrating and coordinating with other agencies, are summarized in Section 4. Section 5 describes approaches for managing and reporting data collected under the WRIA 1 LTMP. Section 6 includes a summary of recommendations and milestones associated with implementing the WRIA 1 LTMP strategy as it is described in this document. Section 7 summarizes the Adaptive Management element of the WRIA 1 LTMP strategy.

## Section 2 –

### WRIA 1 Long Term Monitoring Program Purpose

The purpose of the WRIA 1 Long Term Monitoring Program (LTMP) is to establish and maintain an ambient monitoring program sufficient to assess current water quality, water quantity, and fish habitat conditions and trends and to protect beneficial uses in WRIA 1. The monitoring program will include

37 data collection, quality assurance, data management, data analysis, and reporting. Data collected will  
38 inform policies and management actions necessary to meet the goals of the WRIA 1 Watershed  
39 Management Project by allowing for evaluation of the effectiveness of management actions and  
40 refinement of management tools.

41 The WRIA 1 LTMP consists of a tiered strategy that includes:

- 42 ▪ An over-arching WRIA 1-wide program that addresses WRIA 1 Watershed Management Project  
43 goals and objectives;
- 44 ▪ A complementary monitoring element that supports existing monitoring programs designed and  
45 implemented to meet an entity's specific program goals and objectives, that complement the over-  
46 arching WRIA 1-wide monitoring program, and that are important to achieving the goals of the  
47 WRIA 1 Watershed Management Project; and
- 48 ▪ A drainage-based monitoring element that incorporates monitoring elements associated with  
49 individual drainages as the drainages implement organized management units are implemented.

50 Funding for the monitoring program will be through a combination of federal, tribal, state, and local  
51 funding. A dedicated funding source is needed to support implementation of the LTMP. The program  
52 strategy will be reviewed on a regular basis as described in the adaptive management element of this  
53 document. The spreadsheet included as Appendix A identifies sampling stations for the WRIA 1  
54 LTMP, parameters measured, frequency, costs, and lead entity. The spreadsheet is a working document  
55 that will be completed and/or modified as the WRIA 1 LTMP is implemented.

56

### 57 **Section 3.0 –**

### 58 **WRIA 1 Long Term Monitoring Program Goals and Objectives**

59 The WRIA 1 Long Term Monitoring Program involves monitoring surface and ground water  
60 chemistry, stream flows, ground water levels, meteorological conditions, water use monitoring,  
61 biological conditions necessary for salmon and shellfish protection and restoration, and monitoring the  
62 implementation of management actions. The goals and objectives identified in this section of the WRIA  
63 1 LTMP strategy relate to the over-arching WRIA 1-wide program and are listed for water quantity,  
64 water quality, and instream flow/fish habitat.

#### 65 3.1 Over-Arching Monitoring Element

##### 66 3.1.1 Water Quantity

67 Goal 1-Collect water quantity data to meet the following objectives:

- 68 • Quantify stream flows at identified gage locations
- 69 • Refine water use estimates.
- 70 • Evaluate the effectiveness of actions implemented for flow augmentation.
- 71 • Identify status and trends in climate, instream flows, water use, and ground water levels.

72 3.1.2 Water Quality

73 Goal 1- Collect water quality data to meet the following objectives:

- 74 • Determine if applicable water quality standards are being met at sampling stations throughout
- 75 WRIA 1.
- 76 • Evaluate if TMDL targets for identified parameters are being achieved in basins and sub-basins for
- 77 which TMDLs are in place.
- 78 • Determine the duration and extent of water quality standards violations that correlate to storm or
- 79 other events.
- 80 • Identify status and trends in surface and ground water quality.

81 3.1.3 Instream Flow/ Fish Habitat

82 There are several goals and objectives identified for addressing instream flow and fish habitat.  
83 Addressing these goals and objectives will be done in conjunction with the WRIA 1 Salmon Recovery  
84 Program implementation.

85 Goal 1- Collect and analyze data to support negotiated and regulatory instream flows. Objectives  
86 include:

- 87 • Quantify flow conditions at stream gaging stations at key locations and at instream flow
- 88 measurement sites to document existing conditions.
- 89 • Determine if negotiated or target instream flows are being met at identified locations.

90 Goal 2- Determine current fish habitat conditions to meet the following objectives:

- 91 • Quantify instream habitat accessible to upstream migrating adult and rearing juvenile salmon. For
- 92 early run Chinook the WRIA 1 Salmon Recovery Board has identified 4 relevant parameters:
- 93 abundance, productivity, spatial structure, and diversity.
- 94 • Assess the quality and potential use of instream habitat currently accessible to salmonids for use as
- 95 a benchmark beginning with priority geographic areas.

96 Goal 3- Quantitatively determine if fish habitat conditions are improved by management actions

97 Goal 4- Collect and analyze information that will provide a better understanding of factors contributing  
98 to proper functions or impairments of the physical and biological processes that create and maintain  
99 properly functioning salmonid habitats within WRIA 1.

100 3.2 Complementary Monitoring Programs

101 Existing monitoring programs that complement the WRIA 1 over-arching monitoring program and  
102 that are important to achieving the overall goals of the WRIA 1 Watershed Management Project have  
103 specific goals and objectives that those monitoring programs are designed to achieve. The goals and  
104 objectives for the complementary programs are available can be obtained through the entities  
105 responsible for implementing the programs.

106

107 **Section 4 –**

108 **WRIA 1 Long Term Monitoring Program Design**

109 The WRIA 1 LTMP strategy is designed as a tiered program that includes: an over-arching WRIA 1  
110 monitoring element designed to achieve the goals and objectives identified in Section 3; the  
111 complementary monitoring programs implemented by entities to meet their program-specific needs and  
112 that are important in achieving the overall WRIA 1 Watershed Management Project goals identified in  
113 the June 2005 WRIA 1 Watershed Management Plan; and the individual drainage monitoring plans that  
114 will be developed and implemented as drainage-based management units are established (e.g.,  
115 watershed improvement districts). Some aspects of the over-arching monitoring program are underway  
116 while others are scheduled for implementation. The complementary programs are existing programs  
117 that generally have dedicated funding such as the Lake Whatcom monitoring program and the City of  
118 Bellingham urban streams program. Individual drainage monitoring plans are new monitoring  
119 programs that will be designed and implemented within the framework of the Adaptive Management  
120 element of the WRIA 1 LTMP strategy and the WRIA 1 Watershed Management Project.

121 The following is a summary of the WRIA 1 LTMP strategy.

122 4.1 Over-Archiving WRIA-Wide Monitoring Element

123 The over-arching monitoring element of the program is designed to meet the core needs of the WRIA  
124 1 Watershed Management Project. Monitoring associated with this element of the WRIA 1 LTMP  
125 includes measuring stream flows, water quality, and meteorological conditions for purposes of  
126 achieving the goals and objectives listed in Section 3. The strategy is built on developing and  
127 formalizing partnerships with entities involved in monitoring activities within WRIA 1 at identified core  
128 stations. The core stations are the stations considered necessary for collecting data to address the  
129 WRIA 1 LTMP over-arching goals and objectives. Formalizing partnerships with the entities involved  
130 in monitoring activities at these stations will maximize available monitoring resources, potentially  
131 leverage additional federal, state, and local monitoring funds, and help ensure coordination among  
132 programs underway in WRIA 1. The map included in Figure 1 identifies the core stations for the over-  
133 arching monitoring element of the WRIA 1 LTMP strategy.

134 The following is a summary of each constituent of the over-arching WRIA-wide monitoring program.  
135 Although each constituent is described separately (e.g., water quantity, water quality), it is recognized  
136 that they are inherently linked.

137 *Water Quantity*

138 The United States Geological Survey (USGS) and Washington State Department of Ecology (Ecology)  
139 have stream flow measurement gages installed throughout WRIA 1. The types of gages installed include  
140 telemetry, stand-alone (recorder), and manual stage height. Twenty-six (26) of the twenty-nine (29)  
141 gage locations identified in Figure 1 are existing gages operated either by the USGS or Ecology. The  
142 three remaining gages are located on the north side of the U.S./Canada boundary and are operated by  
143 Environment Canada. The twenty-nine stream gage locations have been reviewed in the context of the

144 goals and objectives of the over-arching monitoring element (Section 3) and the WRIA 1 Watershed  
145 Management Project. Table 1 is a summary of stream gage locations, type, and entity responsible for  
146 installation of the gage. The locations of the stream gages listed in Table 1 correspond to the mapped  
147 gages in Figure 1.

148 All of the identified stream gages are considered critical for achieving the WRIA 1 program goals and  
149 objectives. The existing USGS and Ecology gage stations are funded, operated, and maintained through  
150 programs of the sponsoring agency, partnerships with Tribal governments, and/or partnerships with  
151 local governments. Given the importance of the stations to the overall WRIA 1 project, the WRIA 1  
152 LTMP strategy focuses on identifying and pursuing options to ensure continued funding for the gages  
153 identified in Figure 1. Options being considered include consolidating gages currently operating under  
154 partnership agreements for fixed periods of time and/or that are dependent on grant funding under the  
155 auspices of a single agency. Gage stations maintained and operated for local programs such as the  
156 Whatcom County Flood Hazard Management Program that have a dedicated funding source are not  
157 being considered for consolidation. Agreements or other documentation associated with ensuring  
158 continued operation and maintenance of the stream flow gages is included in the appendices of the  
159 WRIA 1 LTMP Strategy.

160 In addition to flow, a number of the existing Ecology telemetry stations collect stream and air  
161 temperature. The WRIA 1 LTMP strategy includes incorporating stream temperature into all of the  
162 telemetry and recording stations in WRIA 1. Additionally, the WRIA 1 strategy includes incorporating  
163 dissolved oxygen measurements as part of the data collected at the gage stations on an opportunistic  
164 basis such as when flow data are downloaded or when station maintenance occurs. Incorporating these  
165 additional measurements into data collection at the stream gage locations is further discussed under  
166 *Water Quality and Meteorological Conditions*.

167 As part of the collaboration between the WRIA 1 Instream Flow/Fish Habitat Technical Team and the  
168 WRIA 1 Salmonid Recovery Steering Committee Work Group three subcommittees were formed to  
169 develop a monitoring methodology for each parameter being addressed by the group. The Water  
170 Subcommittee will be addressing stream flow, the addition of continuous recording of stream  
171 temperature, and the periodic measurements of dissolved oxygen as part of this joint effort, which will  
172 result in completing a monitoring methodology description that addresses of these items. The template  
173 for the monitoring methodology is included as Appendix A of this document.

174 The strategy for managing the data at all of the monitoring sites to ensure consistency in data reporting  
175 and compatibility for use in the WRIA 1 Decision Support System and its underlying models is  
176 described in Section 5.

177

178 **Table 1. Summary of WRIA 1 Long Term Monitoring Program Stream Gage**

Location	Station ID	Gage Type	Agency <sup>a</sup>	Period of Record <sup>b</sup>	Comments
Pepin Cr at International Boundary	08MH156	Recorder	Environment Canada	1985-present	Seasonal data collection
Bertrand Cr at International Boundary	08MH152	Recorder	Environment Canada	1984-present	Seasonal data collection
Bertrand Cr Trib nr H Street nr Lynden	12212430	Telemetry	USGS	Initiated 2007	New station initiated 1/16/07
Bertrand Cr @ mouth	01N060	Telemetry	Ecology	2003-present	
Fishtrap Cr @ International Boundary	08MH153	Recorder	Environment Canada	1984-present	Continuous record 1987-present; seasonal record 1984-1986
Fishtrap Cr @ Front St.	12212050	Recorder	USGS	1998-present	Funded through 6/07
Kamm Slough @ Northwood	01M090	Manual	Ecology	2003-present	
Tenmile Cr abv Barrett Lake	01P080	Telemetry	Ecology	2003-present	
Nooksack River @ Ferndale	12213100	Telemetry	USGS	1967-present	
Nooksack River @ North Cedarville	12210700	Telemetry	USGS	2000-present	Seasonal gage (mid-October through April)
Nooksack River @ North Cedarville	01A120	Manual	Ecology	1959-present	Long term station, sampled monthly
Anderson Cr @ mouth	01L050	Manual	Ecology	2003-present	
Anderson Cr @ Smith Rd nr Goshen	12210900	Recorder	USGS	1998-present	Funded through 6/07
Nooksack River above the MF	01A140	Telemetry	Ecology	2003-present	
Nooksack River @ Brennan	01A050	Manual	Ecology		Long term station, sampled monthly
Racehorse Creek	12206900	Recorder	USGS	1998-present	Funded through 6/07
Maple Cr @ mouth	01K050	Telemetry	Ecology	2003-present	
NF Nooksack River BL Cascade Creek	12205000	Telemetry	USGS	1937-present	
MF Nooksack River near Deming	12208000	Telemetry	USGS	1920-present	
MF Nooksack River abv Clearwater Cr	016100	Recorder	Ecology	2003-present	
Clearwater Creek near Welcome	12207850	Recorder	USGS	1998-2006	Last period data collected 10/5/06; Funded through 6/07
Warm Creek at Welcome	12207750	Recorder	USGS	1998-2006	Funded through 6/07
SF Nooksack @ Potter Rd	01F070	Telemetry	Ecology	2003-present	
SF Nooksack River nr Edfro Cr	12209000	Telemetry	USGS	1934-present	
Skookum Creek	12209490	Telemetry	USGS	1998-present	Funded through 6/07
Hutchinson Cr nr Acme	01C070	Telemetry	Ecology	2003-present	
Sumas R at Telegraph Rd	01D100	Manual	Ecology	2003-present	
Dakota Cr at Giles Rd	01Q070	Manual	Ecology	2003-present	
California Cr at Valley View	01R090	Manual	Ecology	2003-present	

179 <sup>a</sup>The agency listed is the agency that installed the gage; it is not assumed to be the agency responsible for maintaining and/or  
180 funding the continued operation of the gage.

181 <sup>b</sup>The period of record is presented as general information; the initiating year is not intended to imply data collection began  
182 the first day of January of any identified year.

183 *Water Quality*

184 Water quality stations for the over-arching monitoring element of the WRIA 1 LTMP strategy focus on  
185 meeting the goals and objectives outlined in Section 3. There are two types of water quality monitoring  
186 stations identified in Figure 1- continuous flow stations that include water quality measurements (i.e.,  
187 water temperature and periodic measurements of dissolved oxygen) and water quality stations that do  
188 not gather flow data and that use grab samples for collecting data on selected water quality parameters.  
189 For the water quality only stations, analysis will be performed for a range of parameters including:  
190 dissolved oxygen, temperature, pH, suspended solids, nutrients, turbidity, and bacteria. Both types of  
191 stations are important for achieving the goals and objectives of the WRIA 1 LTMP strategy.

192 Table 2 includes a list of both types of water quality monitoring stations – combination flow/quality  
193 (F/Q) and water quality only - and parameters currently being measured and recommendations for  
194 additional ones. The monitoring locations listed in Table 2 correspond to those mapped in Figure 1.

195 The continuous (telemetry and recorder) flow and quality stations identified in Figure 1 may be  
196 considered for consolidation and operation under the auspices of a single agency (refer to *Water*  
197 *Quantity* discussion). In addition to collecting stream flow, some of these stations currently collect both  
198 stream and air temperature. The WRIA 1 LTMP strategy for the continuously recording stations  
199 includes further maximizing resources by incorporating dissolved oxygen (DO) measurements in  
200 proposals for consolidation by taking DO measurements when servicing the station. The WRIA 1  
201 LTMP strategy includes identifying a process to coordinate with entities on data collection. This  
202 process will include communicating with Environment Canada regarding the three gages they operate at  
203 the U.S./Canada boundary – Pepin, Bertrand, and Fishtrap – to discuss the feasibility of incorporating  
204 stream temperature and periodic dissolved oxygen measurements into their data collection activities.

205 There are eight (8) water quality stations identified in Figure 1 for the over-arching monitoring element  
206 of the WRIA 1 LTMP strategy. These sites have been or are being monitored by Ecology as part of  
207 their on-going ambient monitoring activities, the 5-year rotational<sup>1</sup> sites for additional monthly  
208 sampling, and/or the total maximum daily load (TMDL) program. Seven of the eight stations are  
209 currently monitored. Two of the eight stations are long-term ambient monitoring stations sampled by  
210 Ecology on a monthly basis and have a long period of record (>25 years). Five of the stations are sites  
211 currently being monitored by Ecology through September 2007 as part of the 5-year rotating schedule.  
212 One station – Tenmile Creek – is not currently being monitored for the full set of water quality  
213 parameters previously identified, but it is a station that had been part of the TMDL sampling program.

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<sup>1</sup> On a 5-year rotating schedule, the Washington State Department of Ecology funds 1-year of monthly water quality sampling for additional ambient stations in WRIAs across the state.

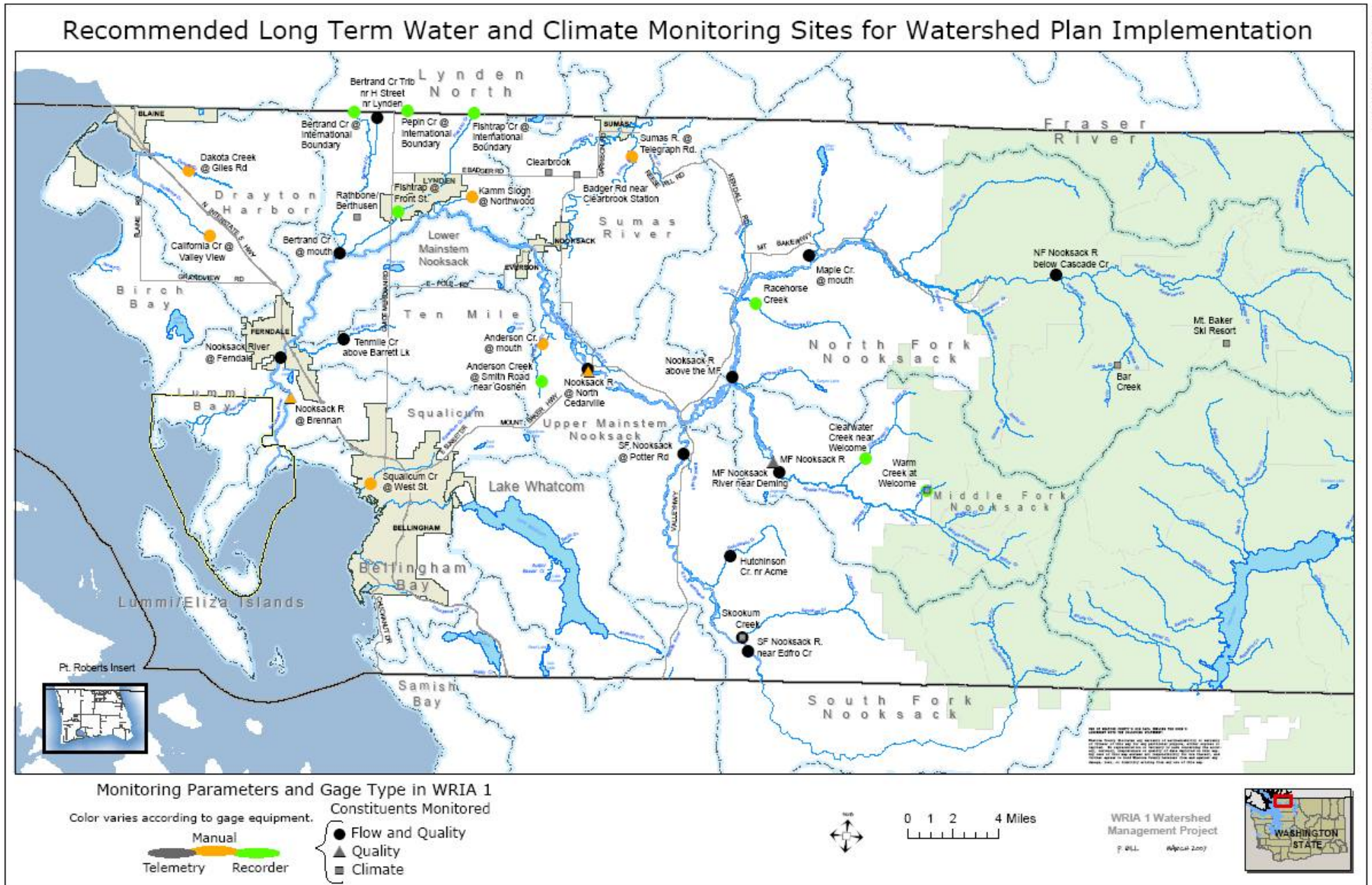


Figure 1. Core stations for over-arching monitoring element of the WRIA 1 Long Term Monitoring Program

215 The locations described above and identified in Table 2 are selected for the over-arching WRIA 1  
 216 monitoring strategy for a number of reasons including: 1) availability of a historic database for assessing  
 217 trends in water quality, 2) a spatial distribution of stations beneficial to assessing current conditions, 3)  
 218 potential for maximizing resources through partnerships with the agencies performing monitoring, and  
 219 4) a database that may provide information for evaluating effectiveness of management  
 220 practices/programs.

221 The Water Subcommittee created as part of the collaboration between the WRIA 1 Instream  
 222 Flow/Fish Habitat Technical Team and the WRIA 1 Salmonid Recovery Steering Committee Work  
 223 Group is developing a monitoring methodology that will address a number of the parameters listed  
 224 (further discussed under *Introduction* and *Water Quantity*). The template used by the Water Subcommittee  
 225 will also be used for the parameters the Subcommittee does not address. The template for the  
 226 monitoring methodology is included as Appendix A of this document.

227 **Table 2. WRIA 1 Long Term Monitoring Program Water Quality Stations**

Location	Station ID	Station Type	Parameter		Comments
			Current	Recommend	
Bertrand Cr Trib nr H Street nr Lynden	12212430	Combination F/Q <sup>2</sup>	Flow, air & water temp	Periodic DO <sup>3</sup>	Newly installed USGS station (1/16/07)
Bertrand Cr @ mouth	01N060	Combination F/Q; Water Quality Station	Flow, air & water temp; nutrients, DO, pH, suspended solids, turbidity, bacteria		This water quality station is one of the stations on Ecology's 5- year cycle. The full set of water quality parameters will be measured 10/06-9/07. The LTMP strategy recommends continued sampling of all parameters beyond 9/07.
Fishtrap @ Front St	12212050	Combination F/Q	Flow	Water temp, Periodic DO	
Fishtrap @ Flynn Rd	01U070	Water Quality Station	DO, nutrients, water temp, pH, suspended solids, turbidity, bacteria		This water quality station is one of the stations on Ecology's 5- year cycle. The full set of water quality parameters will be measured 10/06-9/07. The LTMP strategy recommends continued sampling of all parameters either at Flynn Rd or at Front St.
Tenmile Cr abv Barrett Lake	01P080	Combination F/Q; Water Quality Station	Flow, air & water temp	DO, nutrients, pH, suspended solids, turbidity, bacteria	This location is not currently monitored on an ongoing basis for the full range of parameters listed. Collecting the full range of water quality parameters is a recommendation in the WRIA 1 LTMP strategy.
Nooksack R @ Brennan	01A050	Water Quality Station	DO, nutrients, pH, suspended		

<sup>2</sup> Combination F/Q station is a combination stream flow and water quality station.

<sup>3</sup> Addition of periodic DO (dissolved oxygen) measurements is recommended for all Combination F/Q stations.

Location	Station ID	Station Type	Parameter		Comments
			Current	Recommend	
			solids, turbidity, bacteria, temp		
Nooksack R @ North Cedarville	01A120	Water Quality Station	DO, nutrients, pH, suspended solids, turbidity, bacteria, temp		
Anderson Creek @ Smith Rd nr Goshen	12210900	Combination F/Q	Flow	Water temp, Periodic DO	
Nooksack R above MF	01A140	Combination F/Q; Water Quality Station	Flow, air temp; nutrients, DO, pH, temp, suspended solids, turbidity, bacteria	Water temp at flow station	This water quality station is one of the stations on Ecology's 5-year cycle. The full set of water quality parameters will be measured 10/06-9/07. The LTMP strategy recommends continued sampling of all parameters beyond 9/07.
Racehorse Creek	12206900	Combination F/Q	Flow	Water temp, Periodic DO	
Maple Cr @ mouth	01K050	Combination F/Q	Flow, air & water temp	Periodic DO	
NF Nooksack River BL Cascade Cr	12205000	Combination F/Q	Flow	Water temp, Periodic DO	
MF Nooksack River	01G070	Water Quality Station	DO; nutrients, pH, suspended solids, turbidity, bacteria, temp		This water quality station is one of the stations on Ecology's 5-year cycle. The full set of water quality parameters will be measured 10/06-9/07. The LTMP strategy recommends continued sampling of all parameters beyond 9/07.
MF Nooksack River near Deming	12208000	Combination F/Q	Flow, water temp	Periodic DO	
MF Nooksack River abv Clearwater Cr	016100	Combination F/Q	Flow	Water temp, Periodic DO	
Clearwater Cr nr Welcome	12207850	Combination F/Q	Flow	Water temp, Periodic DO	
Warm Cr at Welcome	12207750	Combination F/Q	Flow	Water temp, Periodic DO	
SF Nooksack @ Potter Rd.	01F070	Combination F/Q; Water Quality Station	Flow, air & water temp; nutrients, DO, pH, suspended solids, turbidity, bacteria		This water quality station is one of the stations on Ecology's 5-year cycle. The full set of water quality parameters will be measured 10/06-9/07. The LTMP strategy recommends continued sampling of all parameters beyond 9/07.
SF Nooksack R nr Edfro Cr	12209000	Combination F/Q	Flow	Water temp, Periodic DO	
Skookum Cr	12209490	Combination F/Q	Flow	Water temp, Periodic DO	

Location	Station ID	Station Type	Parameter		Comments
			Current	Recommend	
Hutchinson Cr nr Acme	01C070	Combination F/Q	Flow, air & water temp	Periodic DO	

228 As with the continuous flow stations, dedicated funding and/or commitments from sponsoring  
 229 agencies is needed for on-going water quality monitoring at the stations identified in the WRIA 1  
 230 LTMP strategy. Obtaining funding agreements, partnership agreements, and/or other documentation  
 231 associated with ensuring continued monitoring of water quality is an essential part of the WRIA 1  
 232 LTMP strategy.

233 *Instream Flow/Fish Habitat*

234 The WRIA 1 Instream Flow/Fish Habitat (ISF/FH) Technical Team and the WRIA 1 Salmon  
 235 Recovery Steering Committee Work Group are meeting jointly to develop a Habitat Monitoring  
 236 Methodology that addresses issues and selects methods for monitoring that will achieve the salmonid  
 237 habitat monitoring objectives of both the WRIA 1 LTMP strategy (Section 3) and the WRIA 1  
 238 Salmonid Recovery Program. . The meeting summary from the initiating meeting, which outlines the  
 239 process for developing the methodology, is included in Appendix B of this document. Relevant  
 240 elements of the completed Habitat Monitoring Methodology, including funding commitments and/or  
 241 partnership agreements to implement the methodology, will be incorporated into the WRIA 1 LTMP  
 242 strategy as part of Adaptive Management.

243 *Meteorological Conditions*

244 Figure 1 identifies stations for collecting meteorological conditions. The WRIA 1 LTMP strategy is to  
 245 support existing stations and to establish a new station in the upper Middle Fork Watershed. The new  
 246 station will be established as part of Adaptive Management.

247 4.2 Complementary Monitoring Programs

248 A number of program-specific monitoring programs are being implemented by agencies. The goals and  
 249 objectives for these monitoring efforts are designed specifically to address the programs' needs. Several  
 250 of these existing monitoring programs, however, also support the overall goals and objectives of the  
 251 WRIA 1 Watershed Management Project. Therefore, these programs are identified as part of the  
 252 WRIA 1 LTMP strategy and include monitoring associated with the Whatcom County Shellfish and  
 253 Marine Resources Programs, Ecology water use monitoring (WAC 173-173), the Lake Whatcom  
 254 Management Program, and the City of Bellingham Urban Stream Program.

255 Stream flow and temperature monitoring in the Middle Fork Nooksack River are being conducted by  
 256 different entities including the City of Bellingham and the Department of Ecology. Although the effort  
 257 underway in the Middle Fork is a complementary program to the over-arching WRIA 1 LTMP strategy,  
 258 a recommendation will be made to the entities currently involved in the existing complementary  
 259 program to also record temperature at a downstream location on the Middle Fork.

260 Data collected by local industries and the Northwest Clean Air Agency may provide information  
261 associated with meteorological conditions that support the goals and objectives of the WRIA 1 LTMP.  
262 The location of these stations and the type of data collected will be identified and considered as part of  
263 the WRIA 1 LTMP strategy. Outcomes of the review will be considered as part of Adaptive  
264 Management.

#### 265 4.3 Individual Drainage Monitoring Programs

266 This last tier of the WRIA 1 LTMP involves future monitoring programs designed and implemented as  
267 drainage-based management units are established. The WRIA 1 LTMP strategy is to develop a  
268 framework for the management units to adopt as their monitoring program. This framework will be  
269 developed as part of the Adaptive Management element of the LTMP.

270

### 271 **Section 5-**

#### 272 **WRIA 1 Long Term Monitoring Program Quality Assurance, Data Management, and** 273 **Reporting**

274 The entities involved in water quality monitoring programs should have Quality Assurance Project  
275 Plans (QAPP) associated with their collection activities. The QAPPs generally include information  
276 describing the project and/or problem the monitoring plan is designed to address, sampling techniques,  
277 analytical methods, quality controls, data management, and data validation/verification. Since all of the  
278 over-arching water quality monitoring stations are stations currently being monitored by an existing  
279 state or federal agency, the WRIA 1 LTMP strategy is to rely on the QAPPs prepared by those entities.

280 The framework developed for monitoring programs that newly established drainage-based management  
281 units can adopt for their drainage, a QAPP template will be recommended such as the U.S.  
282 Environmental Protection Agency funded publication *The Volunteer Monitor's Guide to Quality Assurance*  
283 *Project Plans*.

284 Additional quality assurance and data management considerations will be incorporated into the WRIA 1  
285 LTMP strategy as part of the WRIA 1 ISF/FH Technical Team and WRIA 1 Salmon Recovery Steering  
286 Committee Work Group's approach for developing a Habitat Monitoring Methodology for each  
287 parameter included in their methodology (Appendix A).

### 288 **Section 6 –**

#### 289 **WRIA 1 Long Term Monitoring Strategy Recommendations and Milestones**

290 This section of the WRIA 1 LTMP provides a summary of tasks and recommendations associated with  
291 implementing the WRIA 1 LTMP strategy. Table 3 is a summary of the recommendations, schedule,  
292 and identified lead. The WRIA 1 Detailed Implementation Plan includes additional detail for  
293 implementing the WRIA 1 LTMP Strategy and recommendations.

#### 294 6.1 Data Collection

295 DC1 - Identify a ground water monitoring program that supports the goals and objectives of the  
296 over-arching monitoring needs for the WRIA 1 LTMP (Section 3) and incorporate the program as an  
297 element of the WRIA 1 LTMP strategy.

298 DC2 - Develop a process and associated agreements for including stream temperature and periodic  
299 dissolved oxygen measurements at all gage stations equipped with recorders or telemetry systems as  
300 identified in Table 2. The process should consider coordinating efforts with Environment Canada  
301 for the three gages located on the north side of the U.S./Canada boundary.

302 DC3 – Secure agreements and/or funding for the stream gaging network identified in Table 1 of this  
303 document. Relative to other watersheds, WRIA 1 has a large number of stream gaging stations. The  
304 annual cost to operate, maintain, and publish the results from each gaging station averages  
305 approximately \$12,700<sup>4</sup> bringing the annual cost for the 26<sup>5</sup> gage network to approximately \$330,000.  
306 This stream gaging network is believed to be the minimum amount needed to reliably estimate stream  
307 flow from the numerous other ungaged drainages in WRIA 1. Although the annual cost is relatively  
308 high, it may be a necessary annual expense in order to support knowledge-based decision making.

309 DC4 – Correlate the existing gaging stations with each other over a range of flow conditions over the  
310 next two years. In addition, short-term (preferably one year duration) measurements should be  
311 conducted at ungaged drainages to establish correlations with existing stations. If certain gaging  
312 stations are found to be highly correlated with other gaging stations, it may be possible to reduce the  
313 annual cost associated with the 26 gaging station network in DC3.

314 DC5 - Secure agreements and/or funding for water quality monitoring of a full range of parameters  
315 at Ecology Station ID Nos. 01N060, 01U070, 01P080, 01A140, 01G070, and 01F070 (Table 2). Five  
316 of the six stations are currently being monitored (10/06-9/07) under Ecology's 5-year rotating  
317 sampling program (refer to *Water Quality*, Section 4.1).

318 DC6 - Develop a general framework for a drainage-based monitoring program that can be adopted  
319 by newly established drainage-based management units.

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<sup>4</sup> USGS and EAP have different annual for their gages and publish results differently. This annual cost is an average of the total estimated annual cost of \$330,000 divided by the total number of gages in the US regardless of the gage's sponsor. Costs associated with the three Environment Canada gages are not included.

<sup>5</sup> This does not include the three gage stations located at the U.S./Canada border operated by Environment Canada. These three border gage stations, however, are critical to the overall stream gage network.

320 **Table 3. Summary of Recommendations, Schedule, and Lead**

ID	Recommendation	Schedule	Lead
DC1	Identify groundwater monitoring program that addresses over-arching goals and objectives identified in Section 3.0.	Q1/08	WRIA 1 Staff Team
DC2	Establish agreements and/or funding for stream temperature and periodic dissolved oxygen measurements at flow stations.	Q4/07- Establish agreements with USGS and/or EAP	WRIA 1 Staff Team
DC3	Secure agreements and/or funding for the stream gaging network identified in Table 1.	Q2/08	WRIA 1 Staff Team
DC4	Correlate the existing gaging stations over a range of flow conditions. Conduct short-term (preferably one year duration) measurements at ungaged drainages to establish correlations with existing stations.	Q1/08- Initiate two-year effort to correlate gage stations. Q1/08- Initiate one-year data collection effort at ungaged drainages.	WRIA 1 Staff Team
DC5	Establish agreements and/or funding for water quality monitoring stations.	Q4/07- Establish agreement with EAP, Ecology-NFO, Tribes, and/or other	WRIA 1 Staff Team
DC6	Develop general framework for drainage-based monitoring programs.	Q1/08	WRIA 1 Staff Team
DC7	Incorporate elements of Habitat Monitoring Methodology into the WRIA 1 LTMP strategy.	Q4/07 – Review parameter monitoring methodologies developed as part of the overall Habitat Monitoring Methodology Q1/08 – Incorporate relevant methodologies into WRIA 1 LTMP strategy	WRIA 1 Staff Team
DC8	Coordinate with entities implementing complementary programs to obtain program information for incorporation into the WRIA 1 LTMP strategy including maps with station location and program goals and objectives.	Q3/07 - Initiate contact with leads of complementary programs; incorporate relevant detail into WRIA 1 LTMP strategy	WRIA 1 Staff Team
DM1	Identify centralized system for managing data at stations identified in the over-arching monitoring program.	Q4/07- evaluate DSS data management system and framework for purposes of a centralized system for data management Q1/08- collaborate with entities involved with data collection to agree on system Q2/08- develop necessary agreements to implement centralized data management system	Whatcom County- Public Works (Data Manager)
DM2	Collaborate with entities implementing complementary programs for purposes of incorporating data into the WRIA 1 data management system.	Q2/08- identify format and process	WRIA 1 Staff Team
DM3	Identify format for Ecology’s metered water use reporting.	Q3/07- identify format	Dept. of Ecology-NFO
DA1	Establish process for analyzing data collected under WRIA 1 LTMP to evaluate extent to which the goals and objectives in Section 3 are being addressed and, based on analysis, making recommendations for program modifications to be considered as part of Adaptive Management.	Q4/07- Identify process for analyzing data and evaluating effectiveness in meeting goals/objectives	WRIA 1 Staff Team

321

322 DC7 - Review outcomes and recommendations included in the WRIA 1 ISF/FH Technical Team  
323 and the WRIA 1 Salmon Recovery Steering Committee Work Group's Habitat Monitoring  
324 Methodology scheduled for completion July 2007. Identify mechanism or next steps  
325 for incorporating applicable elements of the Habitat Monitoring Methodology and associated  
326 recommendations into the WRIA 1 LTMP strategy.

327 DC8 - Coordinate with entities involved in implementing complementary programs to identify  
328 additional monitoring needs such as temperature recorder at a downstream location on the Middle  
329 Fork, to obtain additional information on their programs such as current maps of active sampling  
330 locations, and duration of monitoring resource commitment for the complementary program.

331

## 332 6.2 Data Management

333 DM1 - Identify a centralized system for managing data collected at stations identified in the  
334 overarching monitoring program of the WRIA 1 LTMP strategy. As part of the data management  
335 system, consider approaches that involve interactive linkages to a GIS mapping system that will  
336 reflect changes, modifications, and data. Provide a clear linkage in the data management system to  
337 the process that will be used to update the WRIA 1 DSS and its underlying models. As part of a  
338 centralized data management system, consideration should also be given to a web-based tool for  
339 communicating and coordinating data and related information between agencies, and that can be used  
340 to support public outreach and education.

341 DM2 - Collaborate with entities implementing complementary monitoring programs to incorporate  
342 data into WRIA 1 Decision Support System data management system.

343 DM3 - Coordinate with Department of Ecology to identify a format for Ecology to use in WRIA 1 to  
344 report the metered water use data that Ecology is currently required to collect.

345

## 346 6.3 Data Analysis

347 DA1 - Establish a process for conducting local analysis of data for purpose of evaluating extent to  
348 which the goals and objectives identified in Section 3 are being addressed by the WRIA 1 LTMP.  
349 When appropriate, as part of the analysis recommendations should be made for modifications to the  
350 WRIA 1 LTMP strategy for consideration in Adaptive Management.

351

## 352 **Section 7–**

### 353 **WRIA 1 Long Term Monitoring Program Adaptive Management**

354 The WRIA 1 LTMP adaptive management approach is designed to incorporate monitoring results from  
355 programs identified in the LTMP strategy back into the decision-making process in a manner consistent  
356 with the overall adaptive management approach described in the June 2005 WRIA 1 Watershed  
357 Management Plan. Ensuring monitoring results are appropriately influencing or being incorporated

358 into management programs requires consistent dedication of resources including staff and funding.  
359 The steps associated with the WRIA 1 LTMP adaptive management approach, which will run  
360 concurrent with the WRIA 1 LTMP strategy implementation, include:

- 361 1. Evaluate monitoring data associated with the over-arching monitoring element of the WRIA  
362 1 LTMP strategy and assess extent to which the goals and objectives identified in Section 3.0  
363 have been achieved;
- 364 2. Evaluate monitoring data associated with complementary programs;
- 365 3. Evaluate status of implementing WRIA 1 LTMP recommendations in Section 6.0;
- 366 4. Evaluate status of funding to support implementation of WRIA 1 LTMP strategy;
- 367 5. Assess outcome of evaluations identified in numbers 1-4 and determine appropriate adaptive  
368 management options;
- 369 6. Implement the appropriate adaptive management action consistent with the adaptive  
370 management approach described in the WRIA 1 Watershed Management Plan; and
- 371 7. Monitor the effects of the adaptive management actions.

372 As part of the adaptive management process, a project team involved with coordinating  
373 implementation of the WRIA 1 Watershed Management Plan will initiate the process for implementing  
374 the steps outlined above. The process taken will be consistent with organizational procedures identified  
375 for the WRIA 1 Watershed Management Project.