Recommendations

Miller and Walker Creeks Basin Monitoring Coordination

Final June 29, 2009

Overview

This document presents recommendations on future monitoring in the Miller and Walker Creeks Basin in southwest King County, Washington.

Monitoring recommendations cover:

- Water quantity (flow)
- Water quality
- Biological indicators and habitat

The approach to monitoring includes prioritization within these three categories.

The recommendations also include suggestions of where monitoring should occur (sampling locations).

This list of recommendations concludes with next steps, including development of a proposed quality assurance project plan (QAPP).

Purpose

These recommendations are an intermediate step in carrying out **Recommendation 5: Basin Monitoring** (page 5-4) from the "Miller and Walker Creeks Basin Plan – Executive Proposed" (February 2006), which stated:

> An ongoing basin monitoring program should be initiated that will allow for trend analysis of flow, water quality, and habitat data. The flow data to be collected should include precipitation and stream gauge information sufficient to assess trends in high and low flows and erosive work, and to evaluate the effectiveness of capital projects and regulations. Water quality data to be collected should include data sufficient to conduct trend analysis of conventional water quality parameters, including hardness and temperature; metals; nutrients; and organics. Habitat data to be collected should include spawner surveys and B-IBI data sufficient to determine biological trends in the Basin. Specific parameters to be measured, sampling locations, and sampling frequencies will need to be more fully developed as part of a sampling and analysis plan. Automated sampling should be used to the extent practicable. Estimated cost: $50,000 annual combined costs for both Miller Creek and Walker Creek.

While the Basin Plan has not yet been approved, the Project Management Team agreed in 2007 that the recommendation above should be undertaken. Consequently, a first step – identifying goals and developing a coordinated basin monitoring program – was included in the workplan for the King County basin steward hired through the 2008-2009 interlocal agreement.

Basin monitoring coordination under the interlocal agreement is being performed in two phases:

- Phase I: Goal-setting and coordination
- Phase II: Developing a quality assurance project plan for future monitoring

This recommendations report summarizes and concludes Phase I.

The next step is for the Project Management Team to review this report and decide whether to authorize moving forward with Phase II, developing a quality assurance project plan (QAPP) for monitoring.

Recommendations

Source of the Recommendations
Interested residents in the basin and city/agency staff worked together on an Ad Hoc Advisory Committee in late 2008 to develop most of these recommendations. Appendix A describes the nature, membership, and process of the Ad Hoc Advisory Committee.

Additional recommendations were developed by King County staff Dennis Clark and Dean Wilson, King County water quality scientist based on their knowledge of the basin and best professional judgment.

Recommendation #1: Monitoring Should Focus on Answering Questions Important in the Miller/Walker Creek Basin

It is vital to determine at the outset *why* a given parameter is being monitored to ensure that the monitoring program is designed properly (to answer the right question) and avoid wasting time and money collecting data that cannot or will not be used.

The following list sets forth the question(s) that monitoring is intended to answer. These questions would be used to design the quality assurance project plan if Phase II is approved.

Flow-Related Questions

Flow: Are flow volumes adversely affecting beneficial uses? Are peak flows and low flows a problem in Miller and/or Walker Creek? Are management actions in the basins improving the flow regime? Where do stormwater volumes originate in the Miller Creek basin? Is there a low flow problem in Miller Creek and/or Walker Creek?

Stormwater Origin: Where do stormwater volumes originate in the Miller Creek basin?

Erosion and Sedimentation: Are there erosion and sedimentation problems? If so, where are the significant areas?

Water Quality-Related Questions

Temperature: Are water (e.g., streams and wetlands) temperatures supporting aquatic life? Are management actions in the basins improving the temperature regime?

Conductivity, Turbidity, Dissolved Oxygen, and pH: Are water conductivity, turbidity, dissolved oxygen, and pH during storm events and base flow conditions supporting aquatic life? Are management actions in the basins improving the water conductivity, turbidity, dissolved oxygen, and pH parameters?

Metals: Are metals (e.g., copper, lead, zinc, etc. in association with dissolved ions [hardness]) concentrations affecting aquatic life? Are management actions in the basins improving metals concentrations?

Nutrients: Are nutrient (e.g., nitrogen, phosphorous) levels supporting aquatic life? Are management actions in the basins improving nutrient conditions?

Organics: Are organic contaminants (e.g., hydrocarbons, phthalates, endocrine disruptors, surfactants) affecting aquatic life?

Bacteria: Are bacteria (e.g., fecal coliform) levels safe for human bathing in Walker Creek? If not, where are the bacteria originating from?

Pesticides: Are pesticides affecting aquatic life?

Toxicity: Is water quality toxic to aquatic life?

Biological Indicators and Habitat Questions

Adult Fish Returns: What are the adult fish returns? Is coho pre-spawn mortality a problem? What is origin of adult fish?

Benthic Index of Biotic Integrity (BIBI): Are management actions in the basins improving aquatic food web productivity/diversity?

Juvenile Fish (Coho) Presence and Numbers: Where are juvenile fish (coho) abundant? What is the productivity of stream?

Juvenile Fish Outmigrant Numbers: What are juvenile outmigrant fish numbers (coho and chum)?

In-stream Physical Habitat Structure: Are management actions in the basins improving physical habitat features including pools, riffles, and large wood?

Riparian Terrestrial Vegetation: Are management actions in the basins improving riparian terrestrial vegetation (e.g., percent shade cover, invasive species abundance)?

Recommendation #2: Monitoring Focused on "Vital Signs" Should Be the Initial Priority

To prioritize the list of parameters that could be monitored, the Ad Hoc Advisory Committee eventually agreed to categorize parameters into two categories:

First Priority

1) Monitoring focused on "vital signs" of stream and watershed ecosystem health. These vital signs are monitored to understand status and/or trends in the watershed. This monitoring would be continuous (as in the case of flow) or annual (as in the case of adult fish return counts). These parameters – listed in no particular order – are:

   - Flow
   - Temperature
   - Conductivity, turbidity, dissolved oxygen, and pH (these are grouped because they are relatively easy to collect simultaneously)
   - Benthic Index of Biotic Integrity (BIBI)
   - Adult fish return numbers
   - Juvenile fish (coho) presence and numbers
   - Juvenile fish outmigrant numbers

   See also Appendix B discussion on fish monitoring.

Second Priority

2) Monitoring to "diagnose" known or suspected problems in the streams and basins. This monitoring would likely be episodic, occurring one-time or at intervals of a year or more. For example, if metals were found to be affecting aquatic life in the stream, a "diagnostic" study could be designed to determine the most likely source or sources of metals. These "diagnostic" studies would be a step in the source(s) control of a particular contaminant or stressor. These parameters are grouped by topic and *prioritized in descending order <u>within</u> each of the three topics below*:

   - Flow-related
     1. Origin of stormwater
     2. Erosion and sedimentation problems

     Presented in *descending* order of priority
   - Water quality-related
     1. Metals
     2. Nutrients
     3. Organics
     4. Bacteria
     5. Pesticides
     6. Toxicity

     Presented in *descending* order of priority

- Biological Indicators and Habitat (listed below *in descending order*)
  1. In-stream physical habitat structure
  2. Riparian terrestrial vegetation

  — Presented in *descending* order of priority

Monitoring of the so-called "vital signs" – the first category – should be the initial focus of future monitoring. Taking the "vitals" of the "stream patient" consistently over the long term will:

- Provide information on the most important indicators of stream health
- Ensure uninterrupted data series for flow, which is probably the single most important element of stream health in this basin
- Potentially provide early warning of new or unexpected problems

Several "vital sign" parameters can be collected at relatively low cost. These parameters include temperature, conductivity, turbidity, dissolved oxygen, and pH. Several other parameters – adult fish returns and Benthic Index of Biotic Integrity – may also be collected at relatively low cost if volunteers do much of the field work.

Taken together over the long run, the "vital signs" and "diagnostic tools" monitoring should:

- Reveal trends in aquatic ecosystem health,
- Indicate whether management actions are having a positive effect on aquatic ecosystem health, and
- Diagnose the nature, origin, and degree of problems in the basin, thereby informing management actions on the best, most cost effective ways to restore stream ecosystem health.

Recommendation #3: Flow and Water Quality Monitoring Should Occur at Specific Locations

Monitoring locations may vary somewhat depending on parameters but consistent use of the following locations will maximize the value of the resulting data for flow, water quality, and some biological and habitat parameters. See **Table 1: Miller and Walker Creek Recommended Monitoring Locations for Recommended Parameters**. This list is provisional and may be revised during the development of the quality assurance project plan (QAPP).

Recommendation #4: Monitoring Should be Explicitly Linked to the Use of the Data

Monitoring should be explicitly linked to its intended use. Critical to doing this is identifying the links between parameters, sampling design, analysis, and use of data. Failure to make a strong link can result in wasted effort and money.

Table 2 identifies the intended use of each parameter. The quality assurance project plan (QAPP) would further develop the sampling design, analysis, and use of data.

Table 2: Intended Use of Monitoring Results

#	Parameter	Nature of Data Collection	Possible Uses of Monitoring Results
"Vital Signs" (not in priority order)			
1	Flow	Continuously collected Collected at six locations on Miller Creek Collected at two locations on Walker Creek	▪ Evaluate progress made toward Basin Plan Objective 1 (Reduce current high flows) ▪ Identify areas where additional detention/low impact development (LID) would benefit the stream ▪ Allow the calculation of pollutant loads ▪ Detect low flow problems
2	Stream temperature	Continuously collected Collected at five locations on Miller Creek Collected at two locations on Walker Creek	▪ Monitor overall trends ▪ Identify areas where temperature may be a factor of decline for salmonids
3	Conductivity, turbidity, dissolved oxygen, and pH	Collected at five locations on Miller Creek Collected at two locations on Walker Creek	▪ Monitor overall trends ▪ Identify areas where conductivity, turbidity, DO, and/or pH may be a factor of decline for salmonids
4	Benthic Index of Biotic Integrity	Collected at four locations on Miller Creek Collected at two locations on Walker Creek	▪ Assess status of fish prey species and lower food web ▪ Monitor overall trend in ecological health ▪ Provides measure of intermediate progress toward Basin Plan Objective 3 (Increase salmon numbers)
5	Adult fish return numbers	Monitored annually in October-December	▪ Assess status of fish health ▪ Evaluate progress made toward Basin Plan Objective 3
6	Juvenile fish (coho) presence and numbers*	Monitored episodically in summer	▪ Assess status of coho productivity ▪ Evaluate progress made toward Basin Plan Objective 3
7	Juvenile fish outmigrant numbers*	Monitored in spring	▪ Assess status of fish productivity ▪ Evaluate progress made toward Basin Plan Objective 3

*See also Appendix B for further discussion on monitoring of juvenile fish numbers.

#	Parameter	Nature of Data Collection	Possible Uses of Monitoring Results
	"Diagnostic" Monitoring		
	Flow-related (parameters below listed in *descending priority*)		
8	Origin of stormwater	Episodic survey of principal tributaries and outfalls	▪ Evaluate progress made toward Basin Plan Objective 1 ▪ If flow is determined to be a problem, identify areas or situations causing the greatest harm. Also identify opportunities to cost-effectively manage any identified problems. ▪ Allow the calculation of pollutant loading when combined with water quality testing
9	Erosion and sedimentation problems	Episodic survey	▪ Evaluate progress made toward Basin Plan Objective 1 ▪ Identify the areas or situations causing the greatest erosion. Also identify opportunities to cost-effectively manage any identified problems.
	Water quality-related (parameters below listed in *descending priority*)		
10	Metals including copper, lead, and zinc	Episodic study of principal tributaries and outfalls	▪ Evaluate progress made toward Basin Plan Objective 2 (Reduce zinc and total suspended solids) ▪ Identify sources of metals ▪ Identify opportunities to cost-effectively manage any identified problems
11	Nutrients	Episodic study	▪ Identify problems and source of nutrients ▪ Identify opportunities to cost-effectively manage any identified problems
12	Organics	Episodic study	▪ Identify problems ▪ Identify opportunities to cost-effectively manage any identified problems

#	Parameter	Nature of Data Collection	Possible Uses of Monitoring Results
13	Bacteria	Episodic study	▪ Identify problems potentially affecting human health at the Cove and Normandy Park Swim Club ▪ Identify opportunities to cost-effectively manage any identified problems
13	Pesticides	Episodic study	▪ Identify problems ▪ Identify sources
14	Toxicity	Episodic study	▪ Identify problems
	Biological Indicators and Habitat (parameters below listed in *descending priority*)		
15	In-stream physical habitat structure	Episodic study	▪ Provides measure of intermediate progress toward Basin Plan Objective 3 ▪ Identify the areas or situations causing problems. Also identify opportunities to cost-effectively manage any identified problems.
16	Riparian terrestrial vegetation	Episodic study	▪ Provides measure of intermediate progress toward Basin Plan Objective 3 ▪ Identify the areas or situations causing problems. Also identify opportunities to cost-effectively manage any identified problems.

Recommendation #5: Future Monitoring Should Continue Past/Current Monitoring Where Practical and Desirable

There is significant monitoring on-going in the basin, much of which probably can and should be continued from the perspective of better management of basin ecosystem health. **Table 3: Miller and Walker Creeks Water Quality/Quantity Parameters Monitored to Date** lists parameters, who monitors them, and duration of data collection.

(Some current monitoring is required by permit and thus will continue in its current form for the duration of the permits regardless of the recommendations in this document or the quality assurance project plan.)

The quality assurance project plan should identify:

- Past/current monitoring that should be renewed/continued
- Past/current monitoring that should be modified
- Current monitoring that could be terminated (possibly freeing resources for other, higher priority monitoring)

Recommendation #6: Identify Monitoring Suitable for Volunteer Participation

Monitoring tasks where volunteers can help should be identified. These tasks are likely to be data collection/field work tasks.

Use of volunteers can provide the following benefits:

- Less costly data collection
- More timely data collection where volunteers live on the stream (for example, they can respond quickly to storm events)
- Perspective and historical knowledge that provides context
- A means of educating the broader public as volunteers share their experiences with their friends and neighbors

To be effective, use of volunteers in monitoring should:

- Include training to ensure an adequate level of quality assurance/quality control (QA/QC) is met during data collection
- Focus on tasks that meet the interests and abilities of volunteers
- Include redundancy or backup to ensure data are collected even if individual volunteers do not follow through

Ways in which volunteers could help with monitoring in this basin include:

- Measuring in-stream physical habitat structure (volunteers have done this in 1993 and 2008 in this basin; note, however, that they have used a U.S. Forest Service method of analysis, which may differ from the common U.S. EPA protocol)
- Benthic Index of Biotic Integrity sample collection (volunteers already collect insect samples at three locations at the Cove in Normandy Park and have them analyzed)
- Adult fish counting (volunteers already do this informally in this basin and results have been included in several King County Streamwatchers annual reports)
- Fry/smolt counts
- Monitoring relative flows by tracking changes in water elevation at culverts where a staff plate or other measuring instrument has been installed
- Quantitative water quality monitoring where volunteers have necessary training and equipment
    - Possibility: Veterans Conservation Corps using equipment at Green River Community College to measure conductivity, turbidity, DO, etc.
    - Possibility: Turbidity using turbidity meters stored at the Cove clubhouse

Participation of volunteers may not substantially reduce the cost of monitoring. Volunteers still require training and management. High priority data collection may require "backup" and/or QA/QC assistance from professionals. Data management typically requires professional labor.

Recommendation #7: Track Studies/Monitoring Results in Comparable Streams for Parameters Not Monitored in Miller/Walker Creeks

Monitoring results in similar streams for those parameters not monitored in Miller/Walker Creeks should be tracked and assessed for their applicability to Miller and Walker Creeks. Given that resource limitations make it unlikely that all parameters listed above in Recommendation #1 will be monitored, surrogate results from other basins may be used instead. For example, Longfellow Creek in West Seattle, which is similar to Miller and Walker Creeks in size and degree of urbanization, is undergoing extensive study of pre-spawn mortality of adult coho salmon. Results of these studies may provide sufficient information to guide management actions without requiring replicating the studies in Miller/Walker Creeks. If, for example, the Longfellow Creek research revealed the causes of pre-spawn mortality to be pollutants that are likely to be Miller/Walker Creeks, efforts to solve the problems could be undertaken without extensive monitoring. Similarly, if studies in other comparable basins revealed common trends in, say, organic pollutants, these results could be extrapolated to Miller/Walker Creeks.

This surrogate approach to monitoring is likely to work only for assessing general status and trends that affect aquatic ecosystem health on a region-wide scale. This surrogate approach is not suitable for monitoring that attempts to measure whether specific management actions within Miller or Walker creeks are having a positive effect on aquatic ecosystem health.

Resources and Contributions Supporting On-Going Monitoring

The costs and other resource needs of monitoring will be developed as part of the quality assurance project plan.

In the meantime, it is important to recognize the principal financial resources and other contributions supporting current monitoring. Recognizing these resources will enable the partners to make the case – if necessary – for their continuance to support high-priority monitoring efforts.

The main funding sources or in-kind contributions that support on-going monitoring at present include:

- Rain gauge at Lake Reba operated by the Port of Seattle
- Flow monitoring and water temperature: Port of Seattle funding to King County for operation of five stream gauges (42a, 42b, 42e, 42j, 42k) costing $____ per year through 2012
- Flow monitoring and water temperature: Port of Seattle funding to consultant for operation Miller Creek at Lake Reba gauge costing $____ per year through 2012
- Biochemical oxygen demand, pH, total petroleum hydrocarbons, total suspended solids, hardness, copper, lead, and zinc: data collected at four outfalls to Lake Reba (SDN1,

SDN2, SDN3, SDN4) by Port of Seattle as required under NPDES stormwater discharge permit (likely required in perpetuity)

- Dissolved oxygen, fecal coliform, pH, and water temperature: data collected on Miller Creek at sewer plant collected weekly by Southwest Suburban Sewer District and costing $____.
- In-situ sublethal toxicity monitoring: monitoring is conducted by the Port of Seattle as required under NPDES stormwater discharge permit through ___ [insert year]
- Benthic Index of Biotic Integrity (BIBI) sampling on Miller Creek at S. 160th St. by Port of Seattle: data collected annually through ___ [insert year] and costing $___ per year sampled
- Fish use surveys on Miller Creek (SeaTac International Airport property only) by Port of Seattle: data collected annually through ___ [insert year] and costing $___ per year sampled
- Stream habitat surveys on Miller and Walker Creeks (SeaTac International Airport property only) by Port of Seattle: data collected annually through ___ [insert year] and costing $___ per year sampled

Monitoring by the Port of Seattle largely is required under NPDES stormwater, third runway Section 401 Clean Water Act, and Section 404 Clean Water Act permits. Funding is expected to be guaranteed during the time period required under the permits.

Developing a Quality Assurance Project Plan for Monitoring

If the Project Management Team authorizes its production, a monitoring quality assurance project plan (QAPP) will be developed.

Deliverables

The quality assurance project plan will be prepared in accordance with State Department of Ecology "Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies" (http://www.ecy.wa.gov/pubs/0403030.pdf), unless the parties jointly determine otherwise, and should address:

- Project description
- Organization and schedule
- Quality objectives
- Sampling process design
- Sampling procedures
- Measurement procedures
- Quality control
- Data management procedures
- Data verification and validity
- Data quality (usability) assessment
- Quality assurance/quality control
- Estimated costs

Technical staff from King County Water and Land Resource Division will draft the quality assurance project plan. The draft plan will be shared with interested parties and citizens before it is finalized.

Detailed Schedule

2009	
September - November	Develop the quality assurance project plan
December	Draft quality assurance project plan distributed for review
2010	
January	Organize and facilitate one meeting of the Ad Hoc Advisory Committee to provide comments on draft quality assurance project plan Summarize meeting
February	Quality assurance project plan is revised
March	Quality assurance project plan is delivered

Appendix A: Overview and Participants in the Ad Hoc Committee on Monitoring Coordination

Purpose and Membership of the Ad Hoc Committee on Monitoring Coordination

The purpose of the committee and the workshops was to help develop a coordinated basin monitoring program as requested by the Miller/Walker Project Management Team, which is made up of the Cities of Burien, Normandy Park, and SeaTac; King County; the Port of Seattle; and the Washington State Department of Transportation.

Three workshops occurred in autumn 2008. Discussions at each workshop built on the results of the preceding workshop.

Because of the sustained nature of this effort and the complexity of the topic, Dennis asked participants to consider themselves an ad hoc committee and strive to participate in the subsequent workshops. Membership/participation was open to any participants interested in the topic and willing to work together on the task. Private citizens and city/agency staff participated in all three workshops.

Further information on the nature, purpose, membership, and groundrules of the ad hoc committee can be found in the meeting handout titled "Nature, Purpose, Membership, and Proposed Groundrules of Ad Hoc Committee for Basin Monitoring Coordination and Development." This handout is available at the Miller/Walker Creek website (http://www.kingcounty.gov/environment/watersheds/central-puget-sound/miller-walker-creeks/monitoring.aspx).

Participants

Workshop #1, September 24, 2008 at Burien Community Center

Name	Affiliation/Interest
Kevin Alexander	Burien resident
Jim Burrows	
Dennis Clark	Miller/Walker Creek Basin Steward
Myron Clinton	City of Burien
Noah Davis	City of Normandy Park
Bob Duffner	Port of Seattle
Dave Evans	
Brett Fish	Normandy Park property owner
Dave Garland	Washington State Department of Ecology
Tom Gut	City of SeaTac
Heungkook Lim	City of Burien
John Muramatsu	Trout Unlimited/Stewards of the Cove

Nikki Olson	RH2 Consultants on behalf of ValVue Sewer District
Jim Pitts	Normandy Park resident
Darrell Williams	Environmental Science Center
Dean Wilson	King County Water and Land Resources Division

Workshop #2, October 29, 2008 at Normandy Park City Hall

Name	Affiliation/Interest
Kevin Alexander	Burien resident
Andy Batcho	Trout Unlimited/Stewards of the Cove
Jim Burrows	
Dennis Clark	Miller/Walker Creek Basin Steward
Bob Duffner	Port of Seattle
Dave Evans	
Brett Fish	Normandy Park property owner
Heungkook Lim	City of Burien
Jim Pitts	Normandy Park resident
Jean Spohn	Burien resident
Dean Wilson	King County Water and Land Resources Division
Greg Wingard	

Workshop #3, December 4, 2008 at ERAC Building in Burien

Name	Affiliation/Interest
Kevin Alexander	Burien resident
Andy Batcho	Trout Unlimited/Stewards of the Cove
Dennis Clark	Miller/Walker Creek Basin Steward
Noah Davis	City of Normandy Park
Dave Evans	
Brett Fish	Normandy Park property owner
George Hadley	City of Normandy Park Councilmember
Joy Neubauer	Burien resident
Roger Neubauer	Burien resident
Jim Pitts	Normandy Park resident
Dean Wilson	King County Water and Land Resources Division
Greg Wingard	
Marion Yoshino	City of Normandy Park Councilmember

Dennis Clark, the Miller and Walker Creek Basin Steward, facilitated the workshops. Dean Wilson participated as a technical resource to the ad hoc committee and did not provide policy input on behalf of King County.

Timeline

The schedule for the monitoring coordination effort by the ad hoc committee and other future steps:

September 24, 2008	Workshop #1
	Summarize results Conduct research as needed to prepare for Workshop #2
October 29, 2008	Workshop #2
	Summarize results Conduct research as needed to prepare for Workshop #3
December 4, 2008	Workshop #3
2009	Prepare summary/recommendations
June 2009	Public review of draft summary/recommendations
June 2009	Finalize
September 2009	DECISION POINT: Project Management Team decides on whether to proceed with quality assurance project plan (QAPP) for new monitoring and/or develops recommendations for sustaining/coordinating existing monitoring
Winter 2010	Workshop #4
	QAPP approved by Project Management Team
	Funding lined up
2011	New/expanded monitoring begins?

Appendix B: Discussion of Juvenile Fish Number Monitoring

Due to the high level of interest among the public in monitoring of fish numbers, an overview of one aspect of this topic – monitoring juvenile fish numbers -- is presented here. Further discussion will be required in the quality assurance project plan (QAPP).

There are two principal types of juvenile fish monitoring

- Juvenile fish presence and numbers
- Juvenile fish outmigrant numbers

Each requires its own sampling protocols and each can answer different questions.

At the outset of the monitoring program, it is vital to identify which questions the monitoring is intended to answer. Possible objectives of monitoring include seeking information about a given species such as:

- Estimated abundance
- Spatial distribution
- Species richness
- Size distribution
- Some combination of variables

In addition, answers to the following questions will shape the cost, time, and robustness of results of the monitoring program:

- Status versus trends?
- What is magnitude of the change I am interested in detecting?
- How soon do I need an answer?