King County

1200 King County Courthouse
516 Third Avenue
Seattle, WA 98104

# KING COUNTY

## Signature Report

**December 3, 2013**

**Motion 14010**

**Proposed No.** 2013-0401.1 **Sponsors** Phillips

A MOTION acknowledging receipt of a report on King County's water quality monitoring program in accordance with Budget Ordinance 17476, Section 114, Proviso P1.

WHEREAS, the King County council adopted Budget Ordinance 17476, Section 114, Proviso P1, which provided for a $150,000 expenditure restriction until the executive transmits a report to the council on King County's water quality monitoring program and a motion that acknowledges receipt of the report, and

WHEREAS, the executive has transmitted to the council with this motion the report on King County's water quality monitoring program called for in the proviso, and

WHEREAS, the report on the water quality monitoring program builds upon the 2012 Report on King County's Water Quality Monitoring Program, and

WHEREAS, the report provides additional information, analysis and recommendations regarding current and proposed water quality monitoring activities as part of an overall strategic response to changing regulatory issues, public health concerns, liability management issues, potential upland application of reclaimed water, emerging overlaps and synergy with stormwater National Pollution Discharge Elimination System permit requirements for water quality testing and monitoring and opportunities for coordination with cities, including cost sharing;

NOW, THEREFORE, BE IT MOVED by the Council of King County:

Receipt of the water quality monitoring program report prepared in accordance with Budget Ordinance 17476, Section 114, Proviso P1, Attachment A to this motion, is hereby acknowledged.

Motion 14010 was introduced on and passed by the Metropolitan King County Council on 12/2/2013, by the following vote:

Yes: 9 - Mr. Phillips, Mr. von Reichbauer, Mr. Gossett, Ms. Hague, Ms. Patterson, Ms. Lambert, Mr. Dunn, Mr. McDermott and Mr. Dembowski
No: 0
Excused: 0

KING COUNTY COUNCIL
KING COUNTY, WASHINGTON

Larry Gossett, Chair

ATTEST:

Anne Noris, Clerk of the Council

**Attachments:** A. 2013 Report on King County's Water Quality Monitoring Program

King County

# 2013 Report on King County's Water Quality Monitoring Program

July 18, 2013

**King County**

Department of Natural Resources and Parks

**Wastewater Treatment Division**

Alternate Formats Available

206-296-7380 TTY Relay: 711

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# Exhibit A

Potential Water Quality Monitoring Activities

# EXECUTIVE SUMMARY

This report responds to a proviso in the 2013 King County Budget (Ordinance 17476, Section 114, Proviso P1) calling for the Wastewater Treatment Division (WTD) of the Department of Natural Resources and Parks (DNRP) to conduct a strategic assessment of King County's water quality monitoring program and make potential recommendations for modifications to this program. This report builds on the 2012 Report on King County's Water Quality Monitoring Program.

King County maintains a robust and diverse water quality monitoring program, funded through multiple sources. The 2012 report was limited to WTD's monitoring activities. It described comprehensive reviews in 2008 and 2010 of WTD's water quality monitoring program to focus on the collection of the highest priority information. The WTD-funded portion of the program was expanded in 2013 to include several of the prioritized activities proposed in the 2012 report.

This report describes the breadth of King County's monitoring activities, and emerging issues that affect monitoring activity. It was developed by an inter-agency team consisting of representatives from WTD and the Water and Lands Resources Division (WLRD) of DNRP and Public Health – Seattle &King County(Public Health), with input from staff from the King County Council and several cities in King County. Based on this review of countywide water quality monitoring programs, needs, and issues, an update of the 2012 list of water quality monitoring activities is presented along with a list of newly identified countywide monitoring activities as future potential expansion options.

# 1.0. INTRODUCTION

This report responds to a proviso in 2013 King County budget ordinance 17476, Section 114, Proviso P1, requiring the WTD to provide a report that:

> *..."build(s) upon the 2012 Report on King County's Water Quality Monitoring Program by providing additional information, analysis and recommendations regarding current and proposed water quality monitoring activities as part of an overall strategic response to*
>
> - *changing regulatory issues,*
> - *public health concerns,*
> - *liability management issues,*
> - *potential upland application of reclaimed water,*
> - *emerging overlaps and synergy with stormwater National Pollution Discharge Elimination System permit requirements for water quality testing and monitoring, and*
> - *opportunities for coordination with cities, including cost-sharing.*
>
> *The executive shall form an interdepartmental work group that will work in consultation with council staff to produce the report that is called for in this proviso. The work group shall be comprised of staff from the wastewater treatment division, water and land resources division, including the stormwater services section, the Seattle-King County department of public health, and others the executive deems appropriate."*

King County performs water quality-related sampling, laboratory analysis, reporting, and other monitoring activities for a wide variety of purposes, using a range of funding sources. This report describes these water quality monitoring activities and evaluates them as requested in the proviso.

For this report, King County's water quality monitoring program is defined as ongoing work, funded with operating and/or long-term grant funds, that assesses the amount of water; quality of water and sediment; and health of aquatic organisms in King County's streams, rivers, lakes, groundwater, estuaries, and portions of Puget Sound bordering King County.

Related activities King County undertakes that are not encompassed in this definition, and therefore not addressed in this report, include:

- Monitoring conducted within the wastewater collection and treatment system, at open and closed landfills, or within the stormwater conveyance and treatment system
- Project-specific monitoring conducted in association with capital project construction to meet design, permit, or effectiveness-assessment requirements
- Monitoring conducted under contract for other organizations, agencies, or jurisdictions
- Monitoring funded via short-term grants from other organizations or agencies for a temporary project-specific purpose.

The remainder of this introductory section briefly describes the process used to develop this report and provides a summary of the 2012 proviso report that preceded and was referenced in this proviso request. The report then outlines the components of King County's monitoring

program by funding source. Separate sections describe emerging issues that may influence King County's monitoring program and describe opportunities for increased collaboration and cost-sharing with other jurisdictions.

## 1.1 Process used in Preparing this Report

The report was prepared by an interdepartmental team consisting of staff from WLRD and WTD within DNRP, and Public Health. As requested, the team obtained input from King County Council staff on the report's content. In addition, input was obtained from the cities of Auburn, Bellevue, Covington, Redmond, Renton, Seattle, and Shoreline. Input was also received from staff from the Washington State Department of Ecology (Ecology) and the United States Geologic Survey (USGS).

## 1.2 Summary of 2012 Report on King County's Water Quality Monitoring Program

As required by 2012 King County budget ordinance 17232, the King County Executive delivered a report titled "Report on King County's Water Quality Monitoring Program" to the King County Council in April 2012. Consistent with proviso requirements, the report focused on WTD's water quality monitoring and analysis activities in receiving waters (surface and ground waters, which are performed by WLRD). The 2012 report did not address any other water quality monitoring undertaken by other county agencies or not funded by WTD.

The 2012 report summarized WTD's ongoing water quality monitoring activities and summarized changes to its water quality monitoring program since 2009. The 2012 report described that, driven by changing programmatic needs and as part of a division-wide effort to reprioritize spending, the WTD water quality monitoring program was reduced by about one-third from $5.6 million in 2008 to $3.7 million in 2011, in a manner that allowed for maintaining the highest priority monitoring activities. The 2012 report supported current monitoring levels as sufficient to meet WTD's needs under the existing budget. In addition, the 2012 report included an appendix with a list of prioritized potential monitoring activities that could be considered in the future, should other funding be made available.

With the adoption of the 2013/2014 budget, funding for the WTD monitoring program was increased by $240,000 per year. This increase funded the top two priorities identified in the list of potential activities from the 2012 report: enhancing quantitative marine phytoplankton monitoring and conducting more extensive surveys of toxic chemicals and their sources in King County waters.

In addition, the King County Council also appropriated an additional$278,000 from the Water Quality Fund (used to fund all WTD's operations, including monitoring, and collected from sewer fees within the WTD service area) to restore certain monitoring activities that had been reduced between 2008 and 2011. These included stream flow and temperature gauging activity; annual tissue chemistry monitoring in Lake Washington; and stream water quality monitoring at 20 stream sites that had been monitored prior to 2009.These activities are currently being implemented.

# 2.0. KING COUNTY'S CURRENT WATER QUALITY MONITORING PROGRAM

King County's current water quality monitoring program consists of several different activities with various sources of funding. Monitoring activities help protect and restore water quality, ensure environmental sustainability, and protect public health and safety. King County conducts different types of water-quality monitoring to provide a variety of types of information about long-term changes over time and short-term issues associated with projects and programs.

As described below, King County also collaborates with other agencies and has designed its monitoring program to help ensure there are no redundancies with monitoring activities conducted by other entities.

The monitoring program has evolved to include a variety of activities to help county agencies understand water quality conditions and identify problems in order to fulfill the King County Strategic Plan goals of safeguarding King County's natural resources and environment and promoting health and human potential. King County routinely evaluates and updates its monitoring programs. This report identifies potential additional monitoring activities and the cost to address these new issues.

King County monitoring program activities are described below by funding source. Except as noted below, all water quality monitoring discussed in this report is conducted by WRLD.

## 2.1 Water Quality Fund

King County's Water Quality Fund, funded by wastewater ratepayers in WTD's service area, supports WTD's monitoring program consisting of seven categories of monitoring activities. As described in the 2012 Report on King County's Water Quality Monitoring Program, these include:

1. Marine water quality monitoring, including routine offshore and nearshore water quality, continuous water quality, and sediment quality in King County's marine waters
2. Lake Union, Lake Washington, and Lake Sammamish water quality monitoring, including routine water quality and continuous water quality
3. Stream water quality monitoring in Water Resource Inventory Areas (WRIAs) 8 (greater Lake Washington watershed) and 9 (Green/Duwamish watershed) and on Vashon Island, including routine water quality, stream benthos (bottom-dwelling organisms), and pollution source identification
4. Stream flow and temperature monitoring in WRIAs 8 and 9
5. Freshwater swimming beach monitoring in WRIAs 8 and 9
6. Toxics and contaminant assessment in fish tissue in Lake Washington and addressing new and emerging contaminants of concern
7. Watershed impact assessment/management support affecting the WTD service area.

In anticipation of future delivery of reclaimed water to the Sammamish River valley, and in accordance with an agreement with the City of Lake Forest Park related to Brightwater, groundwater monitoring is included in the last category.

These monitoring activities which WLRD conducts for WTD are used for a variety of purposes to support WTD's operations and implementation of the Regional Wastewater Services Plan. These monitoring activities occur in WTD's service area (and some upstream headwaters) or marine areas potentially affected by WTD activities.

## 2.2 Surface Water Management Fund

King County's Surface Water Management (SWM) fund, funded by Surface Water Management fees paid by landowners in unincorporated King County, is used to fund four types of water quality monitoring, including:

1. Stream water quality monitoring in the Snoqualmie basin and stream pollution source identification monitoring in unincorporated King County
2. Stream flow and temperature monitoring in unincorporated areas
3. Groundwater monitoring on Vashon Island conducted as part of the Groundwater Program
4. King County's portion of the regional stormwater quality monitoring program being implemented as part of King County's stormwater NPDES permit.

## 2.3 King County Flood Control District

The King County Flood Control District (District) is a separate special purpose district. Under an inter-local agreement, King County is the service provider to the District to provide floodplain management services across King County. One service is river flow monitoring through the Cooperative Streamgage Program with the USGS at 21 locations along 15 rivers and streams in King County. These data are used by King County, the USGS, and the National Weather Service to predict flood events and issue flood warnings, update Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, and develop site-specific hydraulic models for capital improvement projects funded by the District. This flow monitoring is focused on major rivers and streams for flood management purposes, whereas flow monitoring funded by the Water Quality Fund and Surface Water Management Fund is focused on smaller streams. While the primary purpose of the river flow monitoring is to support floodplain management and flood risk reduction, these flow data, when combined with water quality data, are also used to help understand pollutant loads to Puget Sound.

## 2.4 Other Funding Sources

Public Health has consistently received annual grant funding from the United States Environmental Protection Agency (EPA) (via Washington State) to conduct weekly swimming beach water quality monitoring for fecal bacteria at seven saltwater beaches in King County during the swimming season. This is the only federal or state funding source King County uses for ongoing and routine water quality monitoring activities. The saltwater beach monitoring compliments King County's freshwater swimming beach monitoring program conducted as part of WTD's monitoring program (see Section 2.1).

In addition, WLRD operates a small lake monitoring program for urban small lakes, which is funded via interagency agreements with nine regional cities for 12 lakes. This monitoring

program relies on volunteer lakeside residents to collect routine water quality data in their urban small lakes as a method of promoting sustainable lake stewardship.

Currently, there are no other funding sources used to support King County's ongoing water quality monitoring program in receiving waters. Between 1999 and 2012, the King County Road Services Division conducted streamwater quality monitoring, but that work has been discontinued due to budget limitations. The Road Services Division continues to collect information necessary for project-specific design, construction, and permitting issues .As noted in the introduction of this report, other facility-specific monitoring, such as the Solid Waste Division's monitoring at open and closed landfills and WTD's monitoring within the wastewater treatment system are not described in this report.

### 2.5 Overall Monitoring Program Summary

King County's water quality monitoring program consists of several types of sampling and analysis activities, for different purposes and funded by different sources. With the exception of EPA-funded monitoring of certain public salt water beaches by Public Health, these monitoring programs are implemented by WLRD.

# 3.0. ISSUES THAT MAY INFLUENCE KING COUNTY'S MONITORING PROGRAM IN THE FUTURE

King County's water quality monitoring program supports a variety of county programs, ranging from public health protection, to water quality protection, to restoring endangered species. The following sections describe factors that may influence King County's monitoring program in the future.

### 3.1 Changing Regulatory Issues

A key purpose of the monitoring program is to provide information that enables King County to comply with regulatory requirements. Given that state and federal agencies routinely review and update regulations and permits, it is important to forecast potential regulatory needs and ensure monitoring programs are sufficient to inform the County's response to them. The interdepartmental team preparing this report identified four substantial changes to regulations and permits that may potentially result in the need for new or additional monitoring information are described below.

#### 3.1.1 Freshwater Sediment Management Standards

The goal of the Sediment Management Standards is to reduce and ultimately eliminate effects on biological resources and threats to human health from sediment contamination. Ecology recently adopted changes to Chapter 173-204 WAC, Sediment Management Standards. These changes will likely impact cleanup at contaminated sediment sites and permitting requirements for source discharge. Because Ecology has not previously adopted freshwater sediment

standards, it has not identified freshwater sites in need of sediment cleanup as it has done in marine areas. While identification of contaminated sites and development of cleanup plans in freshwater areas could improve environmental quality and public health, it potentially could have large future financial impacts on King County, the City of Seattle, and many businesses along Lake Union, the Ship Canal, the Lower Duwamish River, and the Green River.

### 3.1.2 Fish Consumption Rates Used in Human Health-Based Water Quality Standards

Ecology is currently working to raise the fish consumption rates used to calculate water quality and cleanup standards to be more representative of populations who eat higher amounts of seafood. It is anticipated that Ecology will propose new water quality standards using these levels in 2014.

Future changes in these water quality standards have the potential to greatly affect King County's existing water quality monitoring program. These changes could, for example, lead to the need for additional monitoring with specialized laboratory quantification of toxic contaminants in surface water, sediment, and tissues. The identification and effective control of urban sources will likely become a much higher priority.

### 3.1.3 Implementation of Total Maximum Daily Loads and Incorporation into NPDES Permits

The Washington State water quality standards guide how the state regulates water pollution. State and federal laws require Ecology to develop total maximum daily loads (TMDLs) when water segments do not meet state quality standards. TMDLs are essentially water quality improvement plans that describe actions to take to bring water segments back into compliance with the surface water quality standards for specific problems or parameters. As Ecology develops more TMDLs, it is also placing requirements for implementing TMDLs into NPDES permits. This includes stormwater permits issued to local jurisdictions. These requirements may result in additional stormwater management and monitoring activities within the affected water bodies. In addition, it is possible that these TMDLs may force King County to implement increased stormwater or wastewater treatment technologies to meet the TMDL requirements.

Monitoring required for stormwater permit compliance has been forecast and included in the adopted 2013-2014 budget. However, additional monitoring requirements could become apparent as additional TMDLs are completed in south King County. Another area of interest to King County is Ecology's study of the effects of nitrogen on oxygen levels in south Puget Sound and its consideration of the development of a TMDL for nitrogen based on the study results. If Ecology were to develop a TMDL for nitrogen in South Puget Sound, and nitrogen from King County's wastewater treatment plants are found to be contributing to the problem, future NPDES permits for King County's wastewater treatment facilities could include conditions that are very costly to implement. Therefore, ensuring accurate and high quality information on the level of, and associated ecological impacts of, nitrogen in Puget Sound is important for King County.

### 3.1.4 Combined Sewer Overflow (CSO) Control Plan and Consent Decree Implementation

The King County Council approved King County's updated CSO control plan in 2012. A consent decree with the United States Department of Justice, the EPA, and Ecology commits to its implementation. The CSO control plan calls for approximately $711 million (planning level 2010 dollars) in capital expenditures by 2030 to construct a series of projects to reduce CSO discharges to the state standard of no more than an average of one untreated event per year per CSO location for any 20-year period. As part of this effort, King County also plans to implement a "CSO Water Quality Assessment and Monitoring Study" to inform how CSO projects can be best sequenced and integrated with other projects to maximize water quality improvements in areas where King County CSOs discharge. The water quality assessment will inform the pre-construction and post-construction monitoring that will be needed for individual CSO control projects.

## 3.2 Public Health Concerns

Water quality monitoring is an important component of efforts to protect public health. Historically, these efforts originated around preventing public exposures to untreated or poorly treated sewage. Public health concerns related to water quality monitoring are described below.

### 3.2.1 Sewage Treatment via On-Site Septic Systems

There are more on-site septic systems in King County (over 150,000) than in any other county in Washington State. Ensuring that these systems are installed, operated, and maintained properly is essential to protecting public health and protecting and restoring water quality in King County. Since 1999, the King County Board of Health has required all pressurized on-site septic systems (about 95percent of all new septic systems in King County) to have a signed maintenance contract as part of the permit approval process.

Public Health, supported by WLRD, is implementing an on-site septic system inspection and maintenance program for Marine Recovery Areas (MRAs) on Vashon-Maury Islands. This program is intended to ensure that on-site septic systems along sensitive marine shorelines are functioning properly and not causing unacceptable levels of pollution that would limit shellfish harvest.

### 3.2.2 Sewage Overflows and Spills

WTD is responsible for public notification when discharges of untreated sewage to surface waters occur via sanitary sewer overflows and spills. WTD works with Pubic Health to determine when sign posting of affected areas can be removed. This program is event-based, and is coordinated with WLRD Environmental Laboratory's "Trouble Call" water quality monitoring program. This practice is well established, and there is no need for additional monitoring.

### 3.2.3 Combined Sewer Overflows

WTD is responsible for public notification when discharges of untreated sewage to surface waters occur via CSOs. Public Health operates a telephone hotline to offer a way for citizens to ask questions about CSOs. This system is rarely used and may be supplanted by the available real-time data on WTD's website on CSO discharges.

### 3.2.4 Illicit Discharges to Surface Waters or to Municipal Stormwater Systems

Each local government is responsible for responding to an illicit discharge to surface waters or the municipal stormwater system within its jurisdiction. WLRD monitors unlawful discharges into surface waters in unincorporated King County. A portion of the program is being reconfigured due to new NPDES permit requirements.

### 3.2.5 Safe Swimming in Surface Waters

WLRD conducts bacteria and toxic algae monitoring at freshwater swimming beaches, and Public Health conducts bacteria monitoring at salt water beaches. Public Health is responsible for notifying local parks agencies when any freshwater or salt water bathing beaches are not safe for swimming due to fecal bacteria contamination or toxic algae contamination. As indicated above, freshwater swimming beach monitoring is funded from wastewater ratepayers via the Water Quality Fund, and salt water beach monitoring is funded by EPA. These monitoring programs are coordinated, and these agencies work with affected jurisdictions to ensure that any actions necessary to protect public health, such as temporary beach closures, are properly implemented.

### 3.2.6 Other Public Health Concerns

Monitoring for other public health concerns is conducted by other entities. For example, even though about 30 percent of King County's population gets its potable water from groundwater, Public Health has a limited role in assuring safe potable water. Developers of new private water supply wells for single family residents are required to submit laboratory results for bacteria and nutrient levels documenting water safety to allow for Public Health's certifying of water availability. All other potable water monitoring requirements are managed by the Washington State Department of Health (DOH) and implemented by water supply utilities. Likewise, monitoring conducted for safe shellfish harvest and safe fish consumption is conducted by DOH.

## 3.3 Liability Management Issues

King County faces currently undefined potential future financial liability associated with sediment cleanup in the Lower Duwamish Waterway, the East and West Waterways, Elliott Bay, and elsewhere. Sediment cleanups are addressed via state and federal cleanup processes. King County's required future investment in sediment cleanup is defined by established cleanup plans and future agreements. King County's current ongoing marine sediment monitoring provides information that could help track future cleanup needs and additional monitoring is not needed at this time.

## 3.4 Potential Upland Application of Reclaimed Water

While King County reuses water on site at several of its wastewater treatment facilities, reclaimed water distribution from the Brightwater Treatment Plant to a portion of the Sammamish Valley began June 6, 2013, with possible availability to other areas in the Sammamish Valley in future years. King County currently monitors groundwater levels in the Sammamish River valley and continuing this monitoring will allow tracking of potential changes from past baseline monitoring. Additional monitoring is not needed at this time.

## 3.5 Stormwater NPDES Permit Requirements for Water Quality Testing and Monitoring

The recently reissued stormwater NPDES permit will establish a Puget Sound-wide regional coordinated monitoring program across jurisdictions located in watersheds that drain to Puget Sound. This regional stormwater NPDES permit monitoring program calls for all permittees to pay a pro-rated population-based amount into a fund that will be managed by Ecology. Oversight of the implementation of the regional monitoring program will be provided by routine reports to the Stormwater Work Group, a collaborative, multi-stakeholder, caucus-based monitoring coordination body comprised of representatives from local jurisdictions, state agencies, federal agencies, environmental groups, business, and agriculture.

The streams monitoring element of the regional monitoring program is currently planned to include fourteen sites in urban King County (as defined by the Urban Growth Boundary), and six sites in rural King County.

## 3.6 Other Emerging Issues

King County's monitoring program will inform the regional response to other significant emerging issues or regional needs. As these issues develop they may suggest changes in program structure over time. Key issues that may influence monitoring programs are described below.

### 3.6.1 Stormwater Retrofit Needs

Urban stormwater runoff has been identified by the Puget Sound Partnership as one of the major causes of degradation to Puget Sound, including those waterways in King County. Because of the magnitude of this problem, addressing it is likely to take multiple decades, and existing and future stream flow and water quality monitoring programs will need to inform King County's response to this problem.

### 3.6.2 Floodplain Management

Floodplains in King County, and throughout Puget Sound, face unique and complex management issues. While most water quality monitoring appears separate from floodplain management activities, several floodplain management issues require data provided by King County's monitoring program. The information gathered through the monitoring program is sufficient at this time.

### 3.6.3 Puget Sound Recovery

The Puget Sound Partnership was created by the Washington State legislature in 2007 to develop an action plan for recovery of Puget Sound by 2020. It is important that King County participate with the Partnership's efforts to coordinate monitoring activity across Puget Sound and work to share information it collects.

### 3.6.4 Climate Change

In 2012, King County adopted a Strategic Climate Action Plan that describes measures King County is taking to address climate change. More detail on this plan can be found at: http://your.kingcounty.gov/dnrp/climate/documents/2012_King_County_Strategic_Climate_Action_Plan.pdf

King County's water quality monitoring program currently measures rainfall, stream and river flows, and surface water temperatures sufficient to help track climate change. There may be other future needs related to climate change, such as monitoring ocean acidification.

### 3.6.5 Pharmaceuticals, Personal Care Products, and Other Emerging Contaminants of Concern

King County's routine water quality monitoring program is focused on monitoring for bacteria, conventional parameters such as temperature, oxygen, solids, conductivity, salinity, and nutrients (various types of phosphorus and nitrogen). Routine water quality monitoring is not conducted for metals, chlorinated pesticides and Polychlorinated Biphenyls (PCBs), pesticides, pharmaceuticals, personal care products, or other organic chemicals such as Polycyclic Aromatic Hydrocarbons (PAHs) and phthalates (plasticizers). Metals, chlorinated pesticides and PCBs, and other organic chemicals are measured as part of the marine sediment quality monitoring and Lake Washington fish tissue monitoring programs, and in surface water as part of project-specific monitoring efforts.

Emerging contaminants of concern represent a large number of chemicals that are not routinely tested in water or sediment. Researchers have found these chemicals in surface waters worldwide and some have noted effects to aquatic organisms from low-level exposures to these chemicals. In 2013, testing for toxic chemicals was expanded to include chemicals that accumulate in fish tissue in Lake Washington, and to include investigations into the sources of a variety of toxic chemicals.

# 4.0. OPPORTUNITIES FOR COORDINATION AND COST-SHARING

Other agencies and jurisdictions perform some limited water quality monitoring activity within King County, generally tailored to a specific purpose or geographic location. This section evaluates what opportunities exist for greater coordination and cost sharing of water quality monitoring with these entities.

## 4.1 Cities

Staff from the cities of Auburn, Bellevue, Covington, Redmond, Renton, Seattle, and Shoreline was interviewed to provide input to this report. Water quality monitoring programs vary widely between cities in King County. However, of the cities interviewed, only Redmond and Shoreline conduct routine stream water quality monitoring. No city collects water quality data in Lake Sammamish, Lake Washington, or Lake Union/Ship Canal. Only Shoreline collects any Puget Sound water quality data.

Meetings with cities confirmed that their monitoring activities were generally not duplicative of those conducted by King County. In two cases, it was discovered during the meeting that city monitoring sites had shifted in recent years and were near King County's monitoring sites. While King County and the cities are addressing these issues, this demonstrates the importance of ongoing communication and coordination.

Given city budget constraints, opportunities to have cities assume a greater share of the costs of monitoring appear limited. Key messages heard during meetings with the cities include:

- Data Management: King County maintains expert data management systems for its water quality monitoring programs with most data available to the public via the web. Most cities interviewed expressed interest in using these systems for any data they collect as opposed to developing their own systems with similar capabilities.

- Microbial Source Tracking: King County conducts fecal bacteria source tracking monitoring (part of stream water quality monitoring program activity) in cooperation with local stormwater and wastewater utilities to find sources of fecal bacteria so the sources can be eliminated. There is ongoing interest from these cities to continue this program.

- River Flow Cost-Sharing: Staff from Renton and Bellevue currently cost share with USGS and King County for flow gauges on the Cedar River and Lake Sammamish, respectively. Both cities expressed interest in the King County Flood Control District assuming responsibility for all costs associated with these gauges.

- Routine Optimization of Sampling Sites: City monitoring programs generally change more frequently than King County's routine monitoring programs, with sampling sites being relocated based on changing needs. Regular communication was suggested to ensure that all sites remain complimentary over time.

- Small Lake Stewardship Monitoring: WLRD currently runs the Urban Small Lake Stewardship Monitoring Program under contract with nine cities. There is ongoing interest from these cities to continue this program.

## 4.2 State Agencies

Ecology conducts a limited amount of water quality monitoring within King County. Ecology's program includes a small number of stream staff gauges, a small number of long-term "sentinel"

stream monitoring stations, a small number of stream water quality stations that are monitored every four or five years, Puget Sound water quality monitoring at three locations within King County marine waters, and Puget Sound sediment quality monitoring (infrequently sampled within King County on a rotating basis). King County's monitoring programs are coordinated with Ecology's programs and provide local details to these state-wide data sets. Information from King County's monitoring program provides much more complete and current information on King County's water quality than what current state programs would provide. In addition, Ecology and the Puget Sound Partnership incorporate King County's data into Puget Sound-wide and state-wide water quality reports.

The Puget Sound Partnership is responsible for facilitating Puget Sound-wide monitoring coordination efforts between state and federal agencies, local jurisdictions, Native American Tribes, non-governmental organizations, and businesses. This resulted in the creation of Puget Sound Ecosystem Monitoring Program (PSEMP) in 2011, with a steering committee and eight topical work groups. King County staff participates on the PSEMP steering committee and on the stormwater, toxic chemical, freshwater, and marine water quality topical work groups. However, King County's monitoring programs focus on its own needs.

While information from King County's monitoring programs contributes to Puget Sound recovery strategies, broader needs for Puget Sound will not drive changes in King County's monitoring programs. However, there is some possibility that state agencies (such as the Puget Sound Partnership) may make funding available for monitoring activity that assists both King County residents and Puget Sound recovery, and King County will seek such cost-sharing arrangements when it benefits King County's programs and residents.

## 4.3 Federal Agencies

In general, the federal government conducts very limited water quality monitoring in King County. The USGS operates multiple river flow gauges in King County under a cost sharing arrangement with King County and others. USGS also maintains a flow and water quality monitoring site in Thornton Creek as part of the National Water Quality Assessment program, although USGS's funding for the Thornton Creek flow gauge ends this year. King County is considering assuming operation of the Thornton Creek flow gauge as part of its stream flow monitoring program. The metal and organic chemical data and flow data collected by USGS at Thornton Creek complement the bacteria, nutrient, and conventional data collected by King County in the water body.

The Northwest Fisheries Science Center (part of the National Oceanic and Atmospheric Administration) conducts research on a variety of topics in King County. Of note are the studies on pre-spawn mortality in urban creeks and studies on endocrine disruptor impacts on Elliott Bay flatfish. King County's water quality monitoring program is well coordinated with these efforts.

# 5.0. SUMMARY

King County maintains a countywide water quality monitoring program that provides information to support regulatory compliance, inform environmental programs, and meet the needs of the King County Strategic Plan. These ongoing monitoring activities include monitoring surface and marine water and sediment quality, stream flow and health of the aquatic ecosystem, toxic and contaminant assessment, and health of swimming beaches. Funding for these activities derives from: the wastewater ratepayers via the Water Quality Fund for monitoring in the wastewater service area and in Puget Sound; unincorporated area property owners via the SWM Fund for monitoring in unincorporated areas; the Flood Control District for monitoring flows and water levels in large rivers; and Public Health for assisting with managing certain water-quality related public health risks. Most of King County's water quality monitoring program is conducted by WLRD using a variety of funding sources. Implementing countywide water quality monitoring activities that are geographically and programmatically balanced is an ongoing challenge due in part to the variety of funding sources used for water quality monitoring.

King County strives to coordinate its monitoring activities with those of other agencies and jurisdictions, and collaborates with them to share data and information. This ensures that scarce funds available regionally and locally are expended wisely, and data sharing enables the region to develop a more complete understanding of water quality conditions throughout the County. However, research undertaken for this report suggests a continued need to communicate closely with other jurisdictions, so that all entities are aware of each other's monitoring programs as they continue to evolve.

This report has described many emerging issues that could influence King County's monitoring activities, such as changing regulations and new environmental challenges. While King County is not recommending new monitoring programs be initiated at this time, King County's monitoring program will continue to change over time and it is possible that new or different monitoring activities may be prudent if the need for information changes and funding is made available.

During preparations of this report, King County Council staff requested that this 2013 report also include an updated list of potential monitoring activities, should funds be made available. An updated list of potential monitoring activities and funding sources appears as Exhibit A, along with a description of how they would benefit King County residents. Exhibit A also includes a list of newly identified countywide potential monitoring activities. The priority of the activities listed in Exhibit A is dependent on the funding sources and the criteria each partner agency uses for prioritizing monitoring activities given budgetary limitations and the need to address emerging issues.

**Exhibit A**

# Potential Water Quality Monitoring Activities

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| Develop marine zooplankton monitoring to augment King County's marine phytoplankton monitoring program to characterize the base of the food web and track changes over time. | Marine zooplankton are small animals that feed on marine phytoplankton. Zooplankton serve as the food source for larger fishes in Puget Sound. This monitoring activity would assess the status of the marine zooplankton community and track its changes over time. Zooplankton are sensitive to phytoplankton community change and nitrogen inputs to Puget Sound. King County wastewater treatment plants are large sources of nitrogen to Puget Sound. Additionally, increasing atmospheric carbon dioxide is resulting in increasing acidity of ocean waters. This change in ocean acidity has the potential to substantially alter the ocean and Puget Sound zooplankton community, thereby affecting commercial and recreational fish species. | This would provide a more complete assessment of potential impacts of wastewater discharges on the base of the marine food chain by augmenting the phytoplankton information already being collected, and by helping to ensure that any future regulatory issues, such as total maximum daily loads (TMDL) or permit restrictions on these discharges, are based on sound science. | Changing Regulatory Issues<br><br>Other (Puget Sound Recovery) | $95,000 | WTD, SWM, State, NOAA |

[1] This table represents an updated version of the list of potential additional water quality monitoring activities presented in the 2012 proviso report. Activities that are already funded and those that are no longer a priority have been deleted from the list. Other activities were consolidated and cost estimates were updated. The list also describes the benefits of each activity, including the degree to which the activity positions King County to address changing regulatory issues, public health concerns, liability management concerns, and other emerging or existing issues.

[2] Although possible sponsors and partners were identified based on potential linkage with established programs, these entities were not surveyed to assess their degree of interest nor capacity to assist in funding these activities. Entities included in this column include potential King County funding sources such as Surface Water Management (SWM), WTD, and Public Health, as well as other entities that could potentially partner with King County to undertake the activity, such as Washington State agencies (Departments of Health, Ecology, Fish and Wildlife, Puget Sound Partnership); the federal National Oceanic and Atmospheric Administration (NOAA); the University of Washington (UW); King County cities, local utilities, Water Resource Inventory Area (WRIA) groups, and the Salmon Recovery Funding Board (SRFB).

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| Enhance existing marine phytoplankton (microscopic plants) monitoring by collaborating with others to identify and quantify phytoplankton levels in King County's portion of Puget Sound. | Phytoplankton serves as the base of the marine food chain, and are sensitive to the amount of nitrogen in Puget Sound. WTD is a contributor of nitrogen into Puget Sound, and Ecology is currently considering developing a TMDL for nitrogen in South Sound based on eutrophication concerns. Development of scientifically-sound management strategies is of high importance to King County due to the potentially high costs associated with reducing nitrogen discharges from the wastewater treatment system. | This would expand understanding of the impacts of nitrogen on the base of the food chain. The involvement of other entities, such as the University of Washington (UW) and/or NOAA, would further enhance scientific credibility of the information to be used by Washington State Department of Ecology (Ecology) if it develops a TMDL, and position King County to respond to emerging regulatory issues. | Changing regulatory issues<br><br>Other (Puget Sound Recovery) | $75,000 | WTD, State, NOAA, UW |
| Increase the frequency of routine Puget Sound offshore water quality monitoring to twice per month from once per month for February through November. | Ocean dynamics cause water quality to change quickly, especially during times of the year when phytoplankton populations are high. Adding the second water quality sampling run will increase understanding of these complex dynamics, which will be useful in assessing the relationship between nitrogen and phytoplankton in Puget Sound. This information will help improve the understanding of wastewater discharge impacts to marine water quality. | This would help position King County to address emerging regulatory concerns. This activity would improve information on levels of nutrients and parameters affected by nutrients (such as dissolved oxygen) in King County portions of Puget Sound, which will improve understanding of wastewater discharge impacts to marine water quality. This issue is of concern because Ecology is considering developing a TMDL for nitrogen for Puget Sound, which could result in new effluent limits for King County that would be | Changing regulatory issues<br><br>Other (Puget Sound Recovery) | $220,000 | WTD, State, NOAA, UW |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| | | costly to address. | | | |
| Enhance King County's marine sediment quality monitoring program by also monitoring for marine benthos (bottom dwelling organisms) at routine sampling sites and at reference sites. | Benthos community health provides a more direct indicator of whether contamination is having an effect on marine biotic populations. This enhancement would concurrently monitor for marine benthos when routine sediment chemistry samples are collected. Reference sites are needed to allow for improved assessment of benthos community health near WTD outfalls. Ecology has recently reported a concern about deteriorating health of marine benthic community throughout Puget Sound, and this would provide detailed information about the local prevalence of this problem. | This would improve the assessment of the degree of impact, if any, of WTD's combined sewer overflow (CSO) and secondary effluent outfalls on the local marine environment. This improved assessment could result in finding no impacts to local biota when chemical analyses of sediments suggest there is a risk of impacts, thus potentially reducing future cleanup liability. This monitoring activity would also provide more holistic assessments of impacts of contamination on marine organisms in areas where cleanups might otherwise be potentially needed. | Changing regulatory issues<br><br>Liability concerns<br><br>Other (Puget Sound Recovery) | $120,000 | WTD, State |
| Conduct sediment core and surface sediment monitoring in lakes Sammamish, Washington, and Union/Ship Canal to test changes in | Chemical loading to these lakes has varied over time due to changing land use and waste management practices, and regulations. Sediment core studies allow for tracking changes over time, predicting future conditions and program effectiveness. Surficial sediment monitoring allows for assessing recent chemical | This would: inform potential sediment clean-up needs in the lakes relative to the new freshwater sediment standards being implemented by Ecology; provide information on how toxic chemicals accumulate in fishes | Changing regulatory issues<br><br>Liability | $180,000 | WTD, Cities |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| chemical accumulation over time, to assess chemical accumulation in different habitats, and to assess compliance with new freshwater sediment quality standards. | loadings to the lakes, helping to identify any current problems. | associated with consumption advisories; provide information on urban sediment contamination; and inform effectiveness of efforts to keep toxic chemicals from entering our waters. It would help position King County to respond to emerging regulatory issues, address public health concerns, and liability issues. | concerns | | |
| Expand pollution source identification monitoring. | Pollution source identification investigations trace sources of water quality pollution so they can be corrected. These activities are done in cooperation with many agencies and jurisdictions, and can be highly effective in locating and correcting specific sources of pollution. This activity would expand current efforts. | This would provide information directly useful to local stormwater and sewer districts and local jurisdictions to find and eliminate sources of pollution and improve water quality, and will help address the emerging issue of stormwater retrofitting needs (which will require targeting resources effectively). | Public Health Concerns<br><br>Other (stormwater retrofits) | $86,000 | SWM, Cities, Local utilities |
| Monitor zooplankton in large lakes as part of the routine lake monitoring program to augment ongoing large lake phytoplankton monitoring. | Zooplankton are small animals in the water column near the base of the food chain. Zooplankton populations are sensitive to changes in phytoplankton populations and water quality conditions, including shifts in nutrients, acidity, and temperature. This monitoring is useful as a method for tracking changes in the food web over time, with important | This would benefit King County residents by serving as an effectiveness measure of the region's approach to stormwater and sewage management for limiting nutrient and other pollutant discharges to the lakes, for tracking long-term impacts of | Other (stormwater, climate change, endangered species protection) | $50,000 | WRIA 8, SRFB |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| chemical accumulation over time, to assess chemical accumulation in different habitats, and to assess compliance with new freshwater sediment quality standards. | loadings to the lakes, helping to identify any current problems. | associated with consumption advisories; provide information on urban sediment contamination; and inform effectiveness of efforts to keep toxic chemicals from entering our waters. It would help position King County to respond to emerging regulatory issues, address public health concerns, and liability issues. | concerns | | |
| Expand pollution source identification monitoring. | Pollution source identification investigations trace sources of water quality pollution so they can be corrected. These activities are done in cooperation with many agencies and jurisdictions, and can be highly effective in locating and correcting specific sources of pollution. This activity would expand current efforts. | This would provide information directly useful to local stormwater and sewer districts and local jurisdictions to find and eliminate sources of pollution and improve water quality, and will help address the emerging issue of stormwater retrofitting needs (which will require targeting resources effectively). | Public Health Concerns<br><br>Other (stormwater retrofits) | $86,000 | SWM, Cities, Local utilities |
| Monitor zooplankton in large lakes as part of the routine lake monitoring program to augment ongoing large lake phytoplankton monitoring. | Zooplankton are small animals in the water column near the base of the food chain. Zooplankton populations are sensitive to changes in phytoplankton populations and water quality conditions, including shifts in nutrients, acidity, and temperature. This monitoring is useful as a method for tracking changes in the food web over time, with important | This would benefit King County residents by serving as an effectiveness measure of the region's approach to stormwater and sewage management for limiting nutrient and other pollutant discharges to the lakes, for tracking long-term impacts of | Other (stormwater, climate change, endangered species protection) | $50,000 | WRIA 8, SRFB |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| | consequences for juvenile Chinook and Sockeye salmon in our lakes. | climate change on the lakes, and for assisting with salmon and Kokanee recovery efforts. | | | |
| Participate in water quality studies of Coho prespawn mortality in urban stream with NOAA, US Fish & Wildlife, Washington Department of Fish & Wildlife, and City of Seattle. | Excessive Coho prespawn mortality has been observed by NOAA scientists in many urban streams in King County. In the past, King County has contributed detailed water quality monitoring activities to assist in identifying the chemical(s) causing prespawn mortality. Identification of the chemical(s) causing prespawn mortality will assist in developing appropriate management actions to eliminate this phenomenon. | This would benefit King County residents by helping to identify management actions that would enhance Coho salmon survival in King County's most urban streams. This is of ongoing importance to local residents. | Other (new contaminants, stormwater) | $130,000 | WRIAs 8,9 Cities, NOAA, UW, State |
| Monitor stream sediment chemistry to track changes in pollution over time and to characterize stream basins. | Metals and organic chemicals are difficult to detect in surface waters, but accumulate in sediments. This activity would track changes in sediment quality over time, and assess differences in sediment quality within and between stream basins. This information could be used to find pollution sources, inform pollutant loading calculations, and assess effectiveness of control activities. | This would provide information on potential future sediment clean-up needs in rivers and streams relative to the new freshwater sediment standards being implemented by Ecology, by providing information on source areas of toxic chemicals that accumulate in fish associated with consumption advisories, and on the overall effectiveness of source control efforts to keep toxic chemicals from entering our waters. It would therefore help position King County to respond to emerging regulatory issues, | Changing regulatory issues<br><br>Liability concerns<br><br>Public health concerns | $120,000 | SWM, State |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| | | address public health concerns, and liability issues. | | | |
| Enhance thermistor chain operation and maintenance schedule in Lake Washington to assess water temperature from the top to bottom of the lake, and add one thermistor chain to Lake Sammamish. | Thermistor chains provide continuous temperature measurements throughout the water column, which is important for tracking temperature impacts on the food web, particularly salmonids. Increasing the operations and maintenance frequency of the Lake Washington and Ship Canal thermistor chains will allow for more reliable data collection and fewer missing data due to sensor malfunction. Adding a chain in Lake Sammamish will allow for detailed temperature tracking in that lake. | This would ensure impacts of climate change on lake conditions are thoroughly and reliably tracked, assisting in the development of strategies to protect endangered species. | Other (climate change) | $24,000 | WRIA 8, Cities |
| Provide stream gaging support to other jurisdictions within King County, and provide data repository for all stream gaging data within the service area. | Flow monitoring is difficult without proper training and data management. Many King County cities perform some of this activity and information is not always shared widely. This effort would be a cost-effective way for expanding King County's dataset of stream flow data, which is useful for a variety of purposes. | This would benefit King County residents by improving the sharing of stream flow data being collected by multiple agencies. This would help King County and other jurisdictions to assess watershed health, calculate pollutant loadings from streams, and to manage stormwater and wastewater systems. | Other (climate change, stormwater) | $30,000 | Cities |
| Establish volunteer monitoring of prevalence of Coho prespawn mortality in | Excessive Coho prespawn mortality has been observed by NOAA scientists in multiple urban streams. Tracking prespawn mortality is extremely labor intensive and expensive, but also | This would benefit King County residents by providing a more comprehensive understanding of the extent and possible causes of | Other (new contaminants, stormwater) | $60,000 | Cities |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| three urban streams. | necessary to both understand the extent of the problem and whether progress is being made to solve it. King County is currently running a volunteer monitoring program in Miller/Walker Creeks (funded by the local cities) to track prespawn mortality. This would expand volunteer monitoring to three more urban streams within the service area. | this phenomenon, and increasing stewardship of King County streams. | | | |
| Expand fish tissue chemistry monitoring to include toxic chemical accumulation and biomarkers of chemical exposures in fish from Elliott Bay and King County's portion of Puget Sound. | This would sample fish tissue for toxic chemical accumulation and fish blood, livers, and sex organs for biomarkers of exposures to polycyclic aromatic hydrocarbons (PAHs) and endocrine disrupting compounds while fish tissue contamination is sampled WDFW to assess chemical bioaccumulation levels, this activity would complement such testing by WDFW to provide more in-depth King County – specific information. In addition, some chemicals such as PAHs and endocrine disrupting compounds may cause harm but do not accumulate in fish tissue (but can be detected by using biomarkers), and are therefore rarely assessed for their impacts. These data are useful because they represent the end target of clean-up activities in the Duwamish River and elsewhere in King County. | This would benefit King County residents by assessing the effectiveness of source control and sediment cleanup activities intended to prevent toxic chemicals from entering Elliott Bay thereby lowering levels of chemicals in fishes, and help protect public health and the health of the local marine ecosystem. | Public health concerns<br><br>Other (new contaminants) | $160,000 | WTD, State |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| Conduct groundwater quality monitoring in the Sammamish River valley to support reclaimed water use. | Sammamish River valley waters are heavily managed, and on June 6, 2013, distribution of reclaimed water from Brightwater for irrigation in the valley began, replacing local water sources. This monitoring program would expand the groundwater level monitoring in the Sammamish River valley to also collect groundwater quality data, to assess whether conditions are improving or declining over time. | This would benefit King County residents by providing scientifically defensible data on groundwater conditions in an area irrigated with reclaimed water. | Potential application of reclaimed water | $91,000 | WTD, Cities |
| Initial environmental laboratory method development to support monitoring surveys of new and emerging contaminants. | So called emerging contaminants – for example, endocrine disrupting compounds, personal care products (DEET, sun screen), drugs (opiates, anti-inflammatories), and perfluorinated compounds--may represent some level of ecological risk, even though thresholds of risk have yet to be determined. | This would position King County to respond to concerns about so called "new and emerging" contaminants. Having methods in place to quantify the presence/absence of such contaminants may be needed to understand the extent of such problems locally, and to develop appropriate management responses. For example, such information would be needed to help discriminate between contributions from King County's waste streams (e.g., wastewater or stormwater) and those from other sources. | Other (new contaminants) | $50,000 | WTD, State, Local Hazardous Waste Management Program |

## Table A1. Potential Monitoring Activities Updated from the 2012 Report[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| Collect stream water quality samples during rain events to assess impacts on stream water quality. | Rain events typically result in increased runoff of pollutants from the land surface into streams (in addition, rain events usually lead to increased flow velocities, causing physical damage to riparian habitat). Monitoring stream water quality during these rain events allows for a better understanding of water quality impacts from stormwater. | This would help King County (and jurisdictions) develop more effective stormwater management programs and evaluate their effectiveness. | Other (stormwater) | $130,000 | Cities, Stormwater Utilities |
| Expand large lake routine water quality monitoring frequency to 24 times per year from 21 times per year. | Currently, monitoring occurs at 13 different sites once per month for three months during the winter and twice per month for the other nine months. Twice monthly water quality monitoring throughout the year would provide greater resolution on large lake water quality status and concerns, especially as lake conditions may shift rapidly. | This would provide more detailed information on large lake water quality, which is important to recreational users as well as endangered and other species that reside in the lakes. This will allow for more confidence in the ability to detect problems, and the ability to institute corrective actions or advise the public. | Other (stormwater, endangered species protection, and resident concern for health of large lakes) | $75,000 | Uncertain |
| Inventory stream riparian habitat and update on a routine basis. | Stream riparian habitat is critical to stream basin health, yet many county streams do not have a current inventory available of this resource. This information would be useful for developing riparian restoration plans. | A variety of King County programs focus on stream restoration. This monitoring activity would track improvements in riparian habitat over time, and provide information necessary to target areas still in need of restoration. | Other (Puget Sound recovery, stormwater retrofits, floodplain management) | $50,000 | SWM |

## Table A2. Newly Identified Countywide Potential Water Quality Monitoring Activities[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| Enhanced on-site septic system monitoring and inspections | King County has more on-site septic systems than any other county in Washington State. Additional resources are warranted for addressing failing systems, monitoring system performance, and monitoring water quality impacts. This would provide one full-time employee to Public Health to improve these programs countywide and also fund additional bacteria analyses at the King County Environmental Laboratory. | Ensuring proper operation and maintenance of on-site septic systems is essential for preservation and recovery of King County water quality and for ensuring public health and safety. This addition would greatly improve monitoring associated with these systems. | Public Health Concerns | $180,000 | Public Health, State |
| Conduct high-precision pH monitoring in King County portions of Puget Sound and Lake Washington to assess impacts of climate change on water acidity. | The increasing level of atmospheric carbon dioxide is resulting in greater acidity in ocean waters. This change in ocean acidity has the potentially to substantially alter the ocean food web, including shellfish consumed by humans. | This would provide scientifically valid information on the degree of acidification occurring in our local waters. This information would help identify the need for any local response to this emerging issue, and supports King County's leadership in addressing climate change. Excess discharges of nitrogen have been implicated in exacerbating this problem, so this | Changing regulatory issues<br><br>Other (climate change, Puget Sound Recovery) | $100,000 (this includes annual costs of $40,000 plus $60,000 for one-time equipment | SWM, State, UW, NOAA |

[1] This list includes items identified during the preparation of this report based on a review of countywide monitoring activities.

[2] Although possible sponsors and partners were identified based on potential linkage with established programs, these entities were not surveyed to assess their degree of interest nor capacity to assist in funding these activities. Entities included in this column include potential King County funding sources such as Surface Water Management (SWM), WTD, and Public Health, as well as other entities that could potentially partner with King County to undertake the activity, such as Washington State agencies (Departments of Health, Ecology, Fish and Wildlife, Puget Sound Partnership); the federal National Oceanic and Atmospheric Administration (NOAA); the University of Washington (UW); King County cities, local utilities, Water Resource Inventory Area (WRIA) groups, and the Salmon Recovery Funding Board (SRFB).

## Table A2. Newly Identified Countywide Potential Water Quality Monitoring Activities[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| | | information could potentially help King County respond to future regulatory measures. | | purchase) | |
| Further expand routine stream water quality monitoring by adding 20 more sites to address additional requests from local jurisdictions and to establish reference sites (the 2012 budget passed by the King County Council restored 20 stream sites that had previously been eliminated; this program would add 20 new sites). | Routine water quality monitoring allows for tracking overall system health and long-term changes over time. Results may be used to assess compliance with water quality standards and to prioritize management actions to restore water quality. Additional stream sites will improve our geographic coverage and allow King County to react more quickly to potential water quality problems. | This would benefit King County residents by assessing whether stream water quality conditions are getting better or worse over time. This information is useful for understanding the effectiveness of our restoration efforts and for identifying needed measures to protect and improve water quality. It would also help position King County jurisdictions to respond to emerging regulatory requirements, such as TMDLs. | Changing regulatory issues | $130,000 | Cities |
| Establish a stormwater facility effectiveness monitoring program for unincorporated King County | The stormwater NPDES permit requires construction of stormwater facilities, including Low Impact Development facilities, and future stormwater retrofit efforts will result in more facilities. The long-term effectiveness of some of these facilities is not well documented and could result in sooner-than-expected replacement costs. In addition, limited effectiveness study has been done to evaluate stormwater treatment of | This would benefit King County residents by tracking the effectiveness of different types of stormwater facilities over their life history. This information is useful when designing stormwater retrofit program and long-term operation and management efforts. | Other (stormwater) | $180,000 | SWM |

## Table A2. Newly Identified Countywide Potential Water Quality Monitoring Activities[1]

| Activity | Background Information | Benefits to King County Residents | Responds to: | Estimated Annual Cost | Possible Sponsors/ Partners[2] |
|---|---|---|---|---|---|
| | new and emerging contaminants. | | | | |
| Rural small lake stewardship monitoring to track water quality in 20 small rural lakes. | Rural small lakes are sensitive to land use changes and actions in their immediate watersheds. Implementation of a rural small lake stewardship monitoring program would collect data on health of the lakes and improve lake stewardship around these lakes. | Lake health is important to King County residents, including the rural area. This activity would benefit King County residents by improving small lake stewardship in unincorporated King County, helping to prevent these lakes from becoming water quality- impaired in the future. | Other (resident concerns regarding rural lake water quality) | $200,000 | SWM |
| Establish stream benthic macroinvertebrate sampling in WRIA 7. | This monitoring program would assess the health of the community of "bugs" that live on the bottom of streams in WRIA 7. The health of the bug community serves as an excellent indicator of the health of the watershed and is useful for assessing restoration needs and activities. | This would provide information to assist in planning and evaluating stream restoration efforts, or ensure other land management activities are done in a manner protective of stream health. This would be useful for salmon recovery plan implementation, floodplain management and protection efforts, and agriculture support programs. | Other (Puget Sound recovery, stormwater retrofits, floodplain management) | $61,000 | SWM, WRIA 7, SRFB |