Science & Technical Support Section's
SciFYI
King County
Department of Natural Resources and Parks
Water and Land Resources Division
A science section digest of current environmental issues in King County
October 2014

King County's Lake Stewardship Program

By Sally Abella and Rachael Gravon

The largest lakes in King County, including Washington, Sammamish and Union, have been monitored for water quality for many years while our cities have grown tremendously. Their watersheds have been developed and sewage systems installed and updated. However, King County also has many smaller lakes across the landscape – a legacy of the last large glaciation more than 10,000 years ago.

Many lowland lakes have interesting histories as logging mill ponds, summer resorts for city dwellers, and more recently as focal points for residential development on the urban fringes. Quite a few are annually stocked with fish by the Washington Department of Fish and Wildlife (WDFW), and have public boat launches managed by WDFW for public recreational benefit. Some lakes also have parks, trails, and beaches.

Monitoring water quality in small lakes can indicate important environmental impacts occurring in local watersheds, along the lake shorelines, or from climate changes. Monitoring with the assistance of volunteers helps the community understand the processes behind the changes they see and focuses attention on the importance of our smaller lakes. The feeling of ownership that comes with involvement can also help mobilize grassroots efforts for lake protection and restoration.

The King County Lake Stewardship Program began in 1994, combining two volunteer-based water quality programs for small lakes that were managed by King County and METRO before the agencies merged. Over time, 55 lakes were monitored with the help of interested citizens between 1994 and 2004. Budgetary constraints in 2005 resulted in a decrease in monitored lakes, with another reduction in 2009. Twelve urban lake communities have continued sampling since 2009 with the aid of funding from interested cities.

In 2014, restored funding from unincorporated King County Surface Water Management fees allowed for the addition of 22 rural lakes back into the program, making a total of 34 lakes to be tracked in 2014 (see **Figure 1**).

Choosing which 22 lakes to add back into the monitoring program proved difficult because all of King County's lakes have interesting and unique characteristics. Factors

(Continued on page 2)

FIGURE 1.
Currently monitored lakes in King County

(LAKE MONITORING - *Continued from page 1)*

considered included lake location, a history of changes in algae or nutrients, the importance of the lake for water storage or stormwater pathways, public accessibility, or similarity to other lakes found across the county.

Previous volunteer monitors were contacted to see if they would be interested in resuming the work. The response was immediate and very positive: A roster of more than 100 citizens was compiled in just a few weeks. In April 2014 a volunteer training workshop was held at the Preston Community Center with over 60 attendees. Lake volunteers, friends, and family members received training in water sampling and listened to presentations about water quality, aquatic plant life, and algal blooms.

Collaboration with trained volunteers has many benefits. Keeping labor costs down makes it possible to monitor many more lakes than could otherwise be afforded, thus getting a regional picture of lake health. Even more important, training residents increases the number of eyes on a lake, and significant changes can be detected rapidly. Additionally, working with volunteers allows King County residents to have direct involvement with work done in the Sciences and Technical Support Section. Volunteers receive information on water quality and watershed management and also serve as stewards in outreach to other interested citizens.

Volunteers have the option of participating in daily, weekly, or summer bi-weekly (May-October) monitoring programs. In addition to water quality monitoring, volunteers keep track of recreational use and track potential nuisances, such as geese. They also report algal accumulations that could signal a health and safety threat, such as a toxic algae bloom.

Water quality data from the summer program is uploaded onto the King County Small Lakes Information and Data Page (link below). This page provides physical information about the lakes, maps, water quality reports, and the option to download or view water quality data. Currently, it is anticipated that an annual summary of the lakes data will be prepared so that interested people can look at the values in a regional context, as well as compare lakes. Trends will also be evaluated for lakes with enough data for statistical significance. See **Table 1**: TSI average for last year of lake monitoring.

To visit the King County Small Lakes Information and Data Page, go to http://green2.kingcounty.gov/SmallLakes/WQData.aspx. For more information about the Lake Stewardship Program, please visit www.kingcounty.gov/environment/wlr/sections-programs/science-section/lake-stewardship-program.aspx.

TABLE 1.
TSI average for last date of lake monitoring

Table of Trophic State Index: average for last date of Lake monitoring

Lake Name	jurisdiction	last year sampled	TSI-average
Alice	King County	2008	44.9
Allen	King County	2008	56.7
Ames	King County	2008	39.9
Angle	SeaTac	2013	34.9
Beaver1	Sammamish	2013	52.7
Beaver2	Sammamish	2013	43.9
Boren	Newcastle	2013	43.6
Cottage	King County	2008	51.6
Desire	King County	2004	50.6
Echo	Shoreline	2013	50.1
Fivemile	King County	2008	51.4
Forbes	Kirkland	2013	44.5
Geneva	King County	2008	39.3
Green	Seattle	2013	43.7
Joy	King County	2008	39.8
Kathleen	King County	2008	39.9
Killarney	King County	2008	47.1
Langlois	King County	2008	37.9
Lucerne	Maple Valley	2013	36.5
Marcel	King County	2008	49.8
Margaret	King County	2008	37.0
McDonald	King County	2008	46.5
Morton	King County	2008	40.6
Neilson (Holm)	King County	2008	48.1
Pine	Sammamish	2013	38.2
Pipe	Maple Valley / Covington	2013	36.7
Retreat	King County	2008	37.3
Sawyer	Black Diamond	2013	40.0
Shadow	King County	2008	45.7
Spring	King County	2008	42.5
Tuck	King County	2008	50.2
Twelve	King County	2004	42.1
Welcome	King County	2008	45.9
Wilderness	Maple valley	2013	41.1

Trophic state index (TSI) values provide a standardized way to rate lakes on a scale of 0 to 100; each major division (10, 20, 30, etc.) correlates with a doubling of algal biovolume. The indices are based on the summer mean values (May through October) of three commonly measured lake parameters: Secchi depth, total phosphorus, and chlorophyll a. Below 40 is considered low and above 50 is considered high in productivity

Water Resource Inventory Area 9 Stormwater Retrofit Project

By Olivia Wright and Jim Simmonds

Stormwater from developed landscapes is one of the biggest threats to water quality and ecological health of the Puget Sound. Forecasted population growth in the region will result in the conversion of additional land for urban use, and the redevelopment of previously developed land for higher density use. The increase of impervious surfaces associated with development alters the natural hydrology, reducing infiltration and creating larger volumes of stormwater runoff that increase the risk of flooding, erode stream banks and channels, damage aquatic habitat, and increase the amount of pollutants entering a stream. Stormwater facilities, such as rain gardens or detention ponds, are implemented to mitigate the impacts by capturing stormwater runoff and providing flow control or water quality benefits through storage and infiltration. In 2010, King County received a grant from the U.S. Environmental Protection Agency to estimate the stormwater facility needs, and associated costs, necessary to rehabilitate stream flows and water quality of existing and future development within the Water Resource Inventory Area (WRIA 9) to pre-development conditions and extrapolate to the Puget Sound drainage basin.

Project Area

The WRIA 9 project area covers 278 square miles of the Green/Duwamish watershed and portions of the Central Puget Sound watershed, excluding areas upstream of the Howard Hanson Dam and the city of Seattle (**Figure 2**). Land uses range from forested, agricultural, and low density residential in the east to moderate/ high density residential and commercial/ industrial lands in the west.

Project Approach and Methods

Within the project area, stream flow and water quality parameters were measured, and watershed hydrology and water quality models were developed to estimate cost-effective stormwater facilities required to improve stream flow and water quality of existing and future development in the next 30 years. Additional analyses were made on the impacts of population growth and economic activity on stormwater facility construction, the uncertainty associated with climate change impacts on stormwater facility sizing, and the presence of existing facilities. Stormwater facility cost estimates included capital costs (design, construction and land acquisition), operation and maintenance costs, and inspection and enforcement costs. Results of the WRIA 9 project area were extrapolated to the Puget Sound drainage basin.

Key Findings

The model results show that stream flashiness would be reduced and stream water quality improved to near-predevelopment (e.g., fully-forested) conditions with the implementation of the modeled stormwater facilities. Across the project area, the modeling effort estimated the amount of facility storage, measured in watershed-inches, needed to capture stormwater runoff generated from developed areas. The storage needs ranged from approximately 0.1 watershed-inches in rural areas to as high as 3 watershed-inches in urban areas (**Figure 3**).

The most comprehensive and effective approach for managing stormwater would require implementation of stormwater facilities with new and redevelopment as required by existing stormwater regulations as well as building stormwater facilities for roads, highways and the

(Continued on page 4)

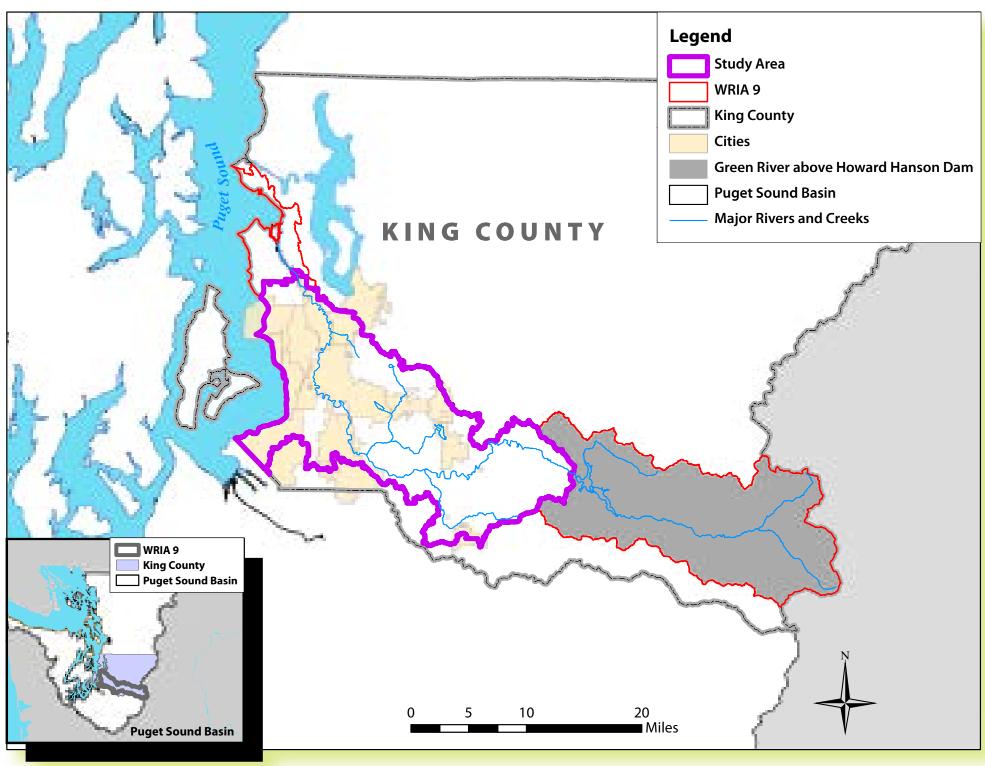


FIGURE 2.
Project area map

(STORMWATER RETROFIT - *Continued from page 3*)

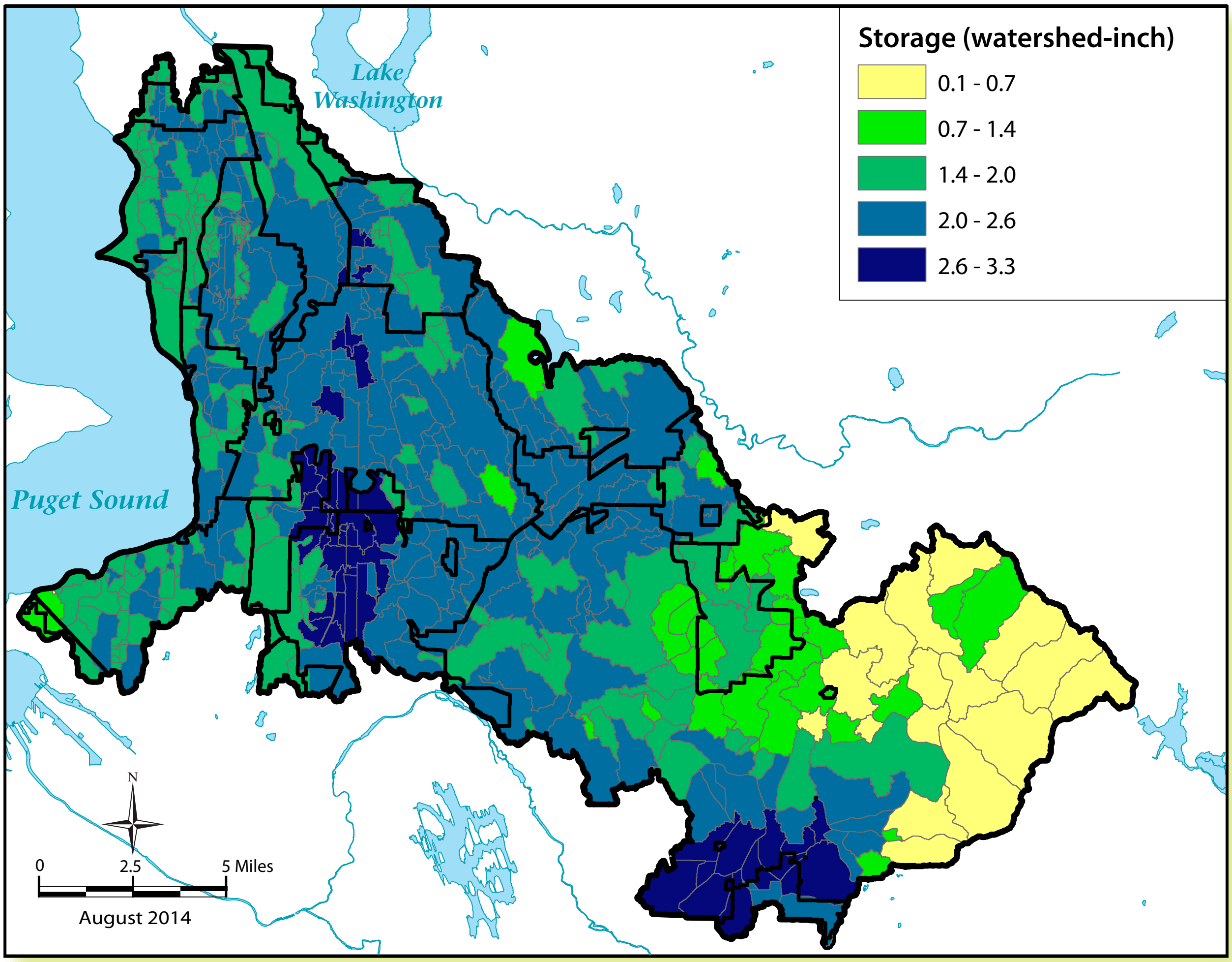


FIGURE 3.
Watershed-inches of stormwater storage needed by 2040 to improve stream health.

remaining developed area. To successfully implement all stormwater facilities, a public program would be needed that takes aggressive action to strengthen stormwater requirements during new and redevelopment to lower thresholds requiring stormwater facilities. Additional funding mechanisms for building public facilities would also be necessary to achieve this ambitious goal.

With stronger redevelopment requirements, facilities needed to mitigate stormwater runoff from nearly half of the landscape would be projected to be constructed as part of new and redevelopment over the next 30 years. A 30-year public stormwater program could be responsible for building regional facilities as well as the remaining facilities for roads, highways and all other non-forested lands not redeveloped within the next 30 years. If longer time horizons for completion are targeted, a larger percentage of the stormwater facilities will be built with new and redevelopment, reaching nearly 100 percent of the landscape within about 100 years. A 100-year public stormwater program would be responsible for building regional facilities and road and highway facilities over the next 100 years. The annual capital costs associated with a 30-year and 100-yr public stormwater program for the WRIA 9 project area and the Puget Sound basin are presented in **Table 2**. Public operating costs would increase annually as more facilities are built.

For project reports, go to www.kingcounty.gov/environment/watersheds/green-river/stormwater-retrofit-project/ documents.aspx

	Annual Public Stormwater Program Capital Costs	
	30-yr Program	**100-yr Program**
WRIA 9 Project Area	$210M each year	$46M each year
Puget Sound Basin	$4.3B each year	$650M each year

TABLE 2.
Annual 30-year and 100-year Public Stormwater Program Capital Costs for the WRIA 9 project area and the Puget Sound basin.

Evaluating PCBs in the Green River Watershed: Supporting the Duwamish Superfund Site Cleanup

Debra Williston and Carly Greyell

The purpose of this study was to evaluate water quality in the Green River Watershed upstream of the Lower Duwamish Waterway Superfund Site. The lower five miles of the Duwamish River sediment is contaminated with polychlorinated biphenyls, or PCBs, which came from many sources, including industries along the waterway and stormwater runoff. Most of the pollution is historical, from times before modern pollution controls were in place.

PCBs are mixtures of man-made organic chemicals that were used in hundreds of industrial and commercial applications. They were used from approximately 1929 until 1979, when the federal government banned PCB manufacturing and use. Although their current commercial use is restricted in the U.S., they continue to be a common environmental contaminant because they do not break down easily. As PCBs enter a river, lake or marine water, they can attach to the sediment (or mud) at the bottom of the waterbody and can accumulate in fish or other animals that live in the water. People who eat lots of fish or shellfish contaminated with PCBs could have a higher chance of health effects such as cancer, weakened immune systems, and developmental effects in young children.

Study objectives and methods

This study was designed to evaluate PCB concentrations in water collected from the Green River and four major tributaries: Newaukum Creek, Soos Creek, Mill Creek and the Black River (**Figure 4**). These tributary basins range in land use from rural to urban, with an increasing mix of commercial/industrial and residential uses as one moves downstream. The two Green River mainstem sampling locations were at Flaming Geyser State Park (upriver of the major tributaries being sampled), and at Foster Links Golf Course (downstream of the tributaries). At each location, there were three samples collected during the summer dry season and six samples collected during the rainy or wet season. Each sample was a composite of multiple sample aliquots collected over a 12-24 hour period.

This study was designed to answer the following two questions:

1. How do the relative contributions of PCBs differ between dry season/baseflow and wet season/ storm conditions?

(Continued on page 6)

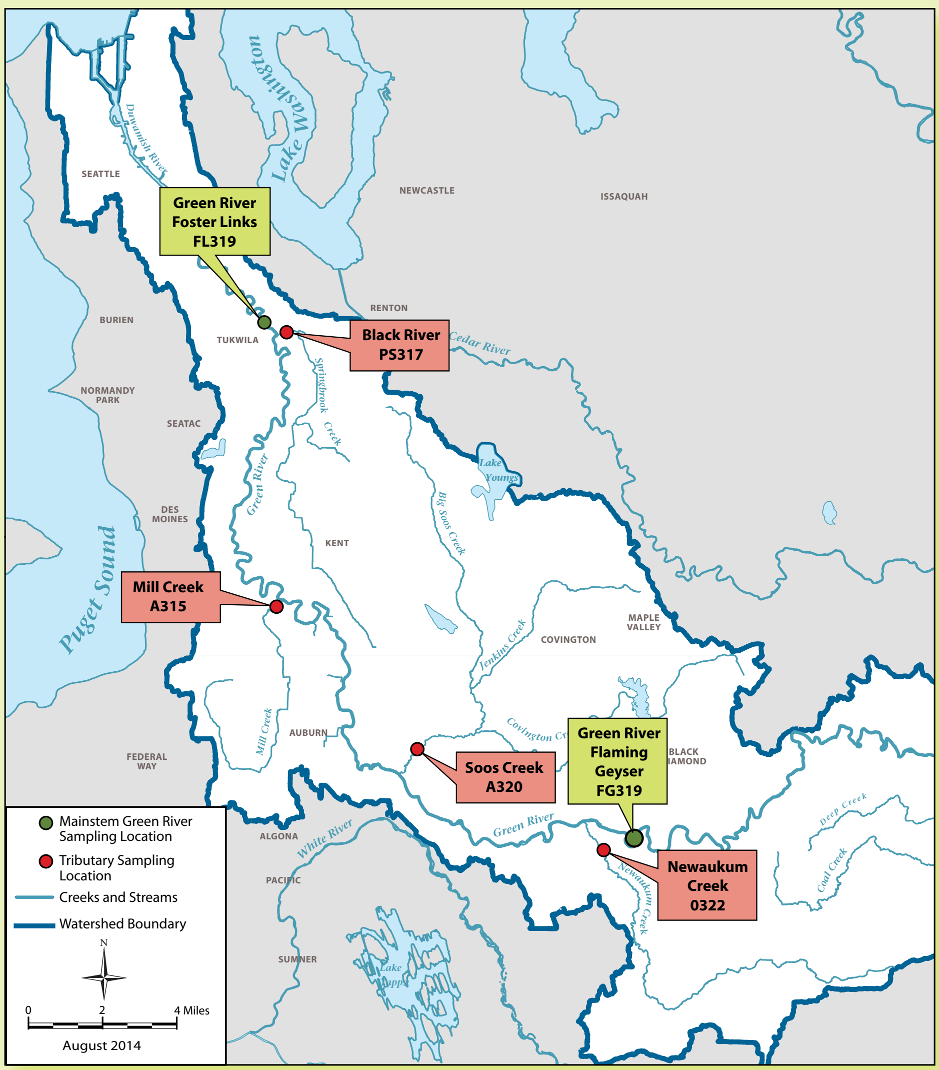


FIGURE 4.
Green River Watershed Surface Water Sampling Locations.

2. What are the relative spatial differences in PCB concentrations in the Green River and its major tributaries?

The data will help King County understand upstream sources of PCBs to the Lower Duwamish Waterway Superfund site. This water quality study by King County is just one of many efforts the County, the City of Seattle and Washington Department of Ecology are undertaking to understand and reduce sources of PCBs to the Lower Duwamish Waterway.

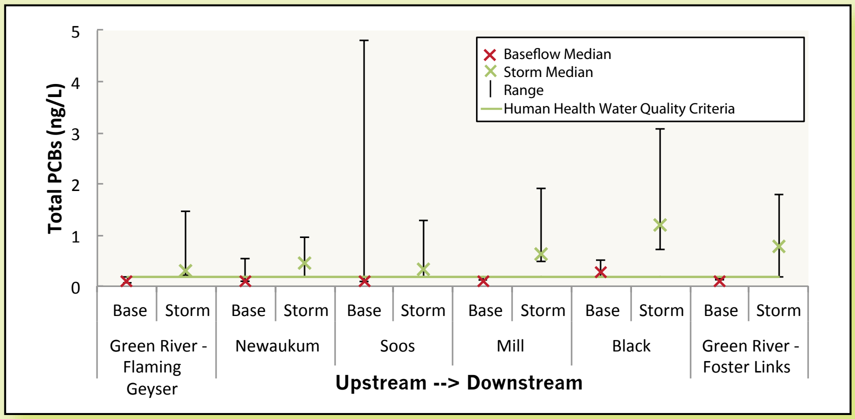


FIGURE 5.
Total PCB concentrations by location and for baseflow and storm flow conditions.

Results

PCBs were detected at relatively low concentrations in all samples. Total PCB concentrations during baseflow ranged from 0.0668 to 4.80 nanograms per liter (ng/L)[1] with an average concentration across all sites of 0.442 ng/L. Total PCB concentrations during storm events ranged from 0.173 to 3.09 ng/L with an average concentration across all sites of 0.804 ng/L. The concentrations are well below Washington state water quality criteria for the protection of aquatic life (14.0 ng/L) but some are above the criteria based on protection of human health (0.170 ng/L), which is a level meant to protect people who eat fish from the river, not a level for drinking the water.

Median[2] concentrations during storm events were higher than baseflow medians at all sites. At the three most downstream sites – Mill Creek, Black River and Green River Foster Links – all storm event PCB concentrations were higher than baseflow PCBs (**Figure 5**). PCB concentrations were statistically higher during storm events than during baseflow when the data were grouped by Green River mainstem sites or by the three tributaries, Newaukum, Soos and Mill creeks. This means we saw higher concentrations overall during storm conditions than during summer baseflow conditions. This suggests more PCBs are entering the river during periods of rainfall than during periods without rainfall.

During both baseflow and storm events, the lowest median PCB concentrations were detected at the most upstream location, Green River – Flaming Geyser, and the highest median PCB concentrations were detected at the most downstream tributary, the Black River; however, there were no statistical differences between sampling locations. This tells us that while we can see a difference in median concentrations, the variability in the concentrations of PCBs at each location is too high to result in true difference between the locations.

The downstream Green River mainstem location includes more developed land use than the upstream location, which we might expect to be associated with higher PCB concentrations. When we compared PCB concentrations at the two sites, they were generally within the same range of each other. It is possible more samples collected over a longer time period could tease out potential differences in PCB concentrations or perhaps the large volume of flow from upstream is diluting the influence of PCBs from local runoff at the downstream location.

PCB concentrations found in this study are comparable to previous sampling efforts in the lower Green River and to a study in the Snohomish River and Puyallup River watersheds.

Currently, we are analyzing additional surface water data from the upper reaches of the Green River, both above and below the Howard Hanson Dam, to characterize PCB concentrations in areas further removed from development and urbanization and therefore less impacted by their pollution sources. The new sampling sites above Howard Hanson Dam will allow evaluations of water quality in forested land use where PCB sources should be largely from atmospheric transport, including global transport of PCBs.

The full Lower Duwamish Waterway Source Control: Green River Watershed Surface Water Data Report can be found at: www.kingcounty.gov/environment/wastewater/ Duwamish-waterway/PreventingPollution/PollutionSources.aspx

[1] This is the same as parts per trillion or one part in 1,000,000,000,000.
[2] The median represents the middle value of the dataset.

2014 Water Year Summary

By Jeff Burkey

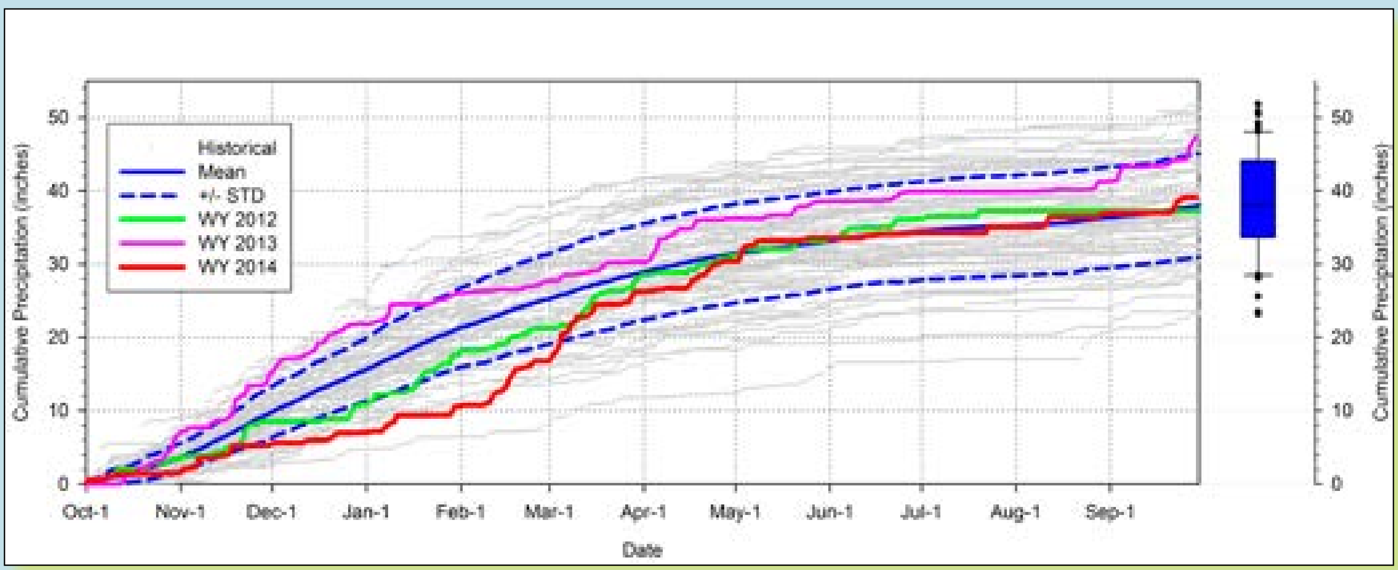
A summary of the 2014 King County water year using National Weather Service Sea-Tac gage; October 1, 2013 thru September 30, 2014 data.

Rainfall

- There were 141 days of measured rainfall (i.e., does not include “trace” amounts)
- 10% of the annual total fell in 3 days (4.42 inches)
- 25% of the annual total fell in 9 days (10.48 inches)
- 50% of the annual total fell in 22 days (19.94 inches)
- Maximum daily total this year: 1.84 inches on March 5, 2014
- Annual rainfall this year was 39.11 inches
- Historical average is 38.36 inches (1949-2013)
- March was a record month for total rainfall at 9.44 inches

Seasons

- The winter and spring were extremely wet,
- The fall was dry and
- The summer was average in total seasonal rainfall
- And there were 28 out of 52 weekends of rainfall during the water year



The cumulated Sea-Tac Precipitation for water years 2012, 2013, & 2014 along with the historical daily mean, and the standard deviations of the daily mean per calendar day. A water year period is October 1 - September 30.

2014 Science Seminar
Wednesday, November 5, 2014

King Street Center, 8th Floor Conference Center
201 South Jackson Street, Seattle Washington

LOOK FOR THE UPCOMING AGENDA

King County's Science and Technical Support Section sponsor's annual Science Seminars, where King County scientist and special guests present recent findings from their environmental, engineering and scientific programs.

Science Seminars provide an opportunity for sharing New Discoveries, Exiting Findings and Fantastic displays in the vast array of environmental science and Natural Resource management.

SCIENCE SEMINAR, NOV 5, 2014 AGENDA

8:00-8:10 **WELCOME** Jim Simmonds and Kate O'Laughlin

SESSION 1 – MARINE
Moderator - Deb Lester

8:10 - 8:30 **Zooplankton monitoring in Puget Sound**
Julie Keister

8:30 - 8:50 **Going with the flow: assessing phytoplankton diversity with the FlowCAM**
Amelia Kolb

8:50 - 9:10 **Marine moorings in Elliott Bay: What you didn't know you were missing**
Wendy Eash-Loucks

9:10 – 9:30 **Brightwater eelgrass restoration: the grass really is greener on the underside**
Kim Stark

9:30 - 9:50 **The WRIA 9 marine shoreline monitoring and compliance pilot project**
Kollin Higgins

9:50 –10:10 **BREAK**

SESSION 2 - FUTURE PLANNING
Moderator - Gino Lucchetti

10:10 -10:30 **Climate change and population growth impacts on stormwater management needs**
Jeff Burkey

10:30 -10:50 **100-year approach for building stormwater facilities to restore stream flows and water quality**
Olivia Wright

10:50 -1:10 **Channel evolution and habitat formation following the removal of the Rainbow Bend levee on the Cedar River**
Josh Latterell

11:10 -11:30 **Duwamish Blueprint: Salmon habitat restoration in the Duwamish Transition Zone through 2025**
Elissa Ostergaard

11:30 -11:50 **Using B-IBI to identify Puget Sound watersheds for restoration and protection**
Chris Gregersen

11:50 -12:00 **Closing Remarks** Jim Simmonds and Kate O'Laughlin

Why are Lake Washington fish contaminated with PCBs?

By Richard Jack and Jenee Colton

In 2002-2003, King County's Water and Land Resources (WLR) Division, in cooperation with the University of Washington, investigated the food web in Lake Washington. These studies included fish and invertebrate tissue testing for a large number of chemicals and documented high levels of polychlorinated biphenyls (PCBs) in multiple fish species. Based on these results, the Washington State Department of Health (WADOH) issued an advisory recommending limited consumption of northern pike minnow, yellow perch, and cutthroat trout because of high levels of PCBs (see **Table 1**). Since then, carp has also been added to the advisory.

TABLE 1.
Lake Washington Fish Consumption Advisory for PCBs

Species	Advisory
Northern Pikeminnow	Do Not Eat
Carp	Do Not Eat
Cutthroat Trout	Limit to 1 meal per month
Yellow Perch	Limit to 1 meal per week

Meal size varies with body weight with 8 oz. of uncooked fish assumed for a 160-pound adult. See WADOH website for details. www.doh.wa.gov/CommunityandEnvironment/Food/Fish/MealSize.aspx

The WLR Division recently completed a U.S. Environmental Protection Agency-funded study to investigate why Lake Washington fish have high levels of PCBs. This project was specifically designed to:

- Determine key pathways delivering PCBs to Lake Washington,
- Estimate the current amount (grams per year load) of PCBs entering Lake Washington each year,
- Estimate the minimum time necessary for fish tissue concentrations to meet WADOH consumption advisory thresholds after PCB load is reduced; and,
- Estimate size of PCB load reduction needed to remove fish consumption advisory.

Collection and testing of unfiltered water samples was necessary to provide data for analysis and modeling. Samples were collected from streams, rivers, combined sewer overflows [CSOs], stormwater discharges, floating bridge runoff, and atmospheric deposition as well as the lake itself.

Data from 146 PCB water samples were combined with modeled and existing flow data to develop annual loading estimates. Loading is the product of a chemical concentration multiplied by the volume. Total PCB loading to Lake Washington was estimated to be 672 grams/year; the relative proportions by pathway are shown in **Figure 1**.

The local drainage pathway represents both stormwater and base flow delivered to Lake Washington

(Continued on page 10)

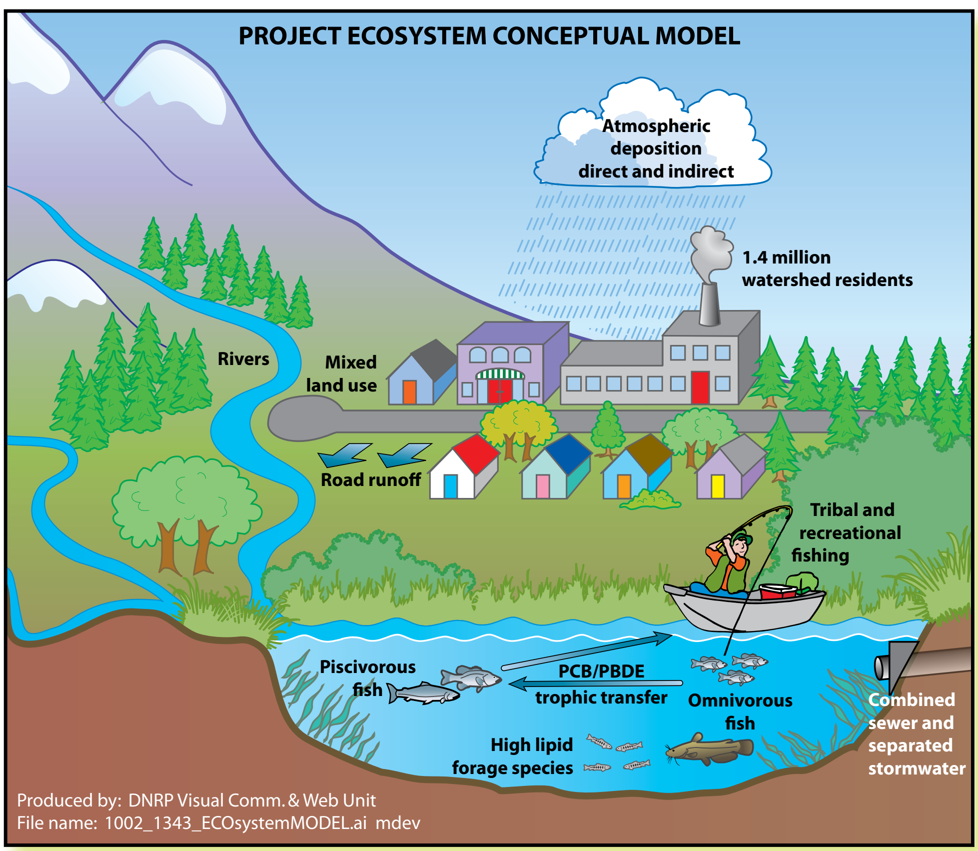


FIGURE 1. Annual PCB load estimates for pathways to Lake Washington

(LAKE WASHINGTON PCBs - *Continued from page 9*)

via streams. This pathway contributes the majority of the annual PCB load to the lake. Although stormwater only represents 40 percent of the annual water volume flowing into Lake Washington, 80 percent or more of the PCB load is from stormwater because of much higher PCB concentrations. The PCB loads delivered through direct atmospheric deposition on the lake surface and by the Cedar and Sammamish rivers are second in importance. Of the 672 grams / year total PCB load to the lake, an estimated 140 grams / year is exported from the lake outlet at the Montlake Cut. The remainder is buried in sediments or volatilizes (i.e. escapes to the air).

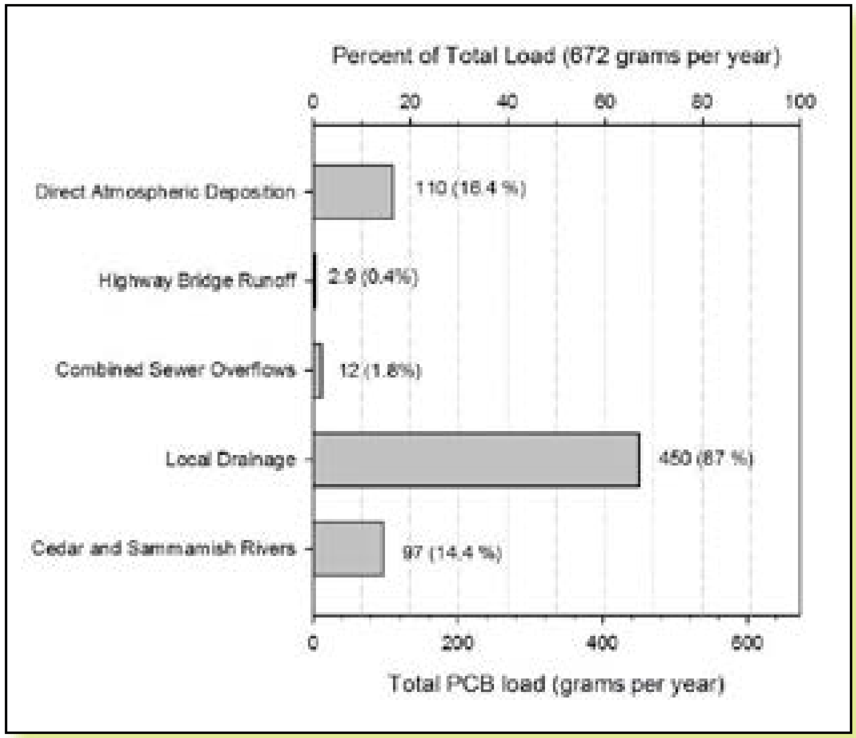


FIGURE 1.
Annual PCB load estimates for pathways to lake Washington.

Water and Land Resources Division scientist developed a fate model to predict sediment and water concentrations given a certain PCB load. This was linked to a bioaccumulation model which predicted fish tissue concentration based on water and sediment concentrations. These linked fate and bioaccumulation models were used to describe the effects and timing of changes in load on fish tissues.

Based on the fate model, Lake Washington sediment and water PCB concentrations would decrease in response to theoretical and instantaneous PCB load reductions most dramatically within 20 years; sediment concentrations would continue to slowly decrease, assuming no other changes in PCB input or output to the lake, for about 40 years. While 20 to 40 years is a long time, in the absence of substantial watershed-wide efforts to reduce PCB loads, the existing fish consumption advisory is projected to remain indefinitely.

Despite a ban on the production and many uses of PCBs in the late 1970s, the fate and bioaccumulation modeling results estimate an 85 percent reduction in PCB loading is currently required to reduce Lake Washington fish tissue concentrations to safe levels and remove the existing WADOH fish consumption advisory. To progress toward reductions of this magnitude we recommend the following actions:

- Trace and identify ongoing PCB sources in current and historically used materials;
- Develop a statewide and/or regional PCB inventory in urban areas to enable targeted source control actions;
- Conduct outreach and engage decision-makers and the community in discussion about the current widespread sources of PCBs, and the financial and regulatory challenges inherent in controlling such sources, Evaluate the effectiveness of existing treatment technologies and best management practices for PCB removal; and,
- Develop models that estimate the contribution of atmospheric PCB deposition to stormwater runoff.

The full array of project products can be found at:
www.kingcounty.gov/environment/wlr/sections-programs/science-section/doing-science.aspx

WHAT ARE PCBs?

PCBs are one of a family of man-made organic chemicals known as chlorinated hydrocarbons. They were manufactured from 1929 until production was banned in 1979. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes, and carbonless copy paper; and many other industrial applications. PCBs persist in the environment today and are still found within materials that are in use.

The Science & Technical Support Section: Equity and Social Justice Business Plan Statement

By Larry Jones and Jim Simmonds

King County's Equity and Social Justice (ESJ) Program directs county agencies to make the 14 determinants of equity increasingly available through their actions (see **Table 1: Determinants of Equity**). ESJ calls for a focus on both equity in the development and decision processes (process equity) and equity in the distribution of project benefits and burdens (distributional equity) This represents an effort to ensure that all residents in King County have equal opportunities in life and King County government acts in a fair and just manner at all times (*www.kingcounty.gov/exec/equity.aspx*).

Advancing equity and social justice foundational practices is an important element of the Science Section's program. It is critically important to the success of our work – that the data and information we provide meet the needs of an increasingly diverse King County population.

The determinants of equity that the Science and Technical Support section can focus on include the following:

- **Equity in County Practices;**
- **Education;**
- **Healthy Built and Natural Environments;**
- **Food Systems;**
- **Parks and Natural Resources;**

While the ways in which the Science Section can best advance ESJ will continue to evolve, the Section's ESJ commitments currently include the following:

- The Science Section recognizes that cultural competency is an ongoing learning process and the section will actively include ESJ training and education into individual and section work program activities.
- Each Science Section staff member shall demonstrate effective, non-biased, and appropriate interaction with all customers, audiences, co-workers, and institutions.
- The Science Section will look to raise visibility of ESJ by integrating Equity and Social Justice Practices into all aspects of our work.
- The Science Section will recognize and identify bias in our service delivery and effectively implement corrective practices.
- The Science Section shall communicate information and education that is beneficial to the health of the environment and resident well-being in all communities.
- The Science Section will work to build community trust, interest, and support for our work.

TABLE 1: 14 Determinants of Equity

Equity in county practices that eliminates all forms of discrimination in county activities in order to provide fair treatment for all employees, contractors, clients, community partners, residents and others who interact with King County;
Job training and jobs that provide all residents with the knowledge and skills to compete in a diverse workforce and with the ability to make sufficient income for the purchase of basic necessities to support them and their families;
Community economic development that supports local ownership of assets, including homes and businesses, and assures fair access for all to business development and retention opportunities;
Housing for all people that is safe, affordable, high quality and healthy;
Education that is high quality and culturally appropriate and allows each student to reach his or her full learning and career potential;
Early childhood development that supports nurturing relationships, high-quality affordable child care and early learning opportunities that promotes optimal early childhood development and school readiness for all children;
Healthy built and natural environments for all people that include mixes of land use that support: jobs, housing, amenities and services; trees and forest canopy; clean air, water, soil and sediment
Community and public safety that includes services such as fire, police, emergency medical services and code enforcement that are responsive to all residents so that everyone feels safe to live, work and play in any neighborhood of King County;
A law and justice system that provides equitable access and fair treatment for all;
Neighborhoods that support all communities and individuals through strong social networks, trust among neighbors and the ability to work together to achieve common goals that improve the quality of life for everyone in the neighborhood;
Transportation that provides everyone with safe, efficient, affordable, convenient and reliable mobility options including public transit, walking, carpooling and biking.
Food systems that support local food production and provide access to affordable, healthy, and culturally appropriate foods for all people;
Parks and natural resources that provide access for all people to safe, clean and quality outdoor spaces, facilities and activities that appeal to the interests of all communities; and
Health and human services that are high quality, affordable and culturally appropriate and support the optimal well-being of all people;

Contributors to King County's Sci FYI

Carly Greyell

Carly Greyell (Western Washington University, B.S.) is a recent addition to the King County Science and Technical Support Section and is part of the Toxicology and Contaminant Assessment group. She has been supporting many of the Lower Duwamish source control projects and will be involved in ongoing toxics monitoring and new projects assessing the effectiveness of stormwater treatment.

Sally Abella

Sally Abella is a senior limnologist and engineer with more than 35 years of experience who leads the freshwater assessment group in the Science Section of the King County Water and Land Resources Division. She is involved in a wide range of projects related to water quality improvement and monitoring on lakes and streams around the county, both as a subject matter expert and as a program and project manager.

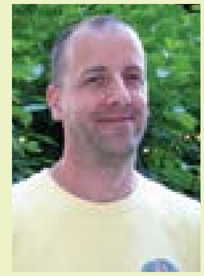
Rachael Gravon

Rachael Gravon joined the Science and Technical Support Section in 2014 as a water quality planner and limnologist. She recently relocated to Seattle from Bellingham, where she received her MS in Environmental Science from Western Washington University. Rachael participates in numerous projects involving lake water quality and watershed management.

Jenée Colton

Jenée Colton is a water quality scientist in the King County Science and Technical Support Section with 20 years of experience in aquatic ecology, environmental toxicology and risk assessment. She is particularly experienced with PCB contamination. She provides technical and project management services for King County on toxics monitoring, source control investigations, and toxics bioaccumulation.

Richard Jack

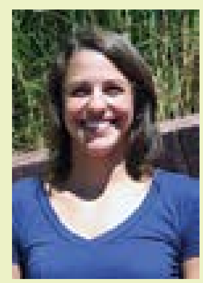


Richard Jack is a water quality scientist within the King County Science and Technical Support Section with over 17 years of experience investigating water, sediment and tissue quality problems. He currently serves internal clients addressing contaminated habitat restoration projects, as section expert to the Wastewater Treatment Division on emerging contaminants, and supports source control investigations in the Lower Duwamish Superfund site.

Debra Williston

Debra Williston is an environmental scientist within the King County Science and Technical Support Section with 25 years of experience in conducting water and sediment quality assessments and ecological risk assessments with a focus on contaminated sediment sites over the last 12 years. She is a member of the technical team conducting remedial investigations and feasibility studies for both the Lower Duwamish Waterway and East Waterway Superfund sites. She also provides technical and project management support for various source control investigations that support the Superfund sites.

Olivia Wright



Olivia Wright is a hydrologist who has been with the King County Science and Technical Support Section for the last year. She specializes in urban hydrologic modeling and stormwater best management practices. She is a transplant from Atlanta, GA who received her Master's degree in environmental engineering from the University of Washington.

Jim Simmonds

Jim Simmonds is the Water Quality Unit Supervisor of King County's Science and Technical Support Section. He has over 25 years' experience monitoring and modeling environmental conditions, managing environmental investigations, managing environmental data, and assessing potential impacts of stormwater, wastewater, and environmental contamination. He has been with King County for 17 years.

Published by:

King County
Department of Natural Resources and Parks
Water and Land Resources Division
Science and Technical Support Section

Section Manager: Dave White

Newsletter Coordinator: Larry Jones

Editor: Doug Williams

Designers: Laurel Preston, Sandra Kraus

Web Design/Production: Fred Bentler

Available on the Web at:
http://www.kingcounty.gov/environment/wlr/science-section/sci-fyi-newsletter.aspx

Send questions, comments and future story ideas to:

Kate O'Laughlin - kate.olaughlin@kingcounty.gov, 206-477-4789

Jim Simmonds - jim.simmonds@kingcounty.gov, 206-477-4825

File: 1408_4252s_SciFYInews.indd skrau