

Appendix H

B-IBI Data



MEMORANDUM

To: Kurt Triplett, City Manager

From: Ryeann-Marie Tuomisto, Water Quality Program Coordinator
Jenny Gaus, PE, Surface Water Supervisor
Marilynne Beard, Interim Public Works Director and Deputy City Manager

Date: September 5, 2014

Subject: **Stream Bug Monitoring in Kirkland**

Since 2001, Surface Water staff within Public Works have been monitoring stream health by collecting samples of benthic macroinvertebrates (stream bugs) from creeks in Kirkland. These bugs are used as indicators of stream health because they are long-term inhabitants of streams, relatively immobile, easy to collect, and represent an assemblage that responds predictably to degradation of water, sediment and habitat.

Stream bugs live in and on the bottom of streambeds. They are also called *benthic macroinvertebrates* (*benthic* = bottom dwelling, *macroinvertebrates* = large animals without backbones). These organisms include mayfly larvae, stonefly larvae, caddisfly larvae, snails, beetles, worms, and many others. These bugs are one of the “vital signs” of a healthy ecosystem, as they play a crucial role in the stream nutrient cycle; the absence of certain species in a stream can signal a problem; and bug population fluctuations can indicate a change (good or bad) in a stream.

Knowledge of what bug species live in these systems, how they interact within the heavily modified stream environment, or how they responds to urbanization and the specific stressors that accompany such change can help us to craft effective conservation and restoration strategies for our local streams.

A method called the Benthic Index of Biological Integrity, or B-IBI, is used as a “report card” for measuring the health of the stream bug community and the stream ecosystem as a whole. The B-IBI is a synthesis of diverse biological information that numerically depicts associations between human influence and biological attributes. This approach compares what is found at a monitoring site to what is expected using a regional baseline condition that reflects little or no human impact (Karr 1996b). Just as doctors use data from a check-up (e.g., blood samples, temperature, weight, blood pressure, etc.) to compare against what is considered healthy in humans, this index utilizes a variety of measurements to assess the biological condition, or health, of streams.

The B-IBI is composed of ten "metrics." Metrics measure different aspects of stream biology, including the diversity of bug species, number of bugs, and presence of bugs that are tolerant and intolerant to pollution, reproductive strategy, feeding ecology, and population structure.

Previously, the total B-IBI score ranged from 10 to 50. A value of 50 indicates that a stream's biology is equivalent to what would be found in a "natural" stream in the region with little or no human impact (ecologically intact, able to support the most sensitive organisms); and a value of 10 indicates poor biological conditions within the stream (unable to support a large proportion of once-native organisms). As of September 1, 2012, Puget Sound samples changed the way of calculating this metric. The total B-IBI score can now range from 0 to 100, with scores ranging within 80-100 represents a stream with excellent biological conditions and scores between 0-20 represents a stream with very poor biological conditions (Table 1 – Attachment A). The change was decided by members of the B-IBI Puget Lowland Calibration Team as a more accurate way to calculate tolerant vs. non-tolerant taxa of macroinvertebrates (Puget Sound Stream Benthos).

In Kirkland, benthic bug samples have been collected from (Map 1 – Attachment A):

- Main stem of Juanita Creek
- Tributaries to Juanita Creek, including:
 - North Fork
 - Kingsgate
 - Billy Creek
- Forbes Creek
- Cochran Springs Creek
- Denny Creek

Some sites have had samples collected consecutively for over thirteen years, while others were inherited from King County Roads Department after the June 1, 2011 annexation or added to expand our knowledge of water quality in other streams within the City. Also, a few sites were removed due to close proximity to King County Department of Natural Resources and Parks (DNRP) sampling locations. King County DNRP has sampling locations in Denny, Juanita, and Forbes Creek (Map 1 – Attachment A). Below is a summary of results per stream:

- Main stem of Juanita Creek (four sampling locations):
 - Using the 10-50 scoring system between the years 2001-2012, B-IBI scores ranged from 10 to 26, which indicates very poor to poor stream conditions (Fig. 1 – Attachment A).
 - Using the new 0-100 scoring system in 2013, B-IBI scores ranged from 14 to 26, which indicates very poor to poor conditions.
- Tributaries to Juanita Creek, including (totaling four sampling locations):
 - North Fork Tributary (E1186) (one sampling location):

- Using the 10-50 scoring system between the years 2005-2012, B-IBI scores ranged from 12 to 20 (Fig. 2 – Attachment A), which indicates very poor to poor conditions.
- Using the new 0-100 scoring system in 2013, B-IBI scores was 14, which indicate very poor conditions.
- Kingsgate Tributary (two sampling locations):
 - Using the 10-50 scoring system between the years 2011-2012, B-IBI scores ranged from 14 to 16 (Fig. 2 – Attachment A), which indicate very poor conditions.
 - Using the new 0-100 scoring system in 2013, B-IBI scores ranged from 14 to 18, which indicates very poor conditions.
- Billy Creek (one sampling location):
 - Using the 10-50 scoring system between the years 2011-2012, B-IBI scores ranged from 16 to 18 (Fig. 2 – Attachment A), which indicates very poor to poor conditions.
 - Using the new 0-100 scoring system in 2013, B-IBI scores was 16, which indicate very poor conditions.
- Forbes Creek (totaling three sampling locations):
 - Using the 10-50 scoring system between the years 2001-2012, B-IBI scores range from 14 – 20 (Fig. 3 – Attachment A), which indicates very poor to poor conditions.
 - Using the new 0-100 scoring system in 2013, B-IBI scores range from 14 to 16, which indicate very poor conditions.
- Cochran Springs Creek (totaling one sampling location):
 - Using the 10-50 scoring system in 2012, B-IBI score was 14 indicating very poor conditions.
 - Using the new 0-100 scoring system in 2013, B-IBI score was 16 also indicating very poor conditions.
- Denny Creek (totally one sampling location):
 - Using the 0-50 scoring system between the years 2006-2011, B-IBI scores range from 12 – 20, which indicates very poor to poor conditions. Sampling occurred sporadically through the years at this site because the channel tends to dry and no bugs can be collected and was decided to be removed as a City of Kirkland sampling site after 2011 due to close proximity to a King County sampling location.

In 2013, we took a deep look at the City of Kirkland data and tried to understand why our biological health scoring system indicated our streams to be generally very poor to poor. We wanted to verify if the health of the stream in regards to benthos was indeed very poor to poor or whether other factors that were influencing our rating, such as low number of bugs collected and timing of sampling occurring after rain storms, which could have wash away the macroinvertebrates. In 2014, we altered our sampling procedures to include more sampling area to increase the amount of bugs collected and sampling during the driest period of the summer. Results of 2014 sampling will be

available early 2015 and the City can verify whether the altered sampling method provided more valid information or if Kirkland biological health is indeed very poor to poor.

Data from over 50 jurisdictions within Puget Sound enter their data into the Puget Sound Stream Benthos website (Fig. 4 – Attachment A). The purpose of the site to allow for one large-scale Puget Sound data repository, consistent data analysis, and sharing of data and program methods.

RESOURCES

“Salmon Web: Community Based Monitoring for Biological Integrity of Streams.”
<http://www.cbr.washington.edu/salmonweb/>

“Stream Bug Monitoring.” <http://kingcounty.gov/environment/data-and-trends/monitoring-data/stream-bugs.aspx>

“Puget Sound Stream Benthos.” <http://pugetsoundstreambenthos.org/Default.aspx>

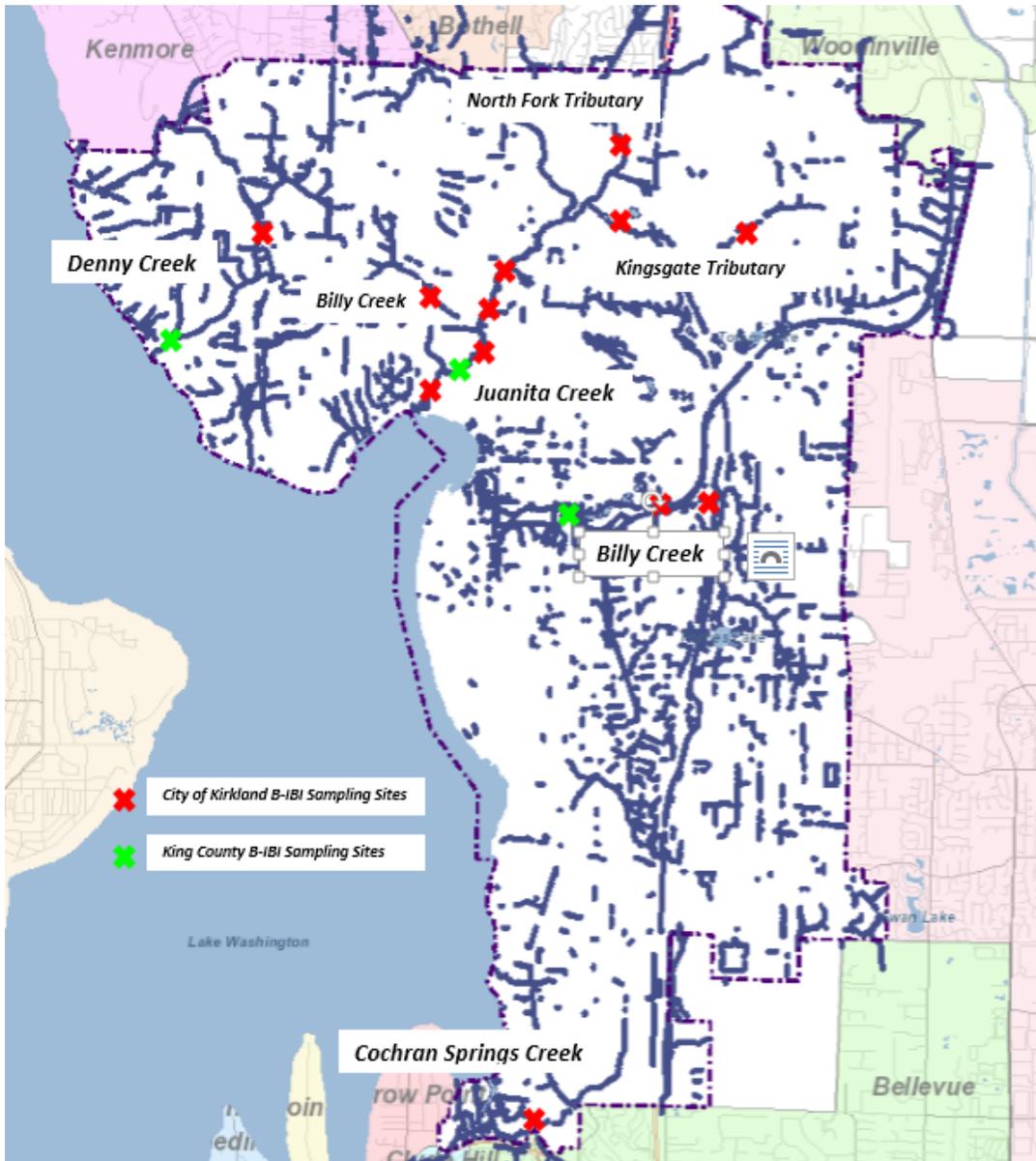
Miller, S. W., P. Budy, and J. C. Schmidt. 2010. Quantifying macroinvertebrate responses to in-stream habitat restoration: Applications of meta-analysis to river restoration. *Restoration Ecology* 18:8-19.

Morley, S. A., J. R. Karr. 2002. Assessing and restoring the health of urban streams in the Puget Sound Basin. *Conservation Biology* 16:1498-1509.

ATTACHMENT A

Score (0-50)	Score (0-100)	Stream Condition
46-50	80-100	Excellent
38-44	60-80	Good
28-36	40-60	Fair
18-26	20-40	Poor
10-16	0-20	Very Poor

Table 1. B-IBI Biological Conditions Scoring System



Map 1. City of Kirkland B-IBI sampling sites

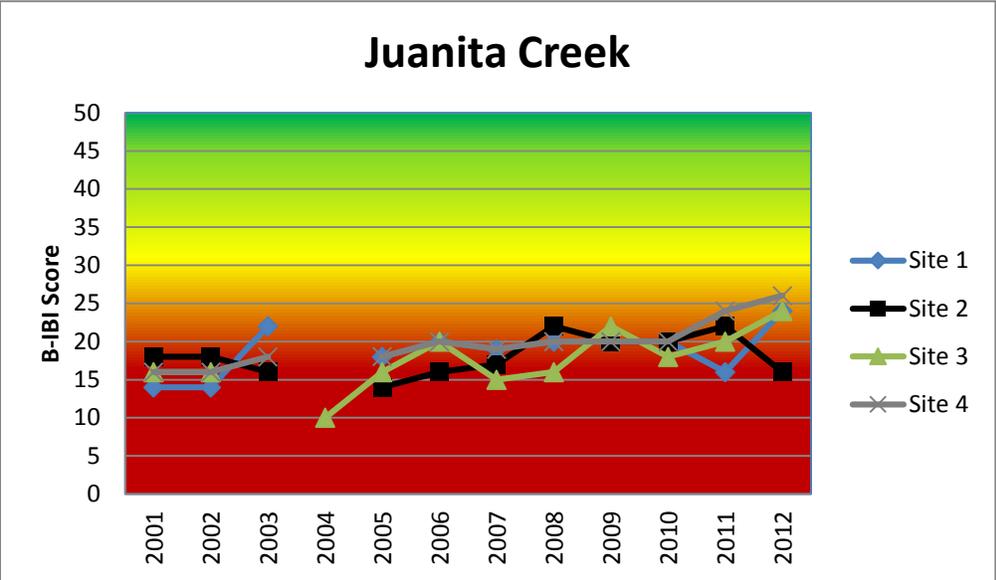


Figure 1. B-IBI Scores for Juanita Creek, 2001-2012

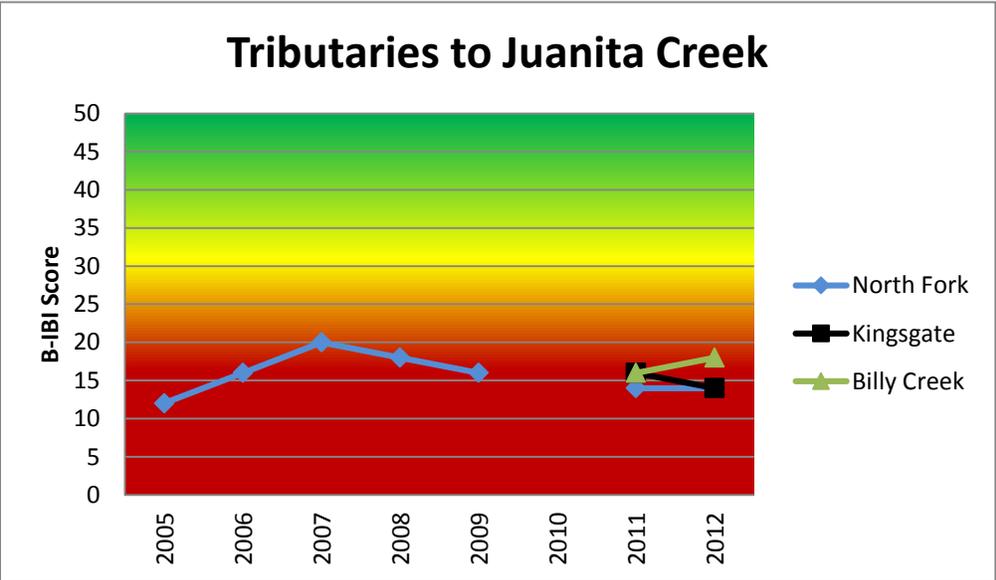


Figure 2. B-IBI Scores for Tributaries of Juanita Creek, 2005-2012

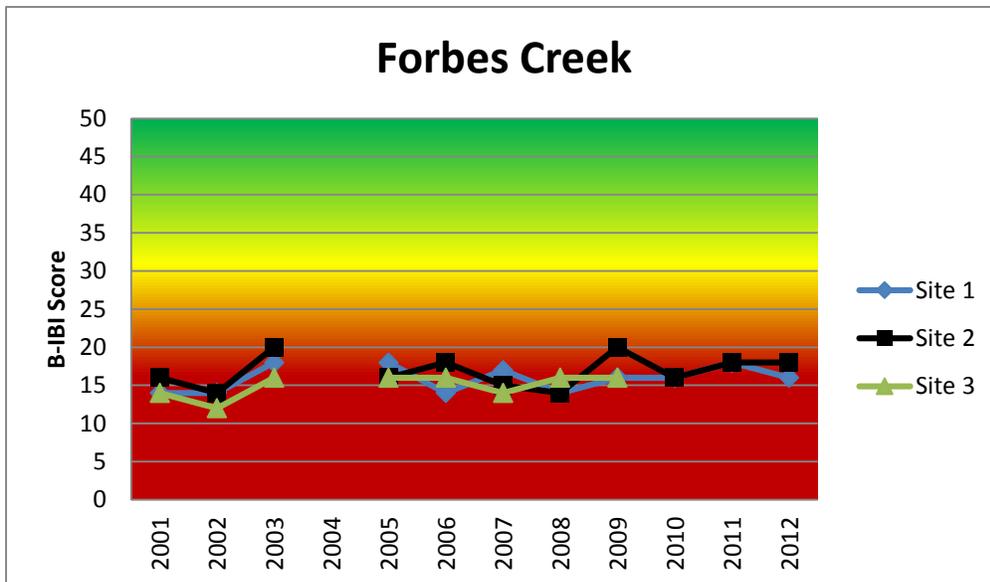


Figure 3. B-IBI Scores for Forbes Creek, 2001-2012

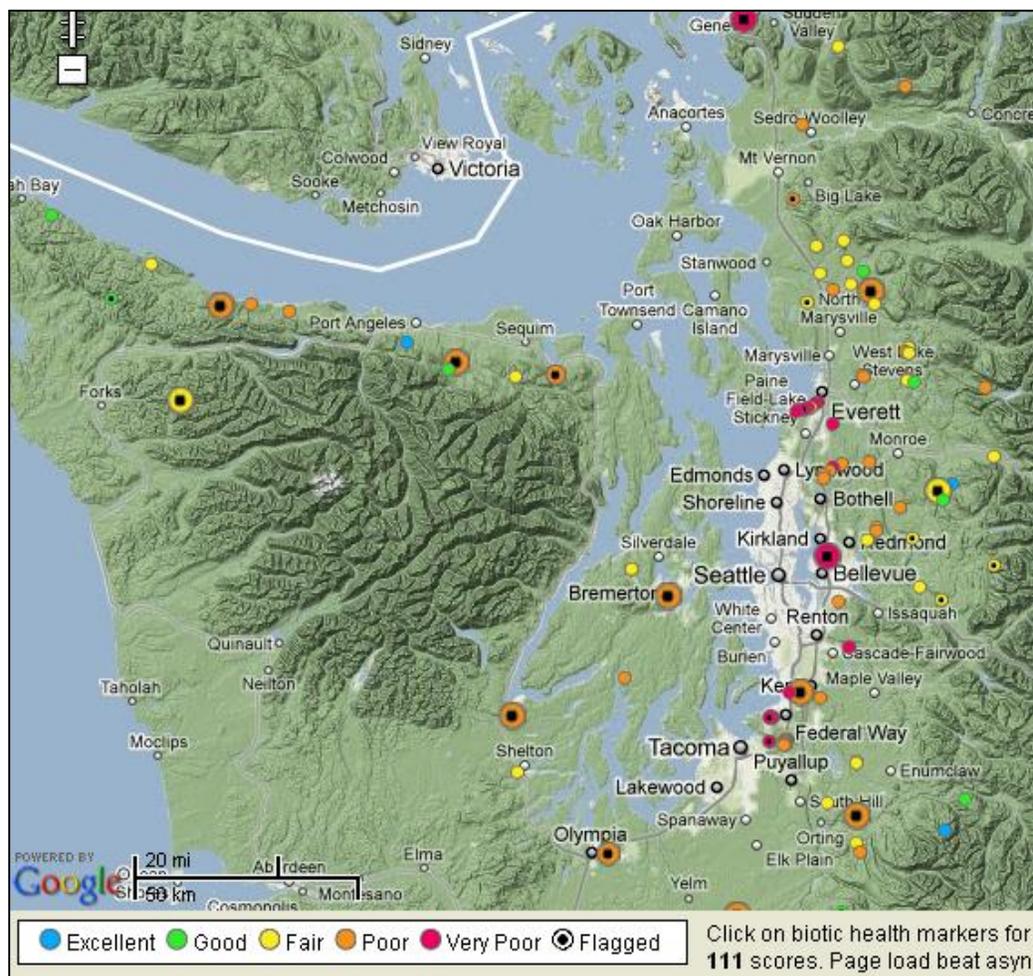


Figure 4. Regional B-IBI scores