



LOST  
URBAN  
CREEKS

## Springbrook Creek Water Quality Monitoring Summary 2019/2020 Final Report



February 2021

A project of



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**King County**

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Figure 1: UTB Intern conducting a Hardness test

**Introduction:** The Lost Urban Creeks Project highlights streams in urban areas, streams that are abused and neglected. These creeks often flow through communities most impacted by pollution and social injustice, highlighting environmental inequities in our region. Springbrook Creek is an example of a Lost Urban Creek.

Springbrook Creek flows through South King County and historically supported healthy runs of Chinook salmon. Its headwaters are still so pure that the City of Renton uses its springs for drinking water<sup>1</sup>. But as Springbrook Creek flows through developed areas of Kent and Renton, it is quickly surrounded by homes, businesses, parking lots and impervious surfaces that deliver pollution and sediment to the creek from stormwater runoff. The creek is also overrun by invasive species and lacks plant diversity and in many areas there is no canopy cover to provide shade for the creek. Today no salmon are found in the Springbrook Watershed.

Youth from Unleash the Brilliance (UTB), a unique youth mentoring program have been working with Puget Soundkeeper Alliance and other partners to restore the health of Springbrook Creek. UTB Youth have contributed over 2000 hours of paid work to protect clean water in Puget Sound. In the Lost Urban Creeks Project, they participate in the following activities along Springbrook Creek:

- **Monitoring Water Quality** – Regularly monitor water quality along the creek to document conditions and identify pollution.
- **Restoring Habitat** – Plan and conduct restoration work in the Black River Forest and new restoration efforts along Springbrook Creek. Doing regular clean-ups along the creek and surrounding region.
- **Building Community** – Many people live, work, and play near Springbrook Creek. UTB Youth engage community members in their work to improve the creek for everyone to enjoy.
- **Developing the Skills of the Youth** – Build environmental literacy to become future leaders, re-connecting to their education, and increasing their job skills.

This paper documents the results of one year of the water quality monitoring efforts in the Springbrook Creek that included the wet (Oct 2019 to Apr 2020) and dry season (May 2020 to Sep 2020).

**Background:** Springbrook Creek is a part of the Green-Duwamish River Watershed and is the largest sub-basin of the lower Green River Basin. It drains an area of about 15,763 acres<sup>2</sup>. Others have studied Springbrook Creek and its water quality in the past<sup>3</sup> and have provided a list of reasons explaining the decline in salmonid use, including riparian conditions, hydrology modification, sediment conditions,

<sup>1</sup> The City of Renton has a groundwater water right for 1050 gpm from the infiltration (spring) area, but currently use only up to approximately 750 gpm. No water is returned to the creek. (personal communication, Lauren Imhoff, Senior Program Specialist, City of Renton Public Works, Feb 19, 2021).

<sup>2</sup> Kerwin, J. and Nelson (2020) WRIA 9 Habitat Limiting Factors and Reconnaissance Assessment for Salmon Habitat Report, Part3.3-2

<sup>3</sup> Ibid. Regular monitoring has taken place at one station on Springbrook near Longacres in Renton (KCM-0317) starting in 1996 and became monthly monitoring in 2004 under the King County Ambient and Wet Weather Streams Monitoring program. In addition, Drainage District #1 monitors several locations in the watershed twice a year.

water quality, land use, and non-native species. Springbrook Creek is also on a Washington State list<sup>4</sup> of impaired streams due to water quality violations for high temperatures and low dissolved oxygen levels at multiple locations<sup>5</sup>. This appears to be a chronic seasonal occurrence and is believed to be the result of low water flows, lack of adequate riparian vegetation and shade, and pollution<sup>6</sup>.

**Methods:** Youth interns of the Lost Urban Creek Project were trained in July of 2019 by the Sno-King Watershed Council to conduct water quality monitoring of Springbrook Creek using methods established by the Alabama Water Watch and Global Water Watch (AWW/GWW). Eight locations were monitored throughout the watershed for Water and Air Temperature, pH, Dissolved Oxygen, Specific Conductance, Turbidity, Total Dissolved Solids, Nitrates, and Salinity. Weather and site conditions were noted, and garbage was collected at these sites. In addition, youth interns were trained in September 2020 in Global Water Watch Biomonitoring protocols and conducted sampling of six locations in Springbrook, Mill and Panther Creek to develop a Cumulative Index Value (CIV) of the benthic invertebrates present in these stream locations. Sampling protocols are outlined in the LUC Quality Assurance Program Plan<sup>7</sup> and the AWW/GWW Quality Assurance Program Plan<sup>8</sup>.

Site locations were identified using a three-letter code for the name of the creek (e.g. SPR for Springbrook Creek, MIL for Mill Creek, and PAN for Panther Creek) and a number for the number of river miles the site was located from the mouth of the creek (eg. SPR1.4 is at Springbrook Creek, 1.4 river miles from the mouth of the creek). The higher this number, the higher up in the watershed the site is located.

A YSI ProPlus multimeter and a LaMotte Water Quality Testing Kit were the main equipment used along with a turbidity tube and telescoping measuring rod. Equipment calibration, training, data collection and management are all detailed in the Lost Urban Creek Sampling plan. Biomonitoring used a kick net, a D-net, a Surber sampler (used variously at two sites in Mill Creek Earthworks Canyon Park, MIL5.3 and an adjacent site upstream above the sedimentation pond) and leaf packs were used at four additional sites (SPR3.0, SPR1.4, MIL0.8, & PAN0.0), which were placed in the stream a month prior to the assessment.

For basic water quality parameters, we visited sites on a monthly basis from September 2019 to September 2020 (the Wet & Dry Seasons of 2019-2020)<sup>9</sup>. Biomonitoring was only done in September 2020. The appendix has the list of sample locations and a map. Sites were selected to see changes along Springbrook and Mill Creeks as we progressed from the upper to the lower watershed (one site at the mouth of Panther Creek was also monitored).

When we were out monitoring the water quality of the creek, we often asked ourselves the question, “Is this a good place for Salmon?” or “Can Salmon do well here?” We wanted to check different water quality parameters to help us answer this question. Springbrook once supported spawning Chinook salmon so we need to learn why no Salmon are found in the creek today. While there are likely a

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<sup>4</sup> State Department of Ecology’s 303(d) list

<sup>5</sup> Kerwin, J. and Nelson (2020) P3.3-12.

<sup>6</sup> Harza (1995) in Kerwin, J. and Nelson (2020).

<sup>7</sup> Forterra NW & Puget Soundkeeper Alliance. (2020).

<sup>8</sup> Alabama Water Watch and Global Water Watch (AWW/GWW). (2019).

<sup>9</sup> The number of sites visited in September and November were limited (4 sites and 1 site, respectively).

number of reasons why this is the case, we wanted to see what role the water quality is currently playing. Can Salmon, or any fish and aquatic organisms survive in Springbrook Creek?

**Results:** Table 1 provides an overview of all of the data collected during the wet and dry seasons in the Springbrook Creek Watershed. During the wet season, most water quality parameters, such as water temperature, pH, Specific Conductance, etc., were well within the range that would allow Salmon to survive but results for two parameters (highlighted in yellow) indicated that there were some concerns. During the dry season, which had lower rainfalls (except in September) and lower stream flows, water temperatures increased significantly with one site exceeding State temperature standards (MIL0.8) in May; six sites fell below State standards for dissolved oxygen, and two sites had high turbidity (consistently so at PAN0.0 throughout the dry season).

Table 1: Springbrook Creek Water Quality Data Review for the wet and dry season (2019-2020)

	Water Temp. (deg. C)	pH	DO (mg/L)	SPC (us/cm)	Turbidity (NTU)	TDS (mg/L)	NO3-N (mg/L)	Garbage Collected (lbs)	Rainfall during visit (inches)	Flow (ft <sup>3</sup> /s)
<b>Wet Season Geomean (Average)</b>	9	7	8	144	<10	79	1.4	8	0.5	28
<b>Wet Season Minimum</b>	6 (at MIL5.3 on Feb 2020)	6	2 (at PAN0.0 on Oct 2019)	66	<10	1	0.1	0	0 (in Oct, Nov, & Apr)	1
<b>Wet Season Maximum</b>	17 (at MIL0.8 on Apr 2020)	8	13 (at MIL5.3 on Feb 2020)	253 (at SPR5.0 on Oct 2019)	40 (at PAN0.0 on Feb 2020)	199 (at SPR1.4 on Feb 2020)	4.5 (at SPR5.0 on Mar 2020)	92.0 (at MIL4.2)	1.96 (in Dec 2019)	99 (at MIL0.8 on Dec 2019)
<b>Dry Season Geomean (Average)</b>	15.2	7.3	5	219.5	<10	143.5	1.5	3.3	0	2.2
<b>Dry Season Minimum</b>	11.9 (at SPR5.0 on Sep 2020)	6.1	0.1 (at PAN0.0 on Aug 2020)	100.3 (at MIL4.2 on Jun 28, 2020)	<10	65 (at MIL4.2 on Jun 2020)	0.57 (at MIL0.8 on Jun 2020)	0.5 (at SPR4.3 on Sep 2020)	0.01 (in May 2020)	0.05 (at MIL0.8 on Jul 2020)
<b>Dry Season Maximum</b>	19.6 (at MIL0.8 on May 2020)	8.1	12.7 (at MIL5.3 on Aug 2020)	440.6 (at PAN0.0 on Aug 2020)	90 (at PAN0.0 on Aug 2020)	286.7 (at PAN0.0 on Aug 2020)	2.98 (at MIL5.3 on May 2020)	94 (at MIL0.8 on Sep 2020)	0.57 (in Sep 2020)	15 (at MIL0.8 on Jun 2020)
<b>Total</b>								541		

#### a. Dissolved Oxygen (DO)

The Washington State standard for northwest rivers and streams states that dissolved oxygen should be 8 mg/L or higher (represented by the dashed red line in the chart below). Adult salmon do best at these levels but salmon eggs in gravel (which would typically be present between October and January) typically require 11 mg/L. Based on the wet season results, stations PAN0.0, SPR1.4, & MIL0.8 (the lowest stations in the watershed) were almost at or often below Washington Standards for dissolved oxygen. In the dry season, dissolved oxygen levels declined at all sites. Sites with the highest levels were located high in the watershed (SPR5.0 & MIL5.3). MIL4.2 only dropped slightly below the State Standard in September. All other sites were nearly at or completely below the State Standard throughout the dry season, with PAN0.0 having the lowest oxygen levels (1.9 mg/L or less), followed by MIL0.8 (4 mg/L or less), SPR1.4 (6.4 mg/L or less), SPR3.0 (7.1 mg/L or less), and SPR4.3 (8.1 mg/L or less).

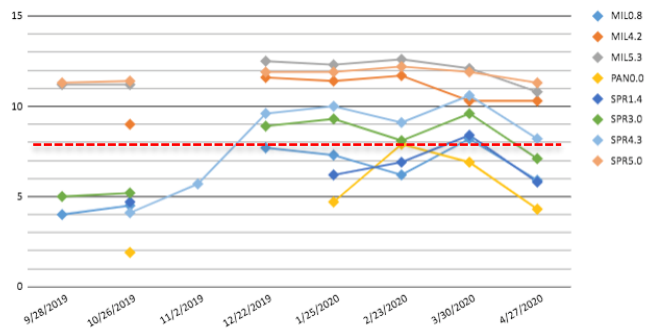


Figure 2: Wet Season Dissolved Oxygen (mg/L) Results

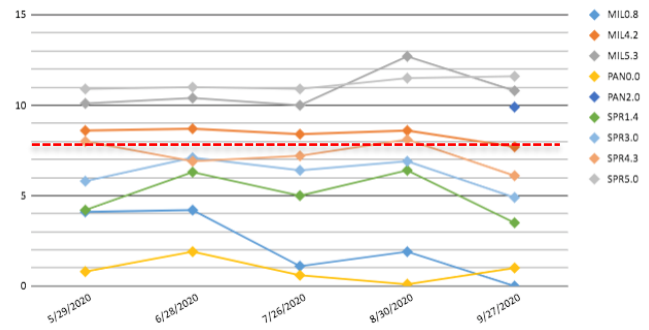


Figure 3: Dry Season Dissolved Oxygen Results

## b. Turbidity

Turbidity is the cloudiness or haziness of a fluid caused by suspended solids floating in the water and is measured in units called nephelometric turbidity units or "NTUs." Due to winter rains bringing more sediment into the creek, we expect to see higher turbidity levels in the wet season. Turbidity was an issue at a few locations between December and March. For Salmon and according to Washington State standards, turbidity should not be more than 5 NTU over the normal background level of turbidity (which for Springbrook Creek should be approximately 10 NTUs). During the Wet Season, six of the middle and lower stations in the Watershed (PAN0.0, SPR1.4, SPR3.0, SPR4.3, and MIL4.2) were often above this level (i.e. >15 NTU) at different times during the wet season: in October (PAN0.0); in December (SPR3.0, MIL0.8 & MIL4.2); in January (SPR4.3); in February (PAN0.0, SPR1.4, SPR3.0, SPR4.3, & MIL4.2), and in March (SPR3.0 & SPR4.3). During the Dry Season, when there is generally fewer rainfall events, we expect the waters of Springbrook to be clearer and have lower turbidity levels. Results showed that this was generally true for most sites except Panther Creek. PAN0.0 had consistently higher turbidity levels than even its winter values perhaps caused by or worsened by high levels of iron bacteria that give an orange color to the water (see photos below). Its highest turbidity level was 90 NTUs in August. MIL0.8 also had somewhat elevated turbidity levels with its high reading of 27 NTUs in August as well.

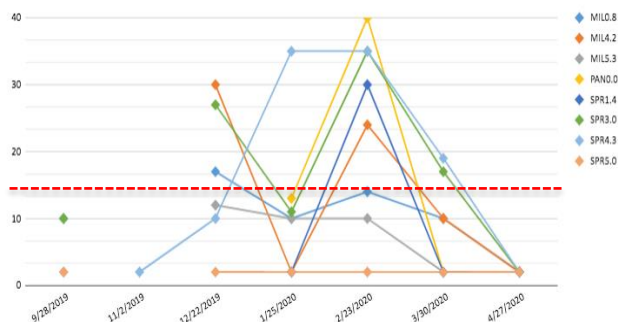


Figure 4: Wet Season Turbidity (NTUs) Results

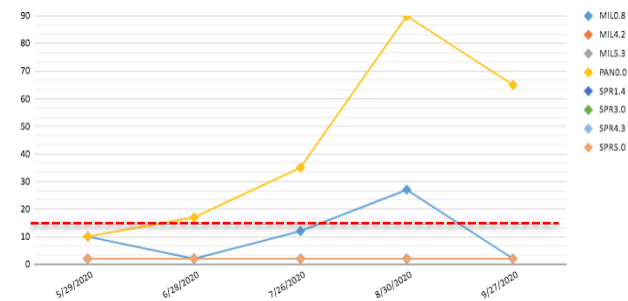


Figure 5: Dry Season Turbidity (NTUs) Results



Figure 6 & Figure 7: During the dry season water at Panther Creek (PAN0.0) had high turbidity and an orange color cause by Iron Bacteria



### c. Temperature

The Washington State Temperature Limit for surface waters should always be  $\leq 17.5^{\circ}\text{C}$ . During the wet season, temperatures achieved this. Temperatures in the wet season ranged from  $6^{\circ}\text{C}$  (in February 2020) to  $17^{\circ}\text{C}$  (in April 2020). During the dry season, temperatures ranged from  $11.9^{\circ}\text{C}$  (in September 2020) to  $19.6^{\circ}\text{C}$  (in May 2020). Three sites exceeded the State temperature standard: MILO.8 ( $19.6^{\circ}\text{C}$  in May and  $19.2^{\circ}\text{C}$  in July), SPR1.4 ( $19.2^{\circ}\text{C}$  in May) and SPR3.0 ( $17.7^{\circ}\text{C}$  in May).

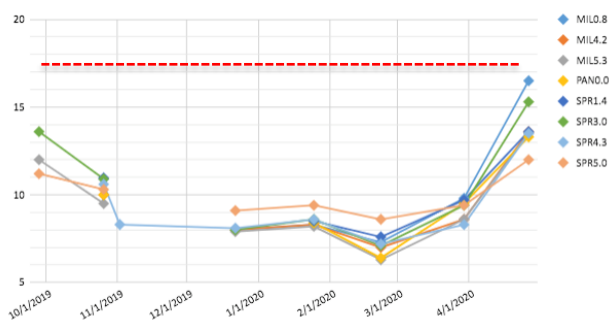


Figure 8: Wet Season Temperature (degrees C) Results

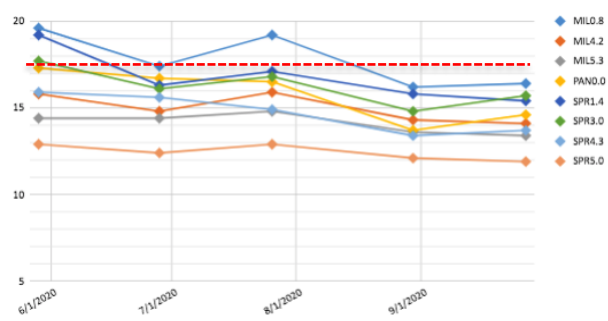


Figure 9: Dry Season Temperature (degrees C) Results

### d. Biomonitoring

At the five locations where biological assessments were done on September 5<sup>th</sup> 2020, the number of different invertebrate species (bugs) living in the stream were counted, which is an important measurement of the streams biological diversity. Invertebrates were classified and counted into one of three groups: Group I were bugs that indicate good to excellent water quality, since they are more sensitive to pollution; Group II were bugs that indicate fair water quality, and Group III were bugs that rate the stream's biological diversity as poor, as these were pollution tolerant species.

The number of species types or taxa observed were then counted to create an index value for each group and then the sum of all the group index values is calculated to find the **Cumulative Index Value (CIV)** for the stream. This number is then used to provide the stream quality assessment of either Poor (CIV < 11), Fair (CIV 11-16), Good (CIV 15-22), or Excellent (CIV > 22). The following table provides the results for each site surveyed (ranked from highest to lowest CIV value, but also highest to lowest sites in their respective streams).



Figure 10: UTB Intern doing bioassessment

Table 2: Springbrook Creek Bioassessment Results

Site	CIV	Stream Quality Assessment
MIL5.3	28	Excellent
Upstream of MIL5.3, upstream of sedimentation pond	16	Fair
MILO.8	8	Poor
SPR3.0	5	Poor
SPR1.4	4	Poor
PAN0.0	2	Poor

The most abundant organisms in the upper watershed were stoneflies, may fly, black fly, scuds and aquatic worms. The most abundant organisms in the lower watershed were leeches, scuds, sowbugs and aquatic worms.

#### e. Garbage Collected

A total of 541 pounds of garbage was collected at the different monitoring locations throughout the year, with the most collected at MIL0.8 (located on the Interurban trail and some commercial buildings near 72<sup>nd</sup> Street), MIL4.2 (located near a Ford Service Station in Kent), and SPR4.3 (located near 192<sup>nd</sup> St in Kent). Also, but to a lesser extent, MIL5.3 (in Mill Creek Earthworks Canyon Park in Kent) had moderate garbage accumulation but this included sharps, which were left in place. Since most of these sites are located in Kent, the work was done in collaboration with the Kent Adopt-A-Spot program and the City of Kent Public Works Department picked up all garbage that was collected.

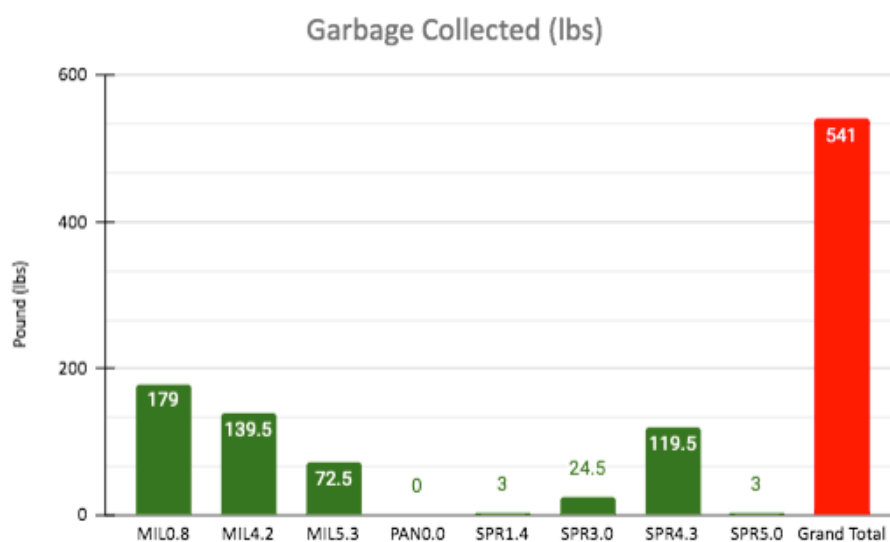


Figure 11: Garbage collected at different sites and overall (in lbs)

**Discussion:** Based on the full year of water quality monitoring, which was evaluated against State Standards and requirements for Salmon, most water quality parameters did not indicate concerns in Springbrook Creek during the wet season. Only two parameters, dissolved oxygen and turbidity, did indicate some potential problems during this period in lower Panther Creek. The summer, dry season showed more water quality concerns with dissolved oxygen, temperature, turbidity and biological assessments of stream invertebrates.

The amount of oxygen dissolved in water is affected by water temperature, as warmer water has less oxygen. While water temperature was within acceptable ranges during the wet season, it is clear that parts of the creek have limited to almost no riparian vegetation to provide shade to the water and water temperatures at some site in April were starting to approach the State Temperature Limit (water temperatures should be  $\leq 17.5$  °C). In the dry season, water temperature increased at all the sites, with three sites going above state temperature limits (MIL0.8, SPR1.4 & SPR3.0) in May and MIL0.8 doing so again in July. High nutrient content in the water can lead to low dissolved oxygen because nutrients encourage plant growth but in the fall plants start to die off and are consumed by other organisms, causing oxygen to be removed from the water. Nitrate levels were generally between Excellent and Fair during the Wet and Dry Seasons, but other forms of Nitrogen and Phosphorous were not tested, so

it was impossible to understand the full scope of nutrients entering the creek. Low and/or stagnant water flows and a lack of turbulence can also lower the dissolved oxygen in the creek and this may be the case as much of the lower part of the watershed is quite flat and water flow was often slow to moderate at best. The Black River Dam/Pump Station contributes to lower flows and stagnation in the lower basin as well. According to staff from the City of Renton, Panther Creek, after it passes under Highway 167, has significant stagnation problems, which likely contributed to low oxygen in the creek. High levels of Iron bacteria found throughout the watershed but particularly in Panther Creek can also consume oxygen and may contribute to low levels. Other pollutants in stormwater that wash into the stream during the winter may also impact dissolved oxygen levels but this was beyond the scope of the current project to evaluate.

Water with high turbidity levels can clog fish gills and suffocate them. The particles in highly turbid water also attach to other pollutants, such as metals and bacteria. Most creeks, urban or not, usually have near zero turbidity outside of rain events. Six of the middle and lower Springbrook Creek stations had higher turbidity during the wet season. High stormwater flows can bring in more pollution from the surrounding land to the creek or re-suspend the sediments in the creek. During the dry season, two sites (PAN0.0 from June through September & MIL0.8 in August) still had high turbidity. Panther Creek turbidity was higher than in the wet season and the creek is heavily impacted by Iron bacteria that is present throughout the watershed, which may play a more significant role in its turbidity issues than rain events.

Biomonitoring results showing very poor water quality in the lower basin sites compared to two upper basin sites in Mill Creek that had fair to excellent results. This confirms the other results that indicate a significant decline in the water quality the further you travel downstream in the watershed.

For garbage, the finding was that it seemed to accumulate most at those sites that offer easy access to the creek but are also less visible to the public, so that dumping of trash is less noticeable. Trash appears to also accumulate where there is a lack of connectivity in the trail system, such as where the Springbrook Creek Trail ends in Renton on the border with the City of Kent.

Puget Soundkeeper was able to maintain monthly sampling during the COVID Pandemic but because the interns could not participate from March to August, some of the additional sampling activities (testing for bacteria and other pollutants was not done).

**Recommendations & Next Steps:** To investigate the dissolved oxygen issues in Springbrook, it is recommended to look more closely at nutrients impacts to Springbrook and identifying where oxygen levels consistently drop below State Standards. King County should also evaluate how the operations of the Black River Pump Station can be changed to improve flows in the lower part of the watershed and support should be provided to the City of Renton to address water stagnation issues in Panther Creek. Increased efforts to control and remove pollutants from stormwater flows (e.g. stream bank restoration, increasing stream buffers, rain gardens, etc.) would improve both oxygen and turbidity levels. Given that dumping appears to occur where the creek is accessible but also out of public view, it is recommended that more attention be brought to these areas through programs like the Kent Adopt-A-Spot Program. Extending the Springbrook trail system into the City of Kent (along Springbrook and Mill Creek) is also recommended as well as providing amenities such as trash cans more frequently along the length of the trail.



The Lost Urban Creeks Project will continue monthly sampling into 2021. The next sampling year will change the list of sites visited to include some additional sites on Mill Creek because the City of Kent will soon initiate a major Mill Creek Re-establishment Project involving extensive sediment removal, culvert replacement, and restoration activities along a large section of this creek.

For more information about the Lost Urban Creeks Project, contact [LUC@pugetsoundkeeper.org](mailto:LUC@pugetsoundkeeper.org) or find us on Instagram at @lost\_urban\_creeks.

## Acknowledgements

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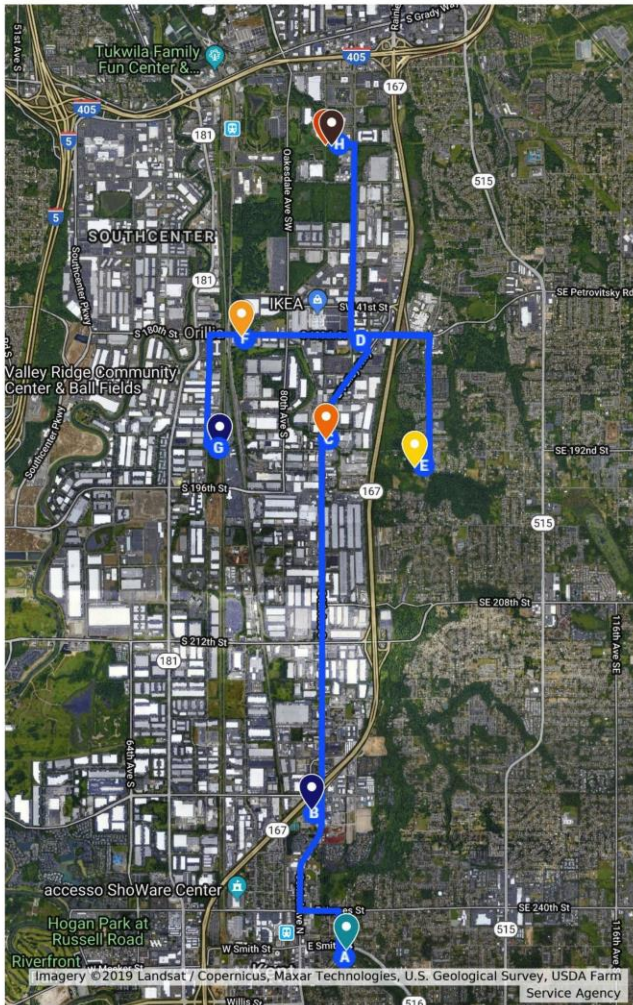
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## Appendix: Sample locations and Map

#	Site Code*	Site Name	Description	Latitude	Longitude
1	SPR1.4	Springbrook below Panther Creek - River Mile 1.4	Below confluence with Panther Creek	47.459	-122.2275
2	SPR3.0	Springbrook below Mill Creek - River Mile 3.0	Below Mill Creek Confluence - Facing Downstream	47.44088	-122.2392
3	SPR4.3	Springbrook below Garrison Creek - River Mile 4.3	Springbrook below Garrison	47.42986	-122.2257
4	SPR5.0	Springbrook - River Mile 5.0	Upper Springbrook Creek at Trout Farm – highest station	47.42852	-122.2150
5	MIL0.8	Lower Mill Creek - River Mile 0.8	Mill Creek – lowest station	47.43017	-122.2422
6	MIL4.2	Mill Creek - River Mile 4.2	Mill Creek near Ford Motor Co.	47.39606	-122.229
7	MIL5.3	Upper Mill Creek - River Mile 5.3	Upper Mill Creek – highest station	47.38282	-122.2246
8	PAN0.0	Lower Panther Creek - River Mile 0.0	Lower Panther Creek	47.45895	-122.2266

\*Site Codes consist of a 3-letter abbreviation for the name of the creek and a number representing the river miles to the mouth of the creek. For example, SPR5.0 is on Springbrook Creek 5 River Miles up from the mouth of the creek.

## Map of sampling locations



*The Lost Urban Creeks Project is funded in part by the King County Wastewater Treatment Division, The Russell Family Foundation and other sponsors.*

H) SPR1.4 – Springbrook Creek at River Mile 1.4 (Next to oil pipeline route)

H) PAN0.0 – Panther Creek at River Mile 0.0 (above confluence with Springbrook Creek)

G) MIL0.8 – Mill Creek at River Mile 0.8 (Next to Interurban Trail in Kent)

F) SPR3.0 – Springbrook Creek at River Mile 3.0 (south of S 180<sup>th</sup>, near our old Subway)

E) SPR5.0 – Springbrook Creek at River Mile 5.0 (the Trout Farm in Renton)

D) Baja Fresh Lunch stop

C) SPR4.3 – Springbrook Creek at River Mile 4.3 (Off S 192<sup>nd</sup> St.,)

B) MIL4.2 – Mill Creek at River Mile 4.2 (Ford-Lincoln Service Center off Central Ave N in Kent)

A) MIL5.3 – Mill Creek at River Mile 5.3 (Canyon Earthworks Park in Kent)