

This presentation is meant to summarize the water quality data collected from March 2021 (last Puyallup River Partnership Meeting) to March 2022.



Currently, Ecology is in the third year of monitoring for this 10 year effectiveness monitoring study that stretches from 2019 to 2030. For the full 10 years, Ecology monitors at long-term sites at the most downstream locations of Boise, Pussyfoot and Second Creeks. These were key areas defined by the 2011 Fecal coliform TMDL as a high priority for water clean-up in the Puyallup Watershed. The TMDL had focused on how these creeks in particular Boise and Pussyfoot are major sources of bacteria, but just from collecting recent water quality data, the water quality issues in the Enumclaw Plateau are a multi-parameter issue.



Ecology samples 4 sites monthly at the most downstream locations of the creeks to understand the trends of water quality at these three tributaries and I sampling for a full suite of parameters. Every 5 years, Ecology does watershed-wide intensive sampling at 26 implementation sites across the three watersheds. But given funding flexibility, there are additional samples collected to investigate potential pollution sources and that means collecting bacteria samples to track the sources of pollution.



The water quality issues in the Enumclaw Plateau are a multi-parameter issue, though we rely on bacteria sampling to track the sources of pollution. The map above displays the average (geometric mean a.k.a. Geomean) for E. coli from March 2021-22.

Ecology samples at the long term site at the mouth of Boise Creek and tributaries connecting to Boise Creek.

Ecology has been helping the City of Enumclaw explore the bacteria levels along the city's stormwater laterals/Drainage Ditch 6. Ecology is focusing on this Lateral since the second long-term site remains the consistently high bacteria source to Boise Creek throughout the summer and winter.



There are multiple sources of pollution to the stormwater system depending on the season:

- There are higher levels in Boise Creek during the dry season, due to slowing flows, increasing temperatures.
- There has been evidence of dog poop in these neighborhoods bordering the stream/drainage ditch.
- During the wet season, there is the influx of bacteria from rural areas bordering the city's stormwater system.

Ecology also explored upstream, northeast tributaries to Boise Creek to support Ecology nonpoint staff's priorities and gather more information on runoff issues associated with certain properties.



Pussyfoot Creek and Second Creek

Anne and I did a more extensive sampling effort in Pussyfoot Creek following the rain event in November. The South Fork Pussyfoot has high levels; this site in the past has had high wet season bacteria levels in 2019.

The combination of the high bacteria from this mainstem and the South Fork contribute to the high bacteria at the downstream Pussyfoot Creek site. Out of all long-term sites this year (2021-22), this Pussyfoot Creek site has the highest average bacteria.

This sampling from this year highlights the areas and creeks segments with higher bacteria pollution and guides nonpoint prioritization. Nonpoint staff are currently focusing on the upstream sections of Pussyfoot Creek and contacting properties where bacteria levels increase. They are additionally focusing on properties that border the SF Pussyfoot Creek.



The state's water quality standards state that:

- a geometric mean of E. coli over 90 day period should not exceed 100 cfu/100 mL and
- 2) a single E. coli sample should not be over 320 cfu/100mL.

Any points or results that do not meet that criteria are shown in red.

Dry season exceedances, bacteria thriving in higher temperatures but still flowing water, and during the wetter season each of these impairments are from the Pussyfoot Creek sites, for November and this past month.



Again, Pussyfoot Creek had the highest average/median bacteria out of the long-term sites for 2021-22). At the start of the wet season in November, Pussyfoot Creek has had high bacteria that exceeded bacteria criteria. This is likely due to the impact of runoff from upstream of this site.



There was a similar increase in nutrients for all sites following rain events for both **Nitrogen** and **Phosphorus** levels. These nutrient levels were the highest in agricultural areas such as Pussyfoot and Second Creeks. Even though these creeks are dry during the summer, during this winter season there are higher flows and thus greater delivery of nutrients directly to White River.

- Second Creek has the highest nutrient levels out of these tributaries. Second Creek tends to have higher nutrients and lower bacteria, at least compared to Boise and Pussyfoot Creek, which may indicate the influence of digestate entering the creek. There were several properties in this subwatershd noted by other agency staff to have improper timing when it comes to manure/digestate application during the wet season.
- There was a peak in nitrogen from the first major rain event in November.
- There was a slight increase in nutrients in Boise Creek in October possibly from the decomposition of salmon, which are a natural source of nutrients in the stream.

*Currently, Washington State does not set total nitrogen or phosphorus standards. This is why there are no results highlighted in red. In absence of a set criteria, water quality issues caused by excess nutrients may first be detected by more sensitive criteria that are already in place. For example, bacteria are usually associated with similar impacts that arise from high phosphorus levels, thus Ecology typically uses bacteria and pH impairments to determine if there are nutrient challenges. The criteria for these parameters are already designed to be reliable indicators of trophic health.



Phosphorus levels are more sporadic and did not follow this same first flush peak. Phosphorus levels seemed to peak and pulsate with every rainfall event. *This connects with the upcoming pH TMDL*. Phosphorus has been identified as the limiting factor for pH—phosphorous is likely related to agricultural land uses, including manure & fertilizer use, as well as septic issues.

Reducing high bacterial discharges could also reduce excessive phosphorous in stormwater runoff; therefore, many of the approaches are the same for addressing both FC and pH TMDLs.



Higher temperatures and lower flow has an impact on dissolved oxygen levels at most of the creeks during the summer. Low flow during the summer and increasing temperatures that de-saturates the amount of oxygen in a stream.

Increased turbidity can affect dissolved oxygen levels. More suspended particles absorb more heat and increase water temperature. These factors lead to a decrease in dissolved oxygen.



There was a drop in dissolved oxygen during the November rain event, below criteria of 8.5 mg/L. Increased turbidity can affect dissolved oxygen levels. More suspended particles absorb more heat and increase water temperature. These factors lead to a decrease in dissolved oxygen. This is ultimately a multi-parameter issue; during these rain events, highly turbid runoff containing high bacteria and nutrients affects factors such as dissolved oxygen, during crucial salmon spawning times.



Water quality index can be used as a report card for water quality for each stream. This score presents water-quality on a scale ranging from 1 to 100, with a higher number indicating better water quality. Each parameter is evaluated and the overall score takes into account all of the evaluated parameters. The index does not replace a technical evaluation and comparing to state's water quality standards, but an index is useful for comparative purposes and for answer general questions (And what particular parameters are of greatest concern at each sites).

https://ecology.wa.gov/Research-Data/Monitoring-assessment/River-streammonitoring/Water-quality-monitoring/River-stream-water-quality-index

To start with the Boise Creek sites on the right, we see that the most downstream location has relatively better water quality compared to other long-term sites, yet there are fecal and temperature issues that are still a concern. The upstream Boise Creek site that is directly downstream of the stormwater outputs has an overall poor water quality score with poor fecal coliform and dissolved oxygen conditions. There has been a slight improvement in the score at both Boise Creek sites compared to the 2020-21 score.

As we move towards the outskirts of the Enumclaw, these sites in this area of the

watershed seem to have a poor nutrient issue. Though it might be an ephemeral stream during the summer months, Second Creek has very high nutrient levels especially during the winter. These nutrient levels combined with poor dissolved oxygen drives down the overall score.

Pussyfoot Creek also has a moderate fecal and dissolved oxygen scores.



The Puyallup River Watershed Fecal Coliform Total Maximum Daily Load (TMDL) set individual targets for Boise Creek sites and a Pussyfoot Creek site based on season (Mathieu and James, 2011). These targets represent the target fecal coliform (FC) capacity, which takes into account the state's water quality criteria for FC (e.g. the geometric mean should not be above 100 cfu/100mL and no more than 10% of the samples should be above 200 cfu/100mL). The target capacity also takes into account the FC levels necessary to handle FC loads and still provide the designated beneficial uses. **Essentially, these targets provide a measure of the loading capacity during the most critical period.** Sites with lower targets have a greater margin of safety for FC loading. **The Puyallup River watershed FC target capacities are expressed not as loads.** Instead, they are expressed as concentration statistics which relate and are comparable to the state's FC criteria stated above. In addition, bacteria standards have changed as of 2020 and no long rely on FC as the main bacteria indicator; however, since the TMDL was approved before the standards changes the TMDL targets that use FC as a bacteria indicator still remain in place.

The TMDL found that Boise Creek had the highest FC loading and geometric mean, particularly during the dry seasons. Boise Creek is represented by the three sites on the right that are in order of downstream to upstream. There have been improvements in the dry season at least for the lower stretches of Boise Creek (i.e. Boise Creek at Mud Mountain Rd and Boise Creek at 252nd), while the wet season levels have been steady. Both Boise Creek at Mud Mountain Rd and Boise Creek at 252nd are downstream of the city of Enumclaw. It is possible that projects such as decommissioning of on-site septic systems (OSS) and connection of more properties to the City's sewer system might have had an impact on dry season bacteria sources.

There was no wet season targets set by the TMDL for Boise Creek at 276th site (shown on the far right), since the site met standards. An evaluation of the 2019-2020 data confirmed that this site currently meets standards for wet season. Yet, here were was an increase in FC levels in the dry season. This site is further upstream than other the Boise Creek sites evaluated by the TMDL and is located near a connecting southern tributary. Based on 2019-2020, this southern tributary has been shown to have consistently high bacteria during the summer months.

Pussyfoot Creek was an also evaluated by the TMDL. Since it is an ephemeral creek that flows mostly during the wet season, targets were set for a full year. The geometric means for Pussyfoot Creek were relatively high for a creek with more wet season flow.



In Washington State FC TMDL studies, the upper limit statistic (i.e. not more than 10% of the samples shall exceed) has been interpreted to be comparable to the 90th percentile value of the log normalized values. The TMDL also uses 90th Percentile as a metric for targets. The 90th percentile represents the upper distribution of results, and the TMDL specified that no more than 10% of results should be higher than 200 cfu/100mL. The evaluation of the 90th Percentile metric shows improvement in dry season FC levels for lower Boise Creek. The upstream sites met targets during the wet season. Pussyfoot Creek has the highest 90th percentile calculated for the 2019-2021 sampling period. Wet season rain events and runoff events may drive these periodically high bacteria levels.



Ecology shares water quality data in multiple ways:

- The Puyallup River partnership page provides links to each of these data sources. It is the main repository for quarterly reports and the meeting summaries.
- Ecology's multi-parameter water quality data are updated at the <u>Puyallup River</u> <u>Tributaries Effectiveness Monitoring StoryMap</u>
- Puyallup partners, including King County Stormwater Services, Washington State Department of Agriculture, and Ecology, update bacteria data on the <u>Whatcom</u> <u>Conservation District StoryMap</u>. This StoryMap allows multiple partners to share and map information in one place.
- Direct download of ecology data from Ecology's database is also available.

