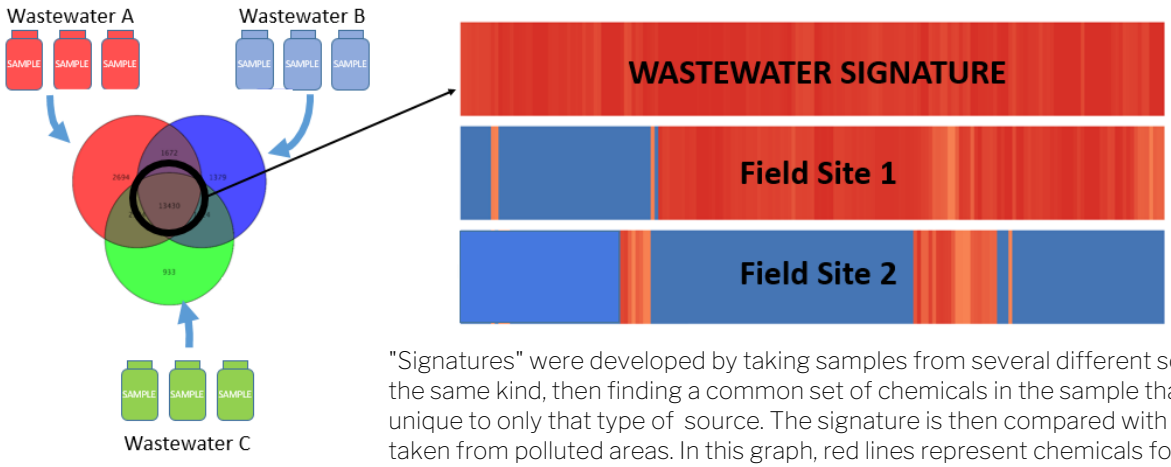
USING CHEMICALS TO TRACE AND IDENTIFY SOURCES OF FECAL POLLUTION

Since 2015, Skagit County has been working with the University of Washington, Tacoma's Center for Urban Waters to develop new ways to identify the source of fecal bacteria pollution in waterways. Previous work identified a set of chemicals like caffeine and ibuprofen that would indicate that pollution was coming from a sewage source. We partnered with UW Tacoma to develop a suite of chemicals that would indicate that a pollution source was coming from livestock.

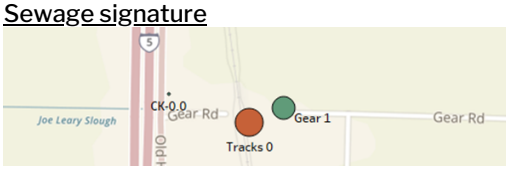
In 2018, we changed our approach. Not all farms and households use the same chemicals, so looking for specific chemicals wasn't as helpful as we'd hoped. Instead, we looked at *all* chemicals in a possible pollution source. This approach let us develop a "signature" or "fingerprint" of chemicals that are common to that specific source. Then we can match those signatures to samples taken from polluted waterways, and understand better where pollution was coming from.

To date, we've developed unique signatures for sewage, dairy manure, and road runoff. Early testing has shown that this approach is more successful at identifying sources than looking for individual chemicals.

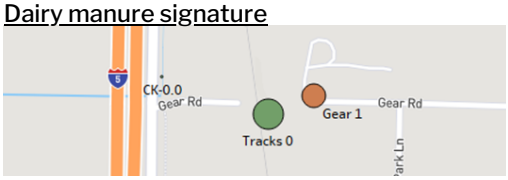


"Signatures" were developed by taking samples from several different sources of the same kind, then finding a common set of chemicals in the sample that are unique to only that type of source. The signature is then compared with samples taken from polluted areas. In this graph, red lines represent chemicals found in abundance. Orange represents a less abundant chemical, and blue represents a chemical not found in a sample. Field Site 1 has a high likelihood of having a wastewater source, while Field Site 2 is not as good of a match.

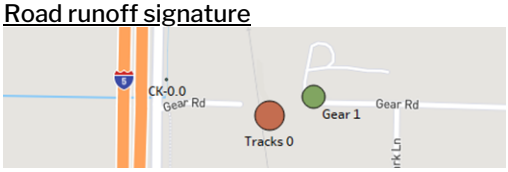
Sewage signature



Dairy manure signature



Road runoff signature



Impact scale: Low — High

Samples were taken at two polluted sites, and compared with the signatures for sewage, dairies, and road runoff. Results clearly indicate that the "Tracks 0" site is heavily impacted by sewage and road runoff, while "Gear 1" is influenced by nearby dairies.

Plans for 2020 and beyond

Now that we've developed the signatures for sewage, dairies, and road runoff, we plan to test it out in places where we've had trouble pinpointing the source of pollution with normal bacteria source tracking.

We also want to use the same "signature" method to develop a signature for dog poop. We know that dogs can be a significant source of fecal pollution in some areas. Having a tool that could help pinpoint them as a source will be helpful.

Last but not least, we want to know whether chemical signatures will change over time as chemicals degrade in the environment. This will help us understand whether, for example, the signature from a dairy manure application that occurred two weeks ago will look the same as one that happened yesterday.

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