

Conductivity

Conductivity at all sites where data are available appears to follow a similar pattern from Nov 2021-present indicating consistent conditions throughout all sites. Spikes in conductivity consistently seen across sites could indicate heavy precipitation events where runoff entered the Bashakill from sewage effluent. High conductivity

often indicates high concentrations of salt and provides lower water quality. Underlying geology can contribute to observed conductivity in water. Underlying geology along the Bashakill includes shales and greywackes, with limestones upstream. This is likely contributing to the high baseline conductivity signal here. Overall, mean conductivity measured at sites PKBK3S (145 uS/cm) and PKBK4S (184 uS/cm) is significantly higher ($p < 2.2 \times 10^{-16}$) than at PKBK2S (136 uS/cm). This could be due to underlying geology, a point source of pollution, or a confluence with another stream system and warrants consideration for further evaluation. Curiously, high conductivity is observed during spring and summer 2020 at sites PKBK2S and PKBK4S, but not PKBK3S. This could indicate a collection error or potentially allude to the behavior of pollutants as they enter the stream, especially since the overall conductivity signal is weaker at site PKBK3S. Examining the hydrology at sites PKBK2S-4S could determine entry points of contaminants into the streams and then help to indicate their nature (density/lifespan).

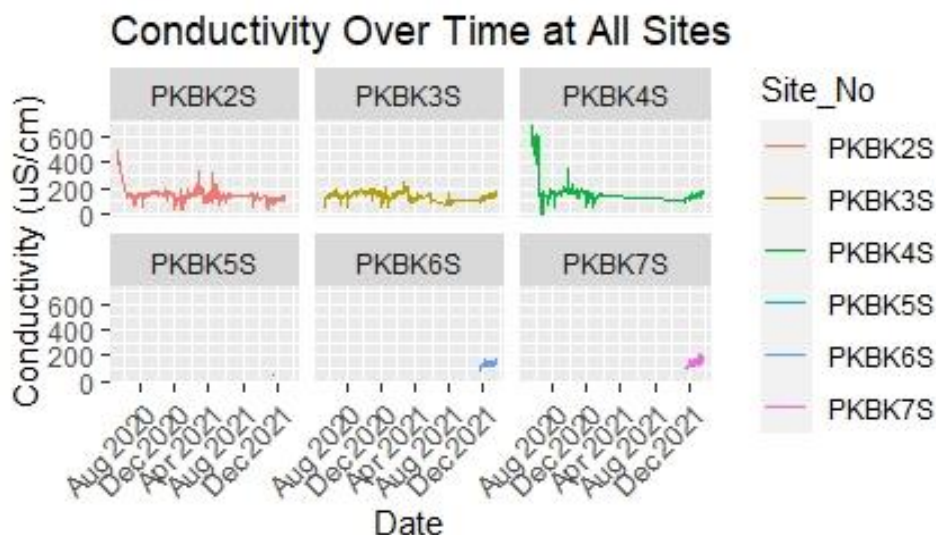


Figure 1. Conductivity Over Time at All Sites. Conductivity at sites PKBK2S-PKBK7S for all dates where data are available. Gap in data exists from winter-fall 2021 at site PKBK4S and from late summer – fall 2021 at site PKBK3S and appears on plot as plateaued line.

Depth

Depth across all sites where data are available appears to follow a consistent trend indicating a precipitation signal. At site PKBK4S there is a gap in data between January and October 2021. Overall, mean depth at site PKBK2S (483 mm) is significantly higher than at site PKNK3S (310 mm) ($p < 2.2 \times 10^{-16}$). This could indicate that erosion is occurring at site PKBK2S faster than at PKBK3S. It also could indicate a change in underlying geology where more permeable material or better soil drainage exists at site PKBK3S than at site PKBK2S.

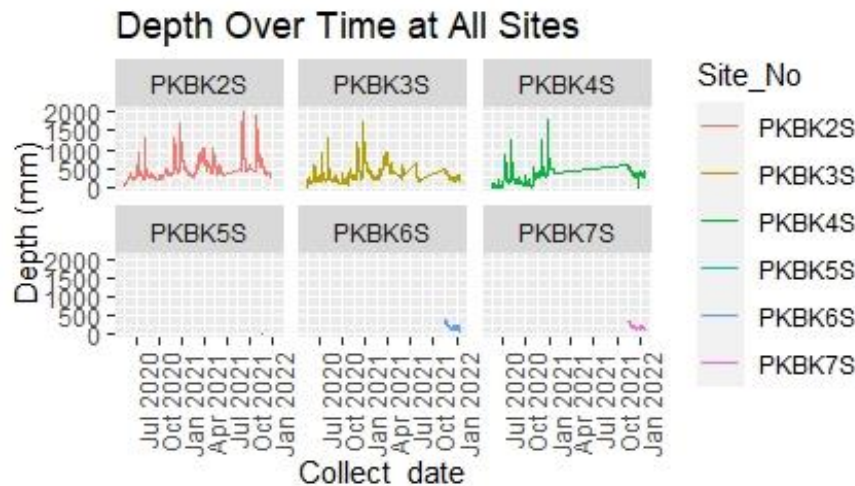


Figure 2. Depth Over Time at All Sites. Depth at sites PKBK2S-7S where data are available. Gaps in data exists at sites PKBK2S-4S and appear on plot as flat lines.

If underlying geology and soil drainage are consistent between sites, it could indicate that there are larger influxes of water at site PKBK2S, and that at any given time there is more water entering the system at that location, and then draining elsewhere before reaching site

PKBK3S. Average depth at site PKBK4S (219.3mm) in 2020 lower than at sites PKBK2S and PKBK4S

perhaps due to the deposition of sediment or the diversion of water into other stream channels.

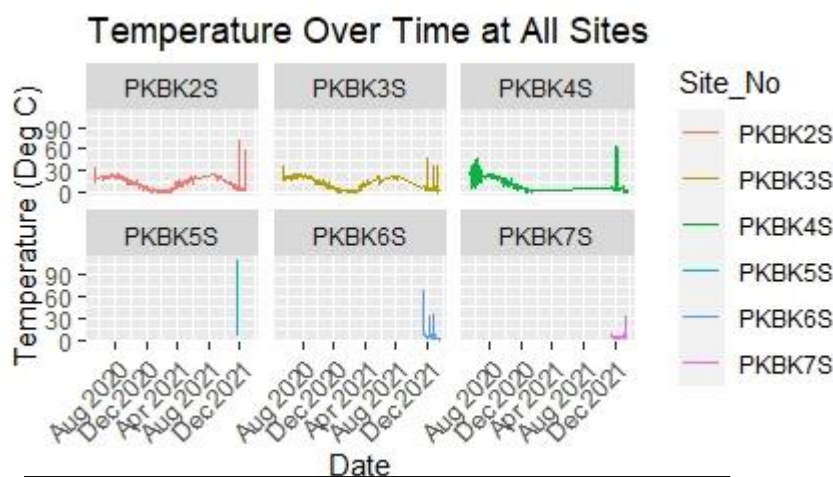


Figure 3. Temperature Over Time at All Sites. Water temperature at sites PKBK2S-7S where data are available. Gaps in data exists at site PKBK4S during 2021 and appears on plot as flat line.

Temperature

Water temperature at sites PKBK2S and PKBK3S follows a distinct seasonal cycle. At site PKBK4S during the spring of 2020, temperature seems to oscillate rapidly, possibly indicating a confluence of waters of different temperatures. Data are not available for the

same period in 2021 so it is unclear if this occurs regularly in the spring at this location. The large spikes in temperature observed across all sites

in late 2021 could be the result of thermal pollution or wastewater where a plume of warmer water entered the stream system. Overall average temperature at site PKBK2S (11.7 °C) is slightly higher than at PKBK3S (11.6 °C), $p < 0.001$, and could possibly be attributed to differences in vegetation. Given similarities in temperatures, dissolved oxygen

should be consistent between sites and should have an inverse relationship with temperature.

Bottle Tests

In May 2020 the Bashakill stream tested positive for total coliform, and during July and August of 2020, the Bashakill Pond tested positive for Fecal Coliform. In May 2020 nitrate was not detected in the Bashakill stream, and <0.05 mg/L of nitrate was detected in the Bashakill pond. In October 2020, 0.179 mg/L of nitrate was detected in the Bashakill Stream, and similarly high levels were maintained through August 2021. An even higher concentration of nitrate (0.275 mg/L) in the Bashakill Pond was detected in June 2021. Nitrate levels could continue to increase if the source is not identified. Possible sources of nitrates include runoff from fertilizers, sewage, seepage from septic tanks, as well as erosion of natural deposits. It is likely that the potential source is sewage effluent considering the presence of fecal coliform.

In May 2020 hardness in the Bashakill stream was measured at 240 mg/L, putting the water into the very hard category of the hardness classification system. Hardness is a measure of total Ca and Mg present in the water, and in this case is likely due to the presence of limestone upstream dissolving into solution. Alkalinity was detected above the minimum detection level for the same reason. Turbidity was measured at 1.7 Nephelometric Turbidity Units (NTU) which is above the national standard of 1.0 NTU. Water containing 1.0 mg/L of fine silica is measured as 1.0 NTU, and often occurs due to erosion. Depending on the bottle test location in relation to PKBK2S, PKBK3S, and PKBK4S the turbidity and depth signals could be used to determine whether erosion is occurring. Total dissolved solids (TDS) concentration described the presence of inorganic salts and small amounts of organic matter in water and is loosely related to electrical conductivity of the water. TDS was measured at 280 mg/L and the presence of chloride, sulfate, magnesium, copper, iron, manganese, calcium, lithium, strontium, sodium, silica, and zinc in the water contribute to this signal, as well as the conductivity signal.