Real-Time Water Quality Deployment Report

TECK Duck Pond Operations 2024

Government of Newfoundland & Labrador
Department of Environment & Climate Change
Water Resources Management Division

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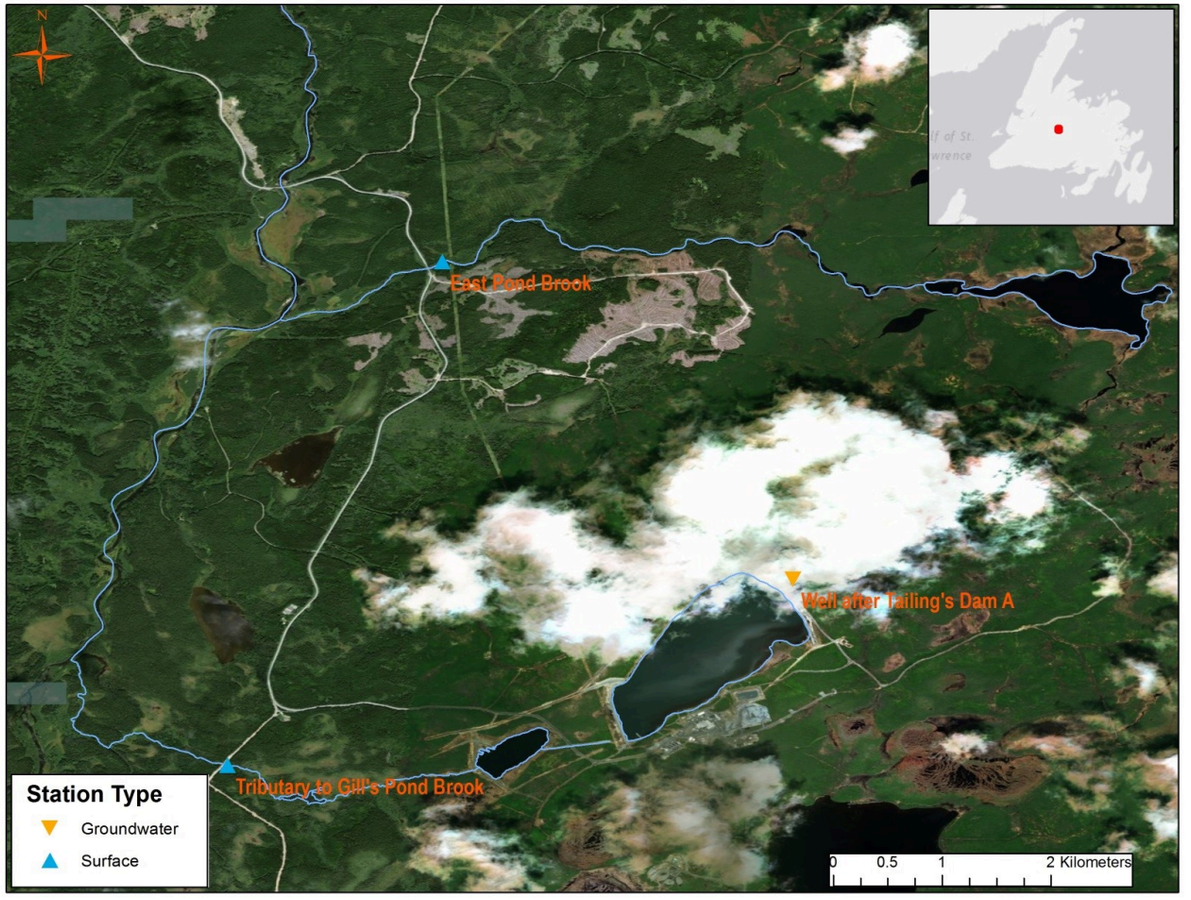
Teck Duck Pond Operations 2024

Real-time water quality (RTWQ) monitoring of surface and groundwater quality on Teck: Duck Pond Operations (DPO) site is carried out by the Department of Environment and Climate Change, Water Resources Management Division. Work is undertaken in circumstances where industrial development has the potential to impact water bodies. The RTWQ program consists of more than 90 stations across the province.

RTWQ work at Teck Duck Pond Operations has been ongoing since 2006 with the installation of three monitoring stations: East Pond Brook station, Tributary to Gill's Pond Brook station, and Monitoring Well after Tailings Dam A station. These stations, identified in the photo to the right, were situated to observe water quality at key locations over the course of the Teck DPO project. East Pond Brook station was placed to intercept potential seepage from underneath flow control structures that maintain the tailings management area. Tributary to Gills Pond Brook is placed to observe water quality following the ultimate discharge of treated effluent from the polishing pond into the environment. Well after Tailings Dam A is also located in the East Pond Brook watershed, but is immediately adjacent to the flow control structure that ensures the tailings management area drains towards the polishing pond and the eventual discharge point above Tributary to Gills Pond Brook station. In this report, notable events and trends from 2024 are identified and discussed in relation to previous years.

Work under the RTWQ program is conducted according to the *Protocols Manual for Real-Time Water Quality Monitoring in NL*. In May 2024, surface water instruments were upgraded to Hydrolab HL7 multi-parameter sondes. In May 2021, WRMD upgraded monitoring equipment at the well station to an EXO 1.



Surface Water Temperature

Water Temperature is a crucial factor used to describe water quality. Temperature has major implications on both the ecology and chemistry of a water body, governing processes such as the metabolic rate of aquatic plants and animals and the degree of dissolved oxygen saturation. Further, many other parameters (specific conductivity, dissolved oxygen saturation) use temperature to calculate values.

Both stations recorded higher average temperatures compared to previous years. In 2024, water levels were abnormally low, likely due to high atmospheric temperatures increasing evaporation rates, combined with reduced precipitation. These low water levels can contribute to increased water temperatures. An upward trend, shown by the black dashed line to the right, is evident at both stations. This warming trend is most likely driven by climate change rather than local factors.

Temperatures generally peak in July and August, when air temperatures are warmest. Conversely, water temperatures generally approach (and sometimes exceed) 0°C in December and remain low until March. East Pond Brook is on average slightly warmer than Tributary to Gill's Pond; it is a larger stream with less canopy cover, which may influence the water temperature.

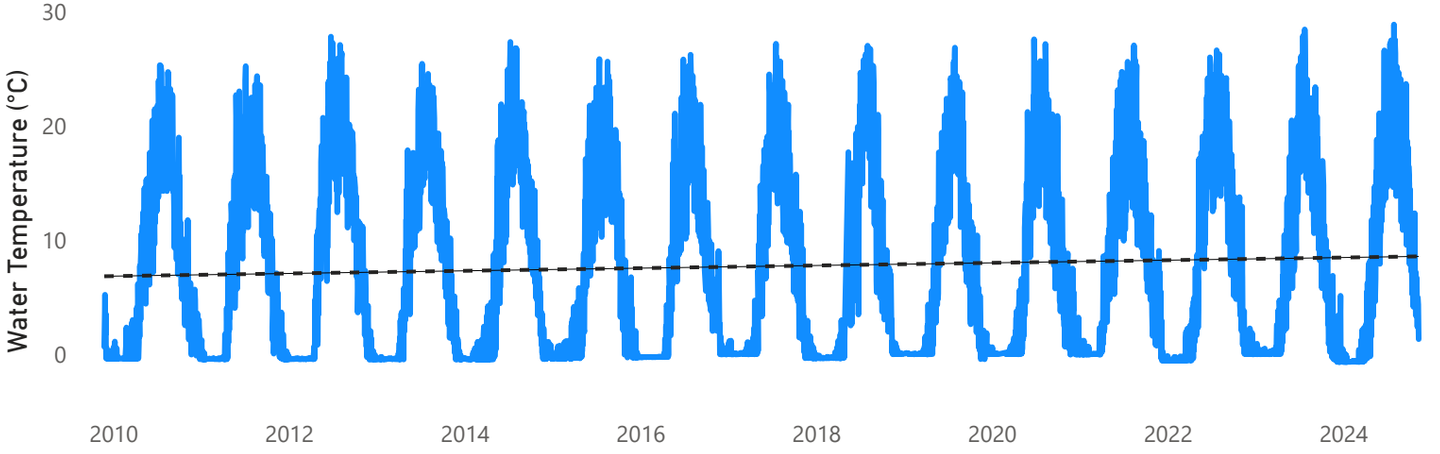
Gills Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	7.30	4.69	-0.68	28.43
2024	9.19	8.52	-0.66	28.86

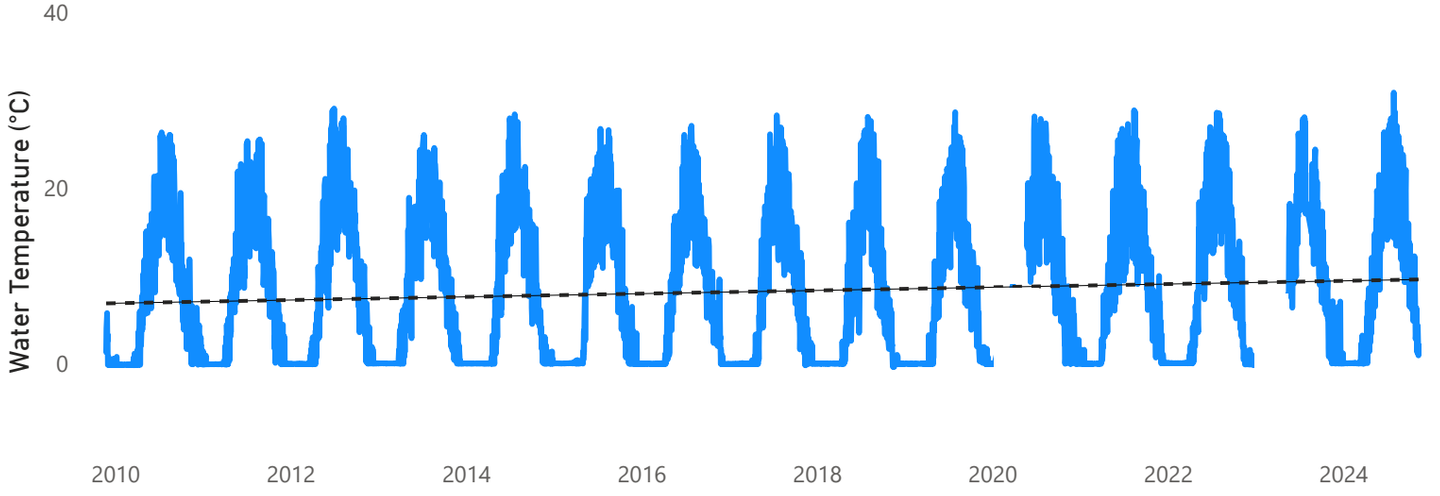
East Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	7.73	5.83	-0.32	29.05
2024	9.45	9.00	0.03	30.86

Water Temperature in Tributary to Gills Pond Brook



Water Temperature in East Pond Brook



Surface Water pH

pH relates to the free hydrogen ions in water and it is a measure of acidity in water. According to the Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life Guidelines, the recommended pH range for aquatic health is between 6.5 and 9.0. However, many rivers in Newfoundland and Labrador are naturally more acidic due to the local geology. Precipitation also influences pH levels—rainwater, which is typically more acidic, can temporarily lower the pH of surface water.

Since 2010, both monitoring stations have consistently recorded pH values below the CCME's upper guideline limit for the protection of aquatic life (pH 9.0), as well as below the minimum recommended threshold of pH 6.5. East Pond Brook naturally exhibits lower pH levels due to the local geology, while pH in the Tributary to Gills Pond Brook is also influenced by treated near-neutral (pH 7.0) effluent released from an upstream polishing pond. At both stations, pH is generally highest during the late summer or early fall and the pH is lowest towards the end of the winter into early spring. There is also a slight increasing trend (indicated by the black dashed line) at both stations.

In 2024, pH at the Tributary to Gills Pond Brook remained consistent with previous years, recording an average of 6.82 pH units. Minimum and maximum values were slightly elevated compared to historical data. Overall, 2024 pH values showed no significant deviation from long-term trends.

At East Pond Brook, pH continued to fluctuate annually due to factors such as seasonal variation and precipitation events. In 2024, pH levels were slightly higher than in previous years, though variability remained consistent with past observations.

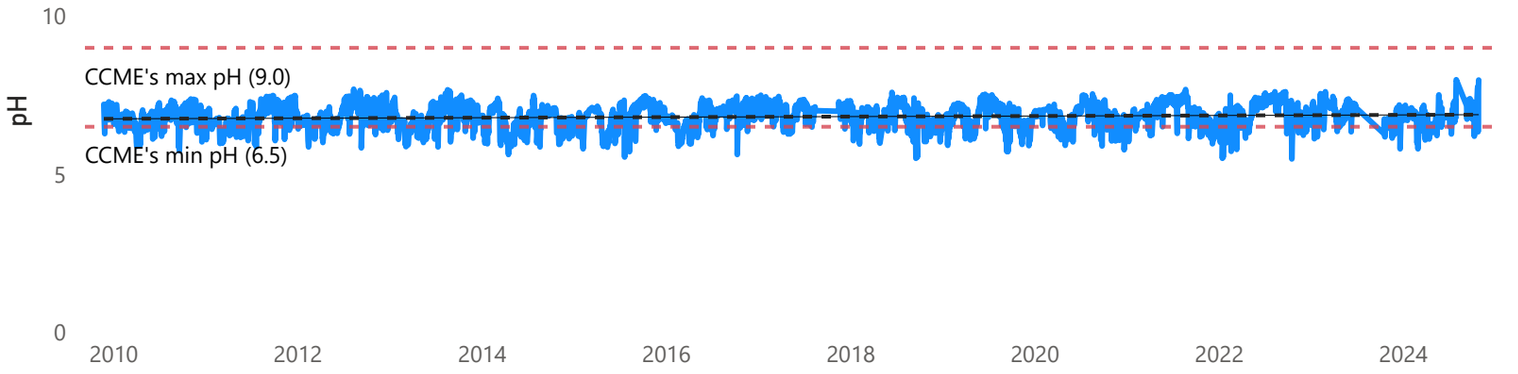
Gills Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	6.82	6.84	5.48	7.69
2024	6.82	6.81	5.80	7.99

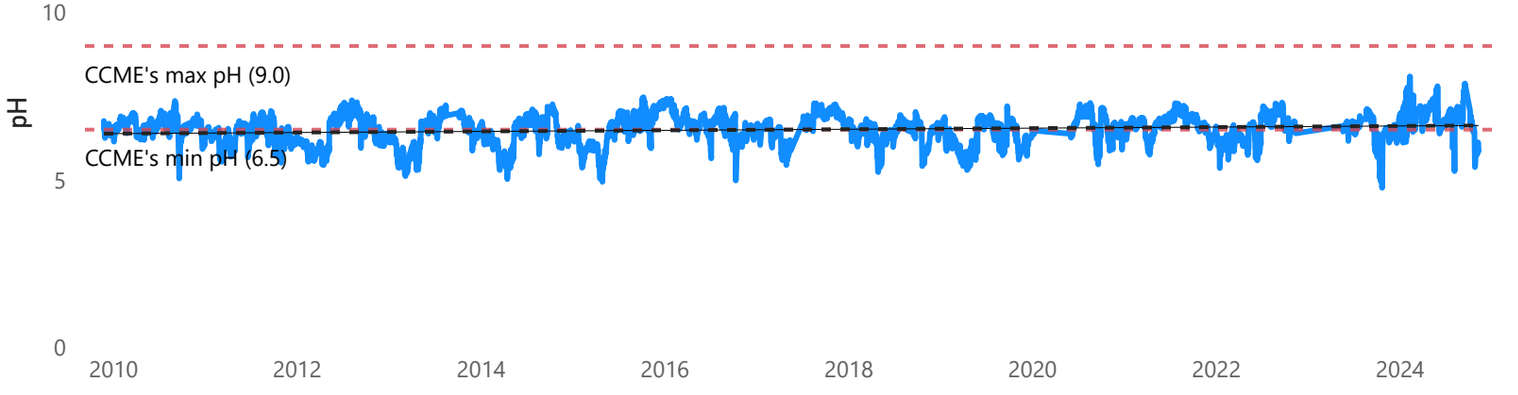
East Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	6.47	6.54	4.76	7.47
2024	6.87	6.90	5.26	8.09

pH in Tributary to Gills Pond Brook



pH in East Pond Brook



Surface Water Specific Conductivity

Conductivity relates to the ability of an electric charge to pass through a solution. Pure water has low conductance and water with dissolved ions has higher conductance. Specific conductance is corrected to 25°C to allow comparison across variable temperatures. Specific conductivity is often affected by precipitation, as rainwater often has a lower conductivity and can temporarily dilute the water column, resulting in a short-term decrease in conductivity.

There is a notable difference between the specific conductivity of waters in Gills Pond Brook and East Pond Brook. Conductivity levels at Gills Pond Brook are elevated due to the upstream discharge of treated effluent from a polishing pond. In contrast, East Pond Brook exhibits relatively low conductivity values reflecting minimal industrial influence. Cyclical patterns are also apparent at both sites. Conductivity typically increases in late summer when water levels drop and dissolved ions become more concentrated. A less pronounced peak is often observed in February or March as well, likely influenced by seasonal changes.

In 2024, specific conductivity values at both Gills Pond Brook and East Pond Brook had a slightly lower average and median compared to previous years. At Gills Pond Brook, conductivity has gradually declined over time, indicating improvement, as shown by the black dashed trendline on the adjacent graph. This downward trend corresponds with the decommissioning of the Teck DPO mine and reduced effluent discharge into the river. At East Pond Brook, a slight overall increase in specific conductivity has been observed in recent years. This may be attributed to other land use activities in the surrounding area or long-term seasonal changes.

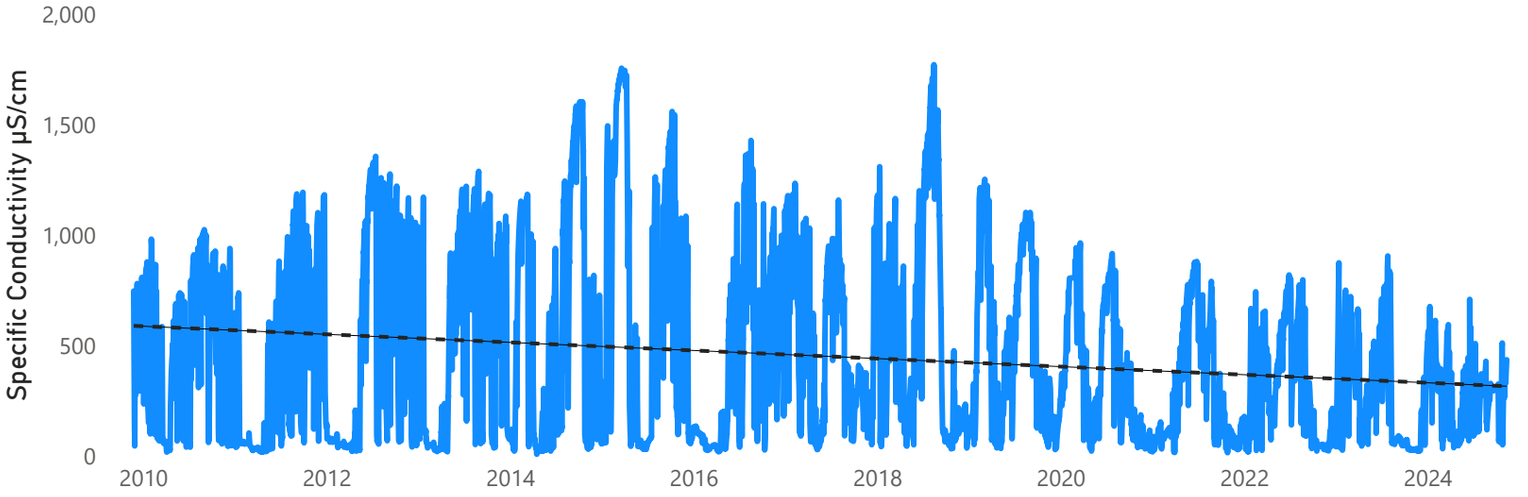
Gills Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	460.60	338.00	7.40	1,771.00
2024	272.14	298.70	32.30	708.50

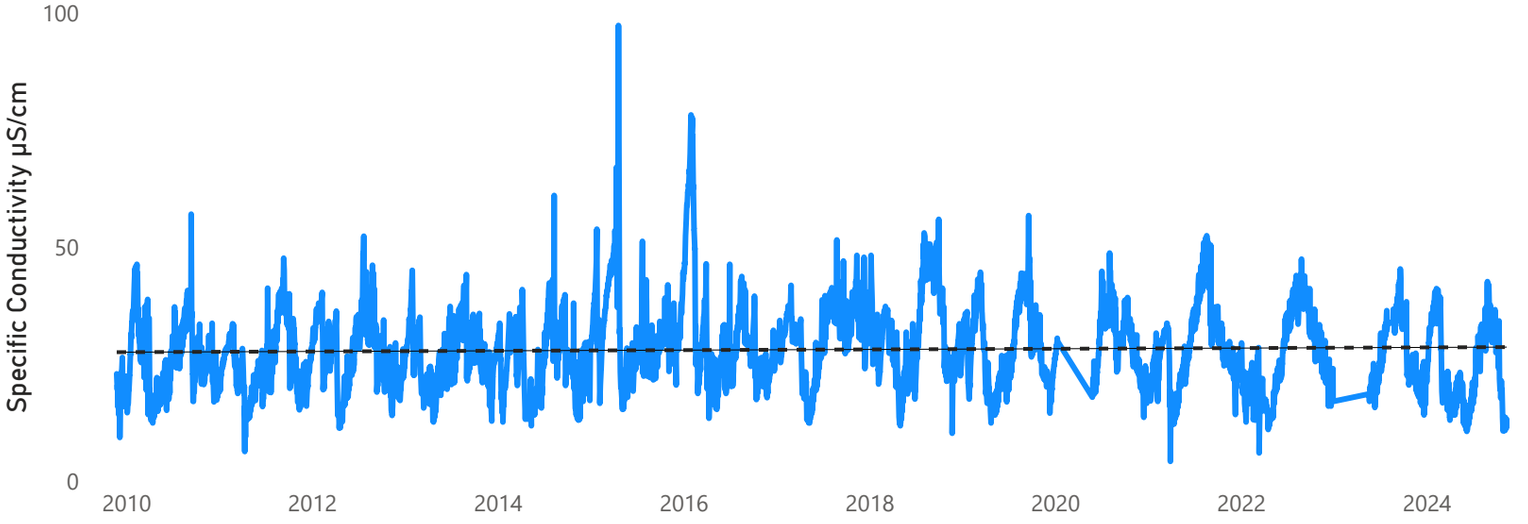
East Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	28.20	27.00	4.20	97.30
2024	24.55	22.70	10.60	42.60

Specific Conductivity in Tributary to Gills Pond Brook



Specific Conductivity in East Pond Brook



Surface Water Dissolved Oxygen

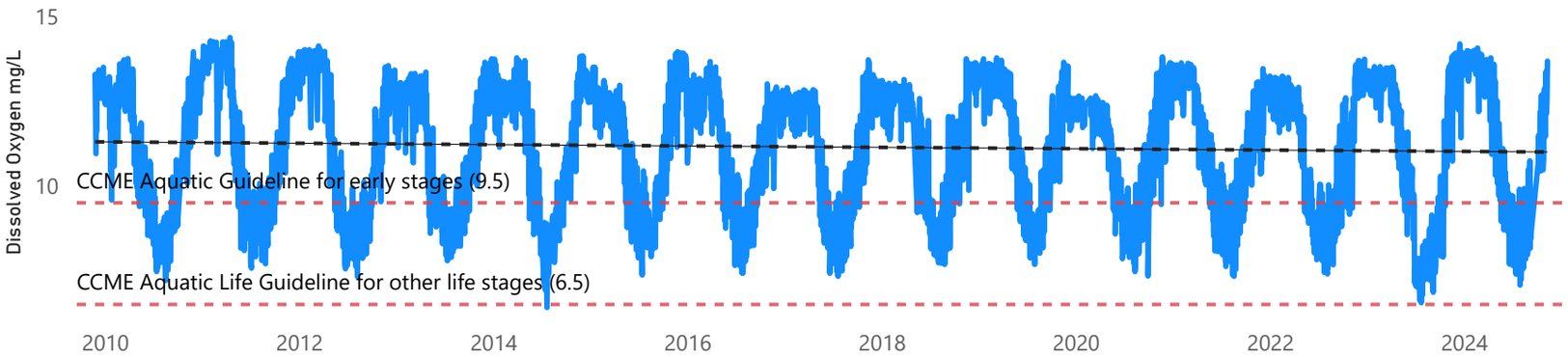
Dissolved oxygen (DO) in water is crucial for aquatic life. The CCME Freshwater Aquatic Life Guidelines provide benchmarks to assess waterway health, with the minimum DO guideline being 9.5 mg/L for early life stages in cold water and 6.5 mg/L for other life stages. DO levels are influenced by water temperature, with colder water able to retain higher DO concentrations, while warmer waters hold less.

From 2010 to 2024, both Gills Pond Brook and East Pond Brook have consistently met the 6.5 mg/L guideline for other life stages, with the exception of a brief dip below this threshold at Gills Pond Brook in 2014. Over the long term, DO concentrations at both sites have fluctuated around the 9.5 mg/L guideline for early life stages. These dips below the early life stage threshold typically occur during the summer months, when warmer water temperatures reduce the capacity of water to hold dissolved oxygen.

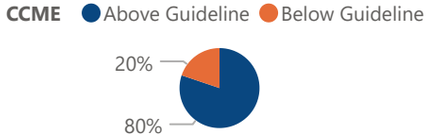
Over the 15-year monitoring period, clear seasonal patterns are evident—DO levels tend to decrease during the summer and rise during the winter. The black dashed trendlines on the adjacent graphs indicate a gradual overall decline in DO at both stations. This trend is likely associated with rising water temperatures driven by climate change.

In 2024, DO levels at both sites remained consistent with values observed in previous years.

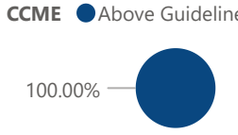
Dissolved Oxygen in Tributary to Gills Pond Brook



Early Life Stages Guideline (9.5mg/L)



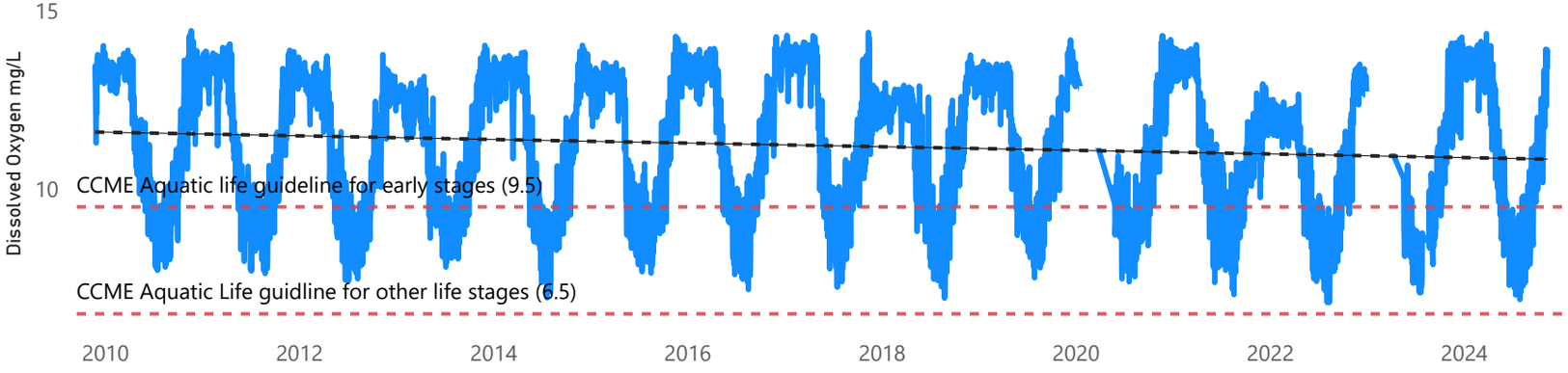
Other Life Stages Guideline (6.5mg/L)



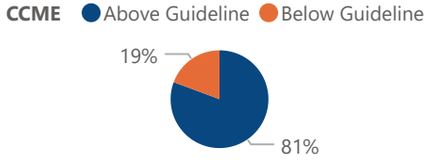
Gills Pond Brook

Report Year	Average	Median	Min.	Max.
2007-2023	11.16	11.59	6.41	14.38
2024	11.22	11.36	7.07	14.07

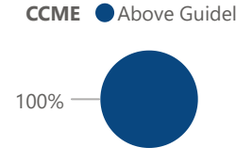
Dissolved Oxygen in East Pond Brook



Early Life Stages Guideline (9.5mg/L)



Other Life Stages Guideline (6.5mg/L)



East Pond Brook

Report Year	Average	Median	Min.	Max.
2007-2023	11.26	11.53	6.82	14.44
2024	11.06	10.95	6.90	14.36

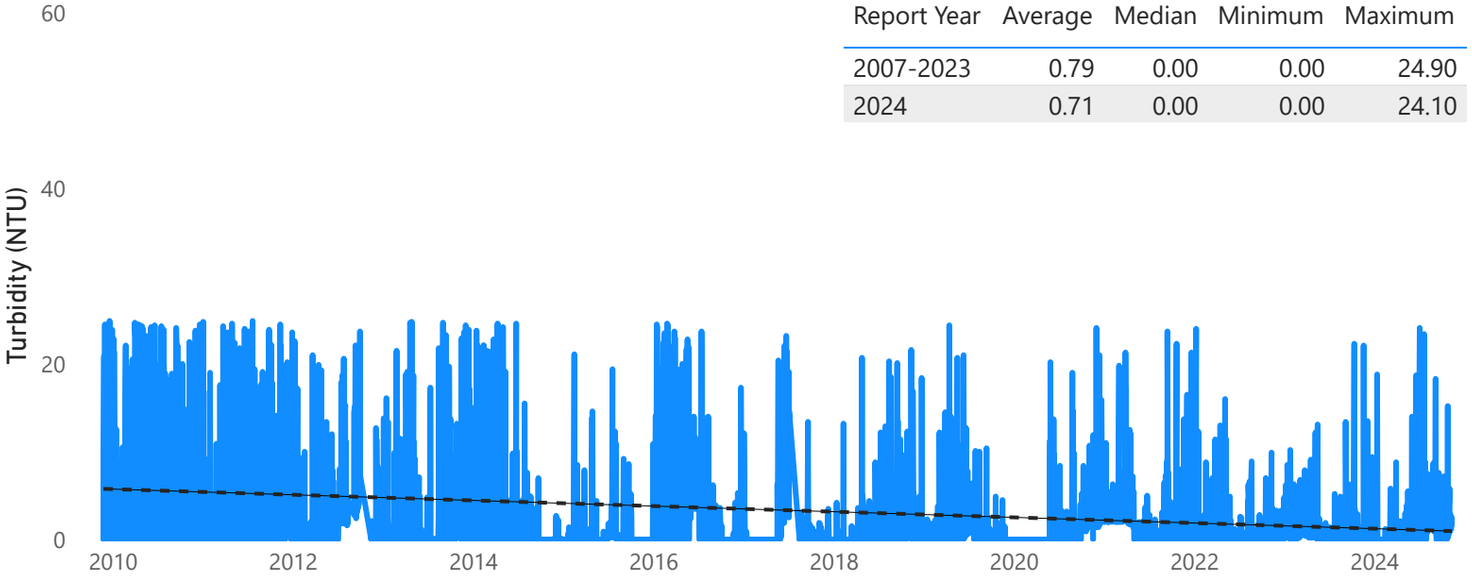
Surface Water Turbidity

Turbidity sensors measure the amount of fine solids, such as silt, clay, or organic materials, suspended in the water column. This parameter is monitored because turbid waters can prevent light from reaching photosynthetic organisms, settle on benthic organisms and spawning areas, and damage delicate respiratory organs.

At both Gill's Pond Brook and East Pond Brook, turbidity levels are generally low, as reflected in the low long-term averages and medians recorded at each station. However, turbidity sensors are susceptible to errors caused by debris accumulating around the sensor. Over 14 years of deployment at Gill's Pond Brook, quality assurance/quality control (QA/QC) readings and grab samples have ranged from 0.0 to 2.4 NTU and 0.2 to 4.1 NTU, respectively. At East Pond Brook, QA/QC readings and grab samples over the same period have ranged from 0.0 to 3.1 NTU and 0.2 to 2.3 NTU, respectively. Despite this, sensors frequently report much higher values during deployment due to sediment getting trapped in the protective cage. To provide a more accurate representation of site conditions, readings above 25 NTU have been excluded from this report.

Turbidity spikes often coincide with precipitation events, as rainfall can disturb sediments near the sensor or increase silt-laden runoff entering the water column, temporarily raising turbidity levels. A trendline For Gills Pond Brook values shows how turbidity has decreased after upstream mining operations concluded. In contrast, East Pond Brook has exhibited a relatively stable trend over time. The median and average turbidity values recorded in 2024 at both stations are consistent with previous years.

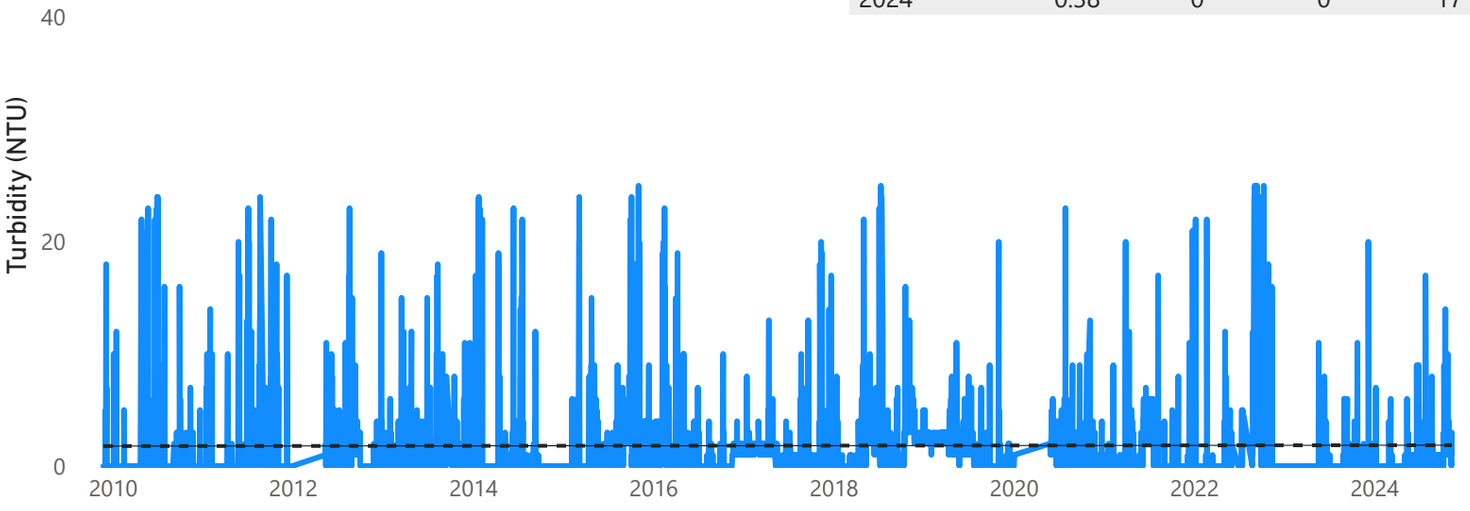
Turbidity in Tributary to Gills Pond Brook



Gills Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	0.79	0.00	0.00	24.90
2024	0.71	0.00	0.00	24.10

Turbidity in East Pond Brook



East Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	0.68	0	0	25
2024	0.38	0	0	17

Surface Water Elevation

Water elevation, also referred to as stage, at Gills Pond Brook ranged between 1.14 m to 1.94 m, with a median of 1.22 m in 2024 - slightly lower than the 2009-2024 long term median of 1.34m. Water elevation at East Pond Brook ranged between 0.86 m to 4.53m, with a median of 1.08m in 2024, consistent with previous years.

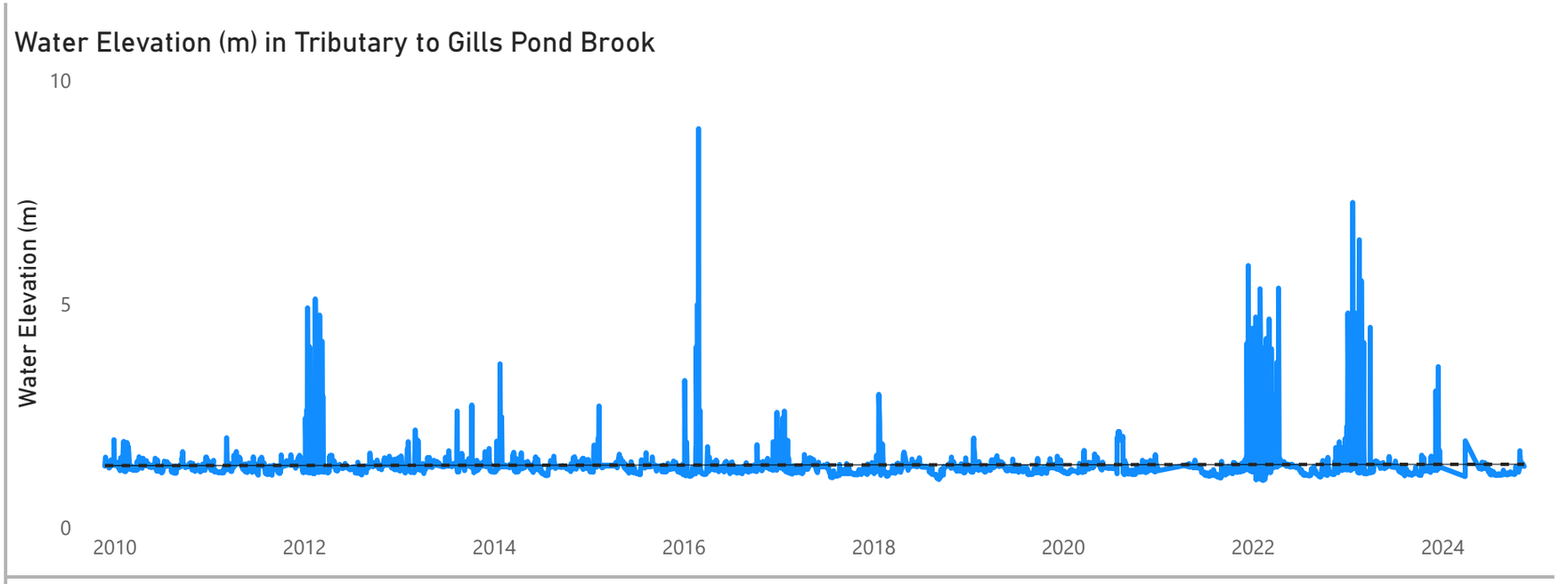
Water levels throughout the summer of 2024 were very low due to high atmospheric temperatures and less frequent precipitation events. Throughout the winter and spring, water levels can be highly variable. This is partially due to seasonal change and increased precipitation, but is mainly driven by snow and ice coverage in the winter causing inaccurate elevated data measurements.

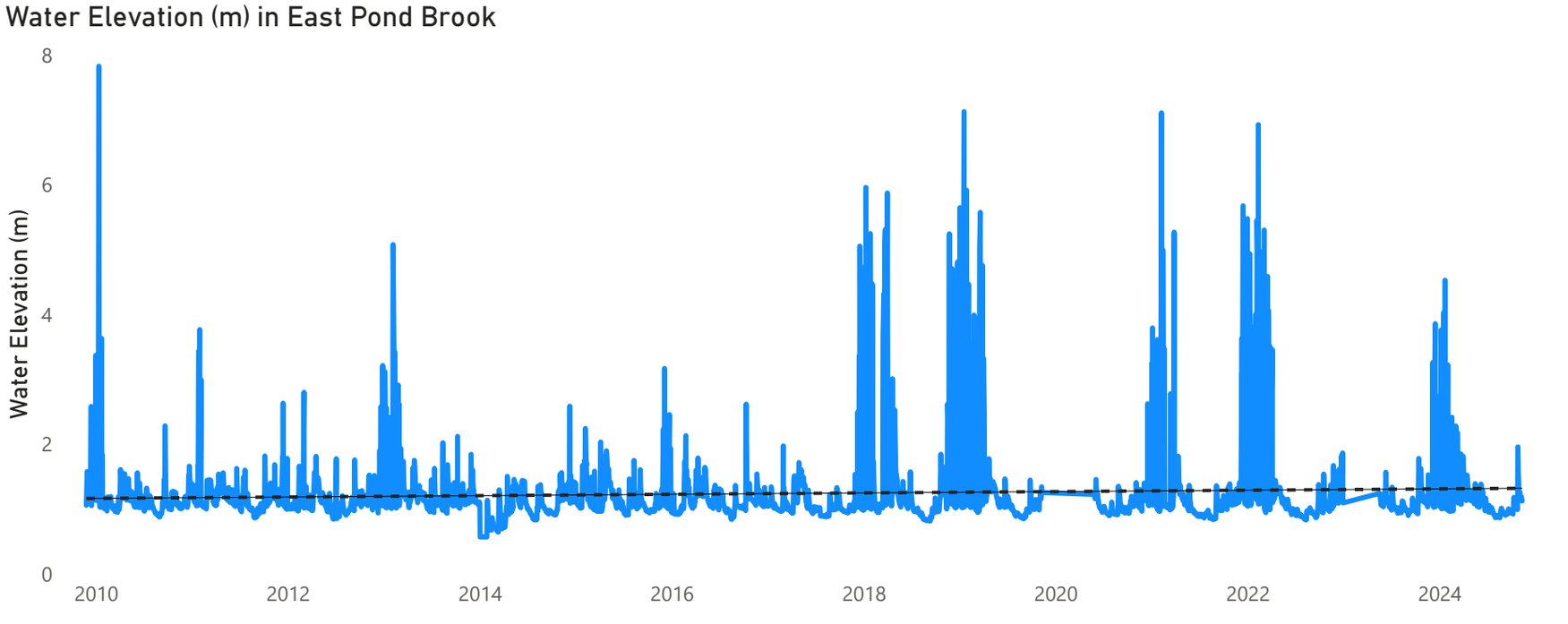
Gills Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	1.35	1.34	1.05	8.92
2024	1.26	1.22	1.14	1.94

East Pond Brook

Report Year	Average	Median	Minimum	Maximum
2007-2023	1.14	1.08	0.57	7.83
2024	1.12	1.08	0.86	4.53





Well Water Temperature

In 2024, the water temperature in the well after tailings dam ranged from 5.25°C to 6.55°C, with an average of 5.83°C - slightly higher than the long-term average of 5.39°C recorded from 2007 to 2023.

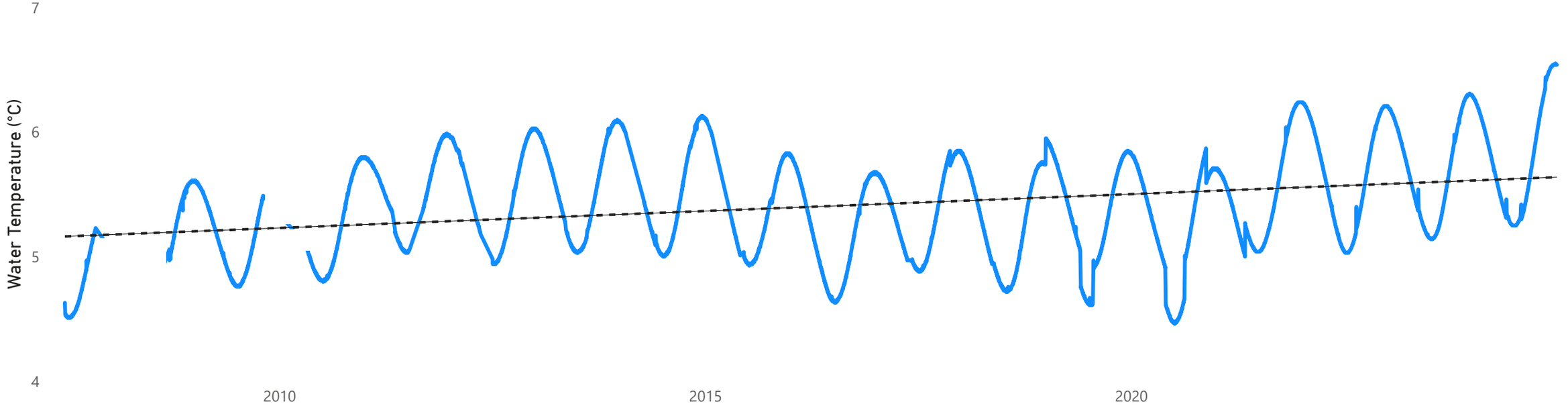
A general warming trend is evident, as shown by the black dashed line in the figure below. In 2011, the average temperature was 5.54°C, which is 0.29°C cooler than in 2024. Although temperatures dipped slightly between 2016 and 2020, they have been steadily rising since. The highest recorded temperature of 6.55°C occurred on December 24, 2024.

The coolest temperatures tend to occur in July, while the warmest temperatures occur in December and January. This is a stark contrast to surface water which displays the opposite pattern. This is due to delayed seasonal warming as a result of the insulative properties of soil. Overall, well water temperatures remain relatively stable throughout the year. In 2024, the temperature range was 1.30°C, compared to a total range of 1.85°C over the 2007–2023 period.

Well after Tailings Dam Water Temperature (°C) Statistics

Report Year	Average	Median	Minimum	Maximum
2007-2023	**5.39**	**5.37**	**4.46**	**6.31**
2024	**5.83**	**5.82**	**5.25**	**6.55**

Water Temperature in Well after Tailings Pond



Well Water pH

Well after Tailings Dam pH (pH units) Statistics

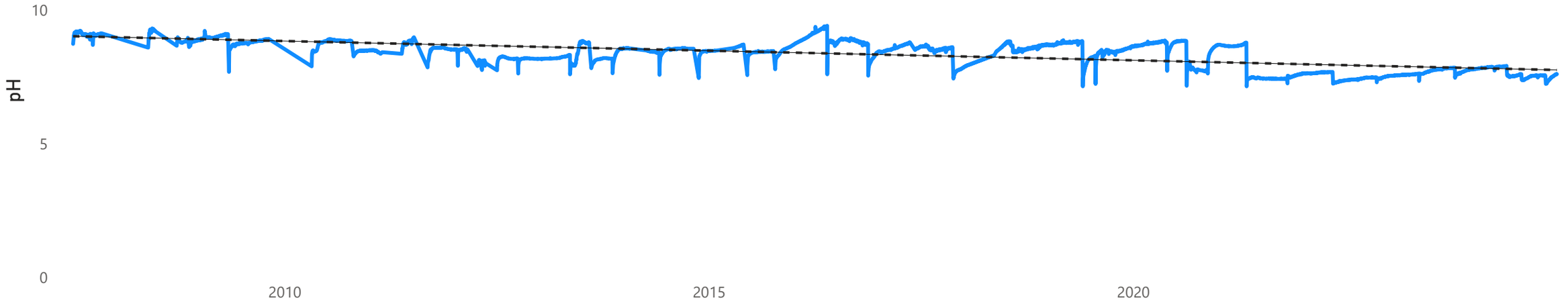
Report Year	Average	Median	Minimum	Maximum
2007-2023	**8.37**	**8.50**	**7.15**	**9.42**
2024	**7.65**	**7.56**	**7.24**	**7.92**

In 2024, the average pH was 7.65 pH units, slightly lower than the 8.37 pH average between 2007-2023. As previously mentioned, waters in Newfoundland tend to be slightly acidic (lower pH) due to the soil composition and geology. When monitoring began, the pH was much higher; however, it has been trending towards more typical readings for the island.

The general decreasing trend, is indicated by the black dashed line below. The average pH in 2008 was 8.92 pH units, which is 1.27 pH units higher than 2024. This is opposite to the two surface water stations which show an increasing pH trend. The downward trending pH in the well may be a result of the decommissioning of the mine, or it may be a result of warming water temperatures. This correlation was noted in 2021; the pH at this site often decreases when water temperatures increase.

When the sonde is removed, the well is purged, which is represented in the graph by downward spikes. Because the pH sensor requires longer to stabilize than other sensors, the disruption is more evident. In 2021 the well sonde was changed to an EXO. The pH readings have been lower since this change was made.

pH in Well After Tailings Dam



Well Water Specific Conductivity

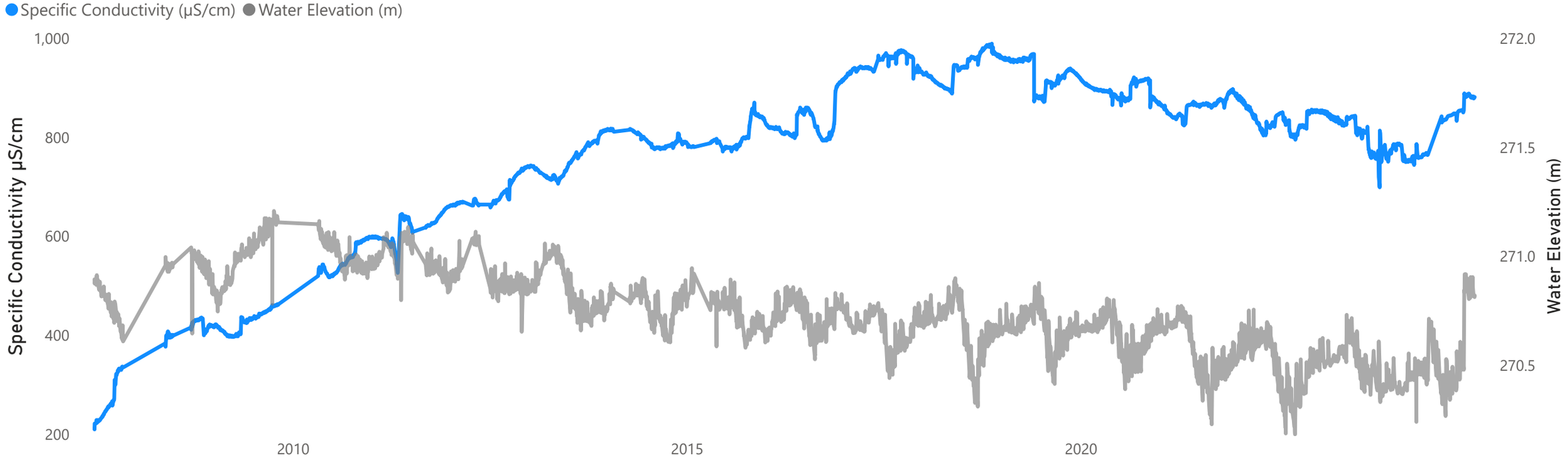
Well after Tailings Dam Specific Conductivity (µS/cm) Statistics

Report Year	Average	Median	Minimum	Maximum
2007-2023	**772.44**	**819.00**	**210.00**	**989.00**
2024	**811.57**	**830.78**	**743.93**	**888.41**

Specific conductivity in groundwater is influenced by a range of factors including seasonal variation, groundwater recharge, and industrial processes. An inverse relationship is often observed between conductivity and water elevation; higher water levels typically dilute dissolved ions, resulting in temporary reductions in conductivity. In 2024, the average specific conductivity in the well was 811.58 µS/cm, slightly above the long-term average of 772.44 µS/cm recorded from 2007 to 2023. The median value for 2024 was 830.78 µS/cm, consistent with previous years and indicative of stable water quality conditions in recent monitoring periods.

Conductivity levels increased steadily from 2007 until 2014, likely due to ongoing mining activities. Following this period, conductivity began to decline, although values remained elevated compared to early years. Between 2014 and 2016, the water level in the tailings pond was lowered to facilitate long-term stabilization work. This reduction in water volume may have concentrated dissolved constituents, contributing to the observed increase in conductivity from 2016 to 2018. Since then, specific conductivity levels have gradually declined and stabilized, with a slight increase noted throughout 2024, though still below historical peak values.

Specific Conductivity in Well after Tailings Dam



Well Water
Oxidization Reduction Potential

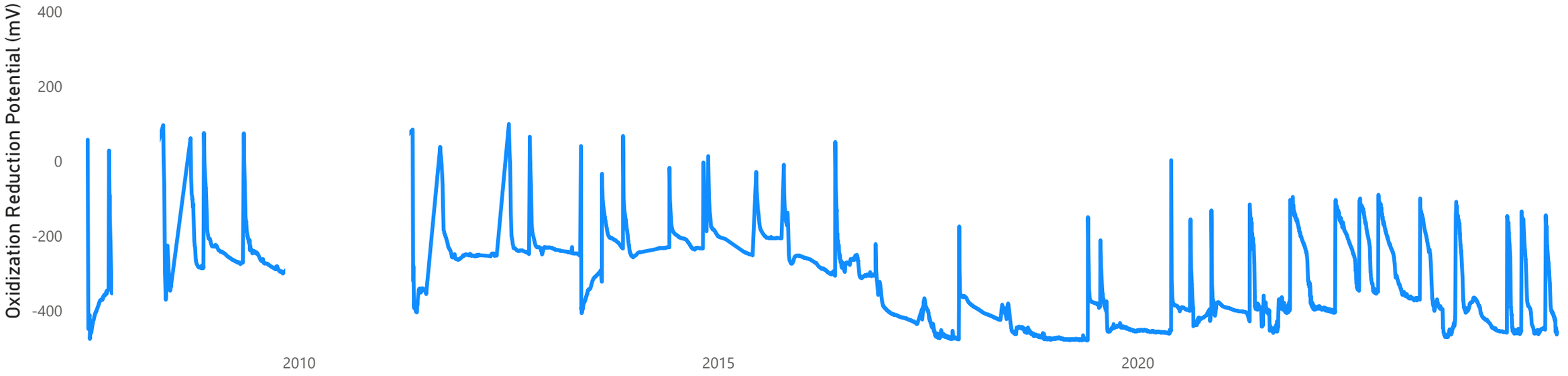
Oxidation-reduction potential (ORP) measures how readily a solution can gain (reduction) or lose (oxidation) electrons. In groundwater systems, ORP is directly linked to the mobility of potential contaminants, as redox conditions control the chemical form, solubility, and behavior of many chemical constituents, including metals. Tracking ORP trends provides valuable insight into shifts in groundwater chemistry and helps detect early signs of environmental changes.

In 2024, the average oxidization reduction potential (ORP) was -393.36 mV, which is slightly lower than the long term 2007-2023 average of -320.36 mV. Like pH, the ORP sensor takes longer to settle than other sensors, resulting in upward spikes in the data. The spikes are likely attributed to the purging of the well to collect grab samples. Purging the well results in fresh, oxidized groundwater entering the well. It can takes days to weeks for ORP to stabilize. ORP values increased from 2007 until 2015, with a plateau occurring from 2010 to 2014. ORP dropped throughout 2016 to 2018, and once again plateaued until 2021. Since 2021, ORP has been relatively stable with minor fluctuations.

Well after Tailings Dam ORP (mV) Statistics

Report Year	Average	Median	Minimum	Maximum
2007-2023	**-320.36**	**-323**	**-480**	**99**
2024	**-398.39**	**-434**	**-464**	**-135**

Oxidization Reduction Potential in Well after Tailings Dam



Well Water Elevation

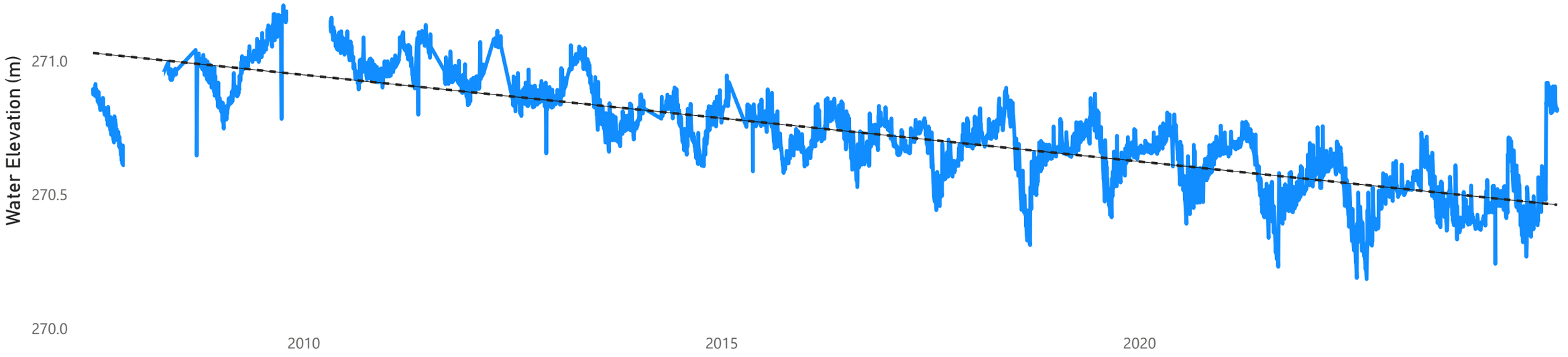
Well after Tailings Dam Water Elevation (m) Statistics

Report Year	Average	Median	Minimum	Maximum
2007-2023	**270.73**	**270.71**	**270.18**	**271.21**
2024	**270.51**	**270.46**	**270.24**	**270.92**

Water elevation indicates the surface of the aquifer above sea level. In 2024, the average water elevation was 270.51 m, slightly lower than the 2007-2023 average of 270.73 m. The lowest elevation in 2024 was 270.24 m, while the highest elevation was 270.92 m, resulting in a total range of 0.68m throughout the year. Dips in elevation are likely related to purging the well to collect grab samples.

The well reached maximum water elevation on 10/6/2009, and the water elevation has been decreasing since, although there was a substantial jump in elevation towards the end of 2024.

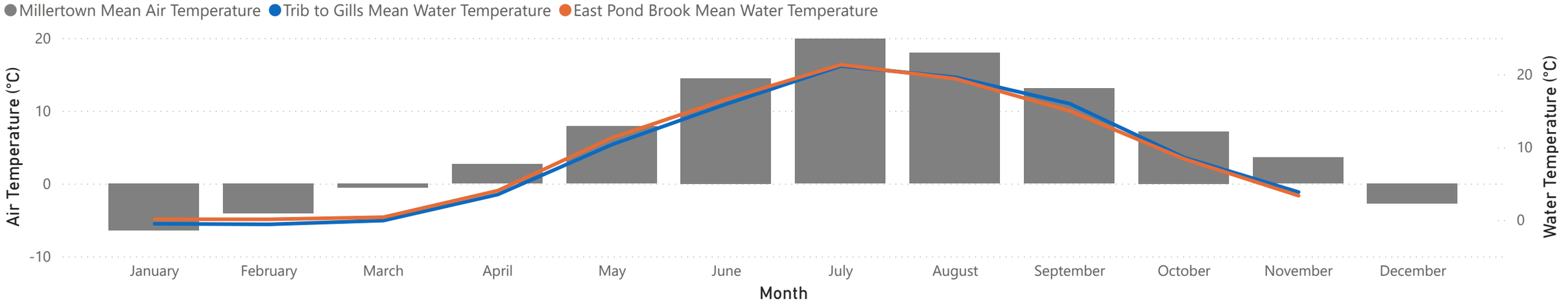
Water Elevation in Well after Tailings Pond



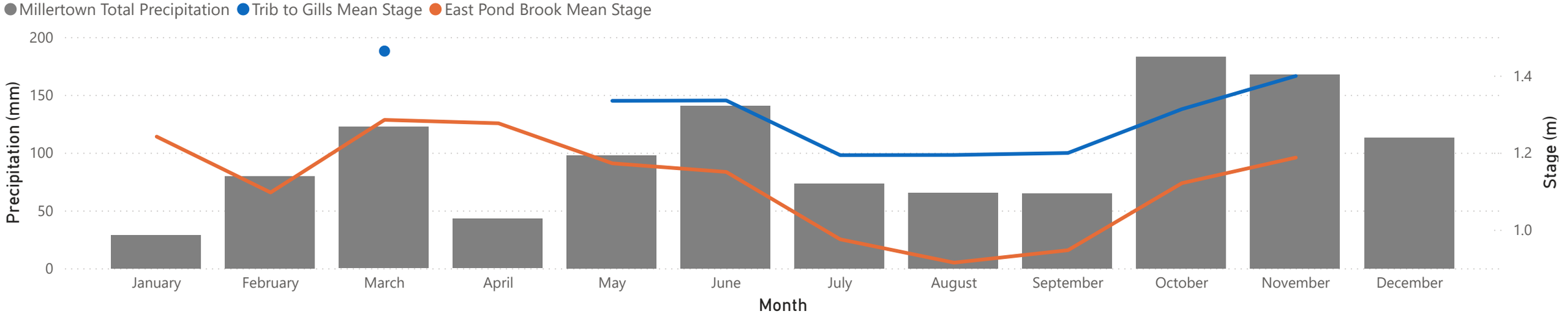
Climate Data from Millertown Climate Station

2024 precipitation data and air temperature from Environment Canada's Millertown, Newfoundland and Labrador weather station.

Millertown Mean Air Temperature and TECK Surface Mean Water Temperature

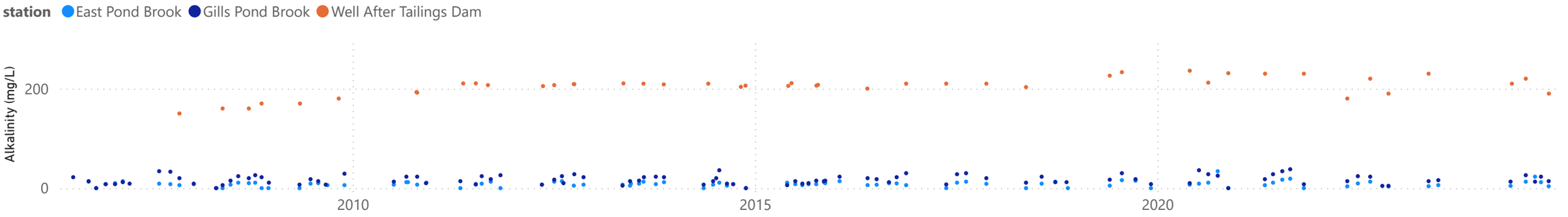


Millertown Total Precipitation and TECK Mean Water Levels (Stage)

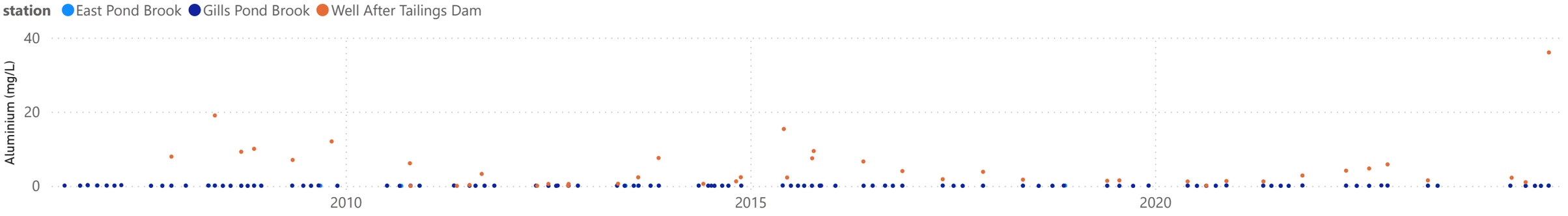


Appendix - Grab Sample Graphs

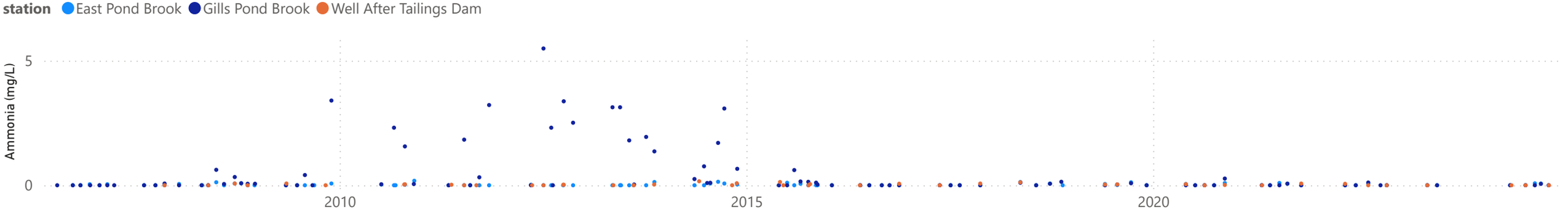
Grab Samples Alkalinity (mg/L)



Grab Samples Aluminium (mg/L)

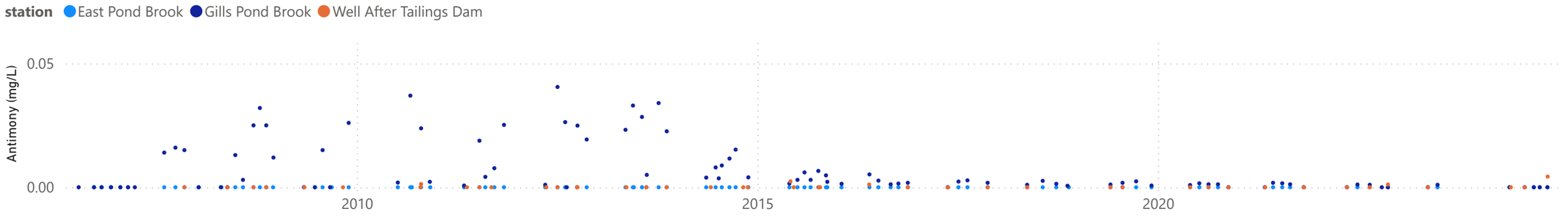


Grab Samples Ammonia (mg/L)

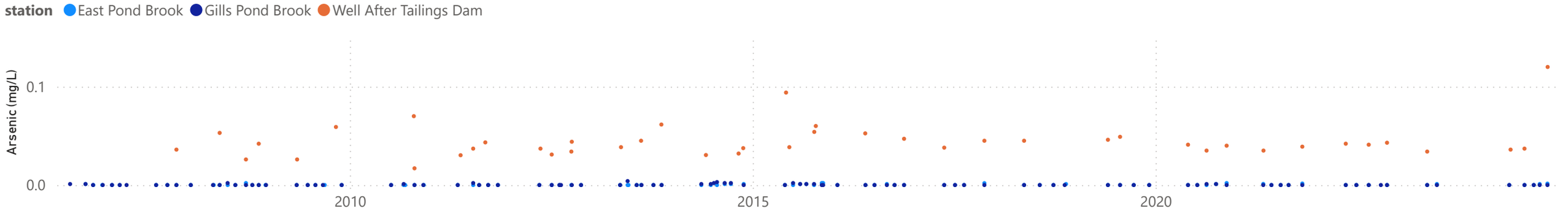


Appendix - Grab Sample Graphs

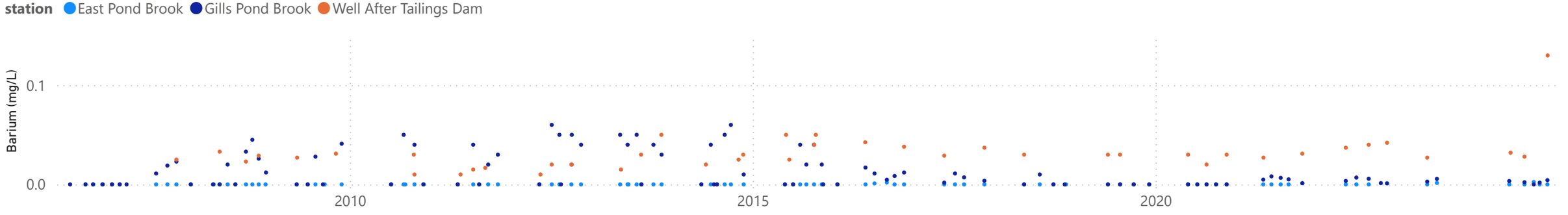
Grab Samples Antimony (mg/L)



Grab Samples Arsenic (mg/L)

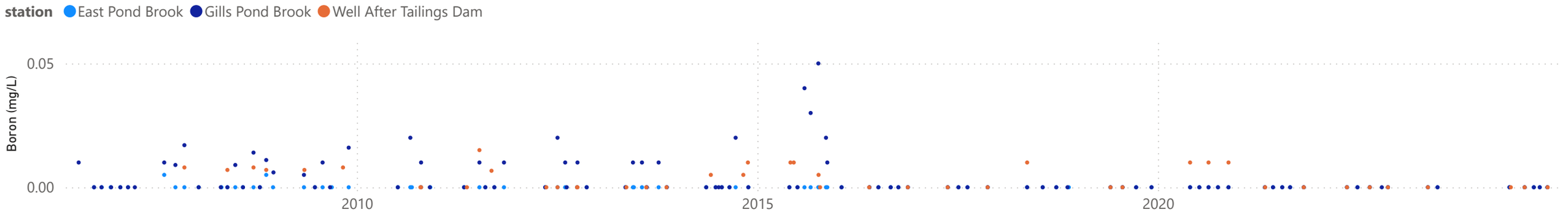


Grab Samples Barium (mg/L)

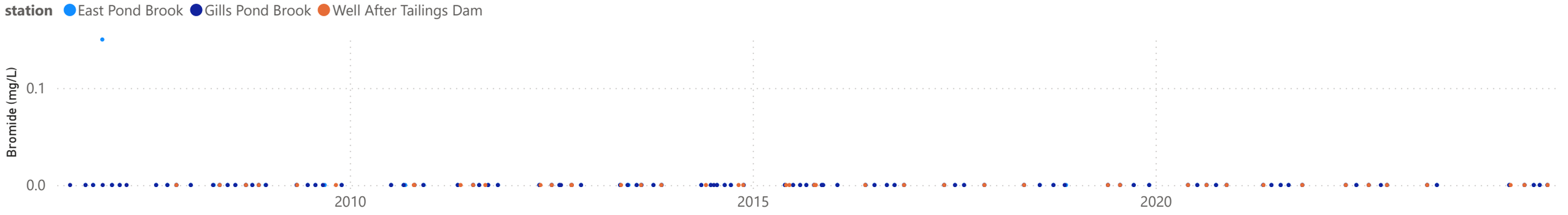


Appendix - Grab Sample Graphs

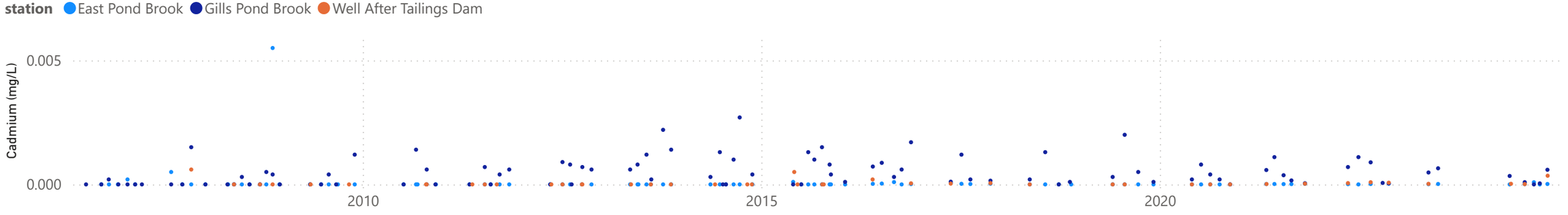
Grab Samples Boron (mg/L)



Grab Samples Bromide (mg/L)

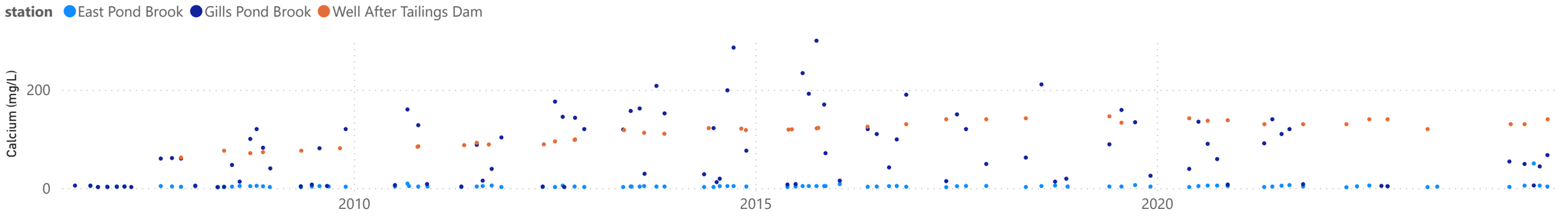


Grab Samples Cadmium (mg/L)

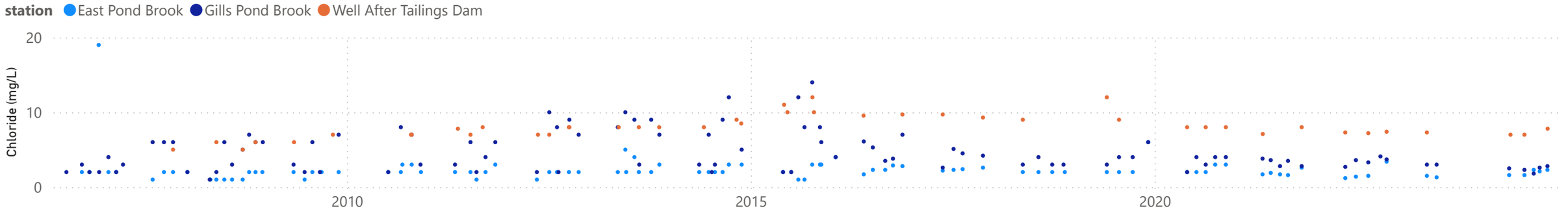


Appendix - Grab Sample Graphs

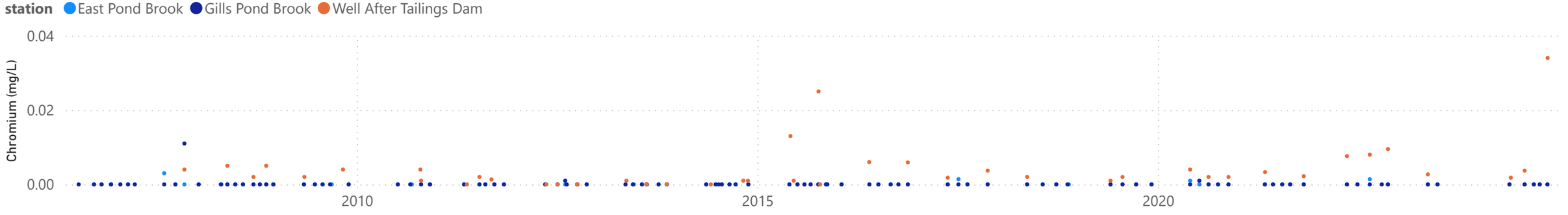
Grab Samples Calcium (mg/L)



Grab Samples Chloride (mg/L)

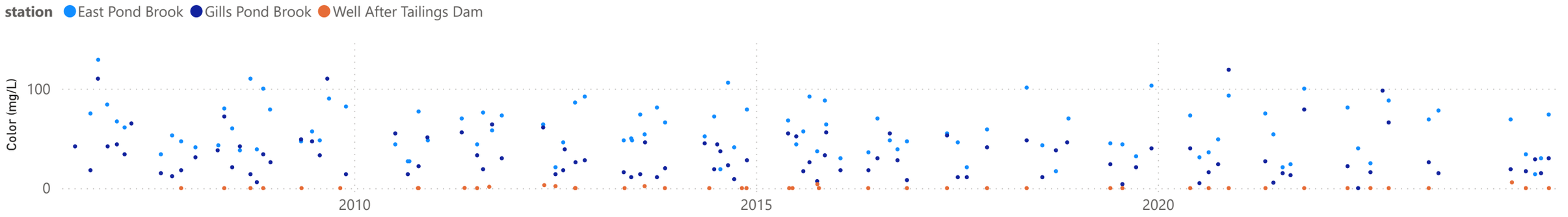


Grab Samples Chromium (mg/L)

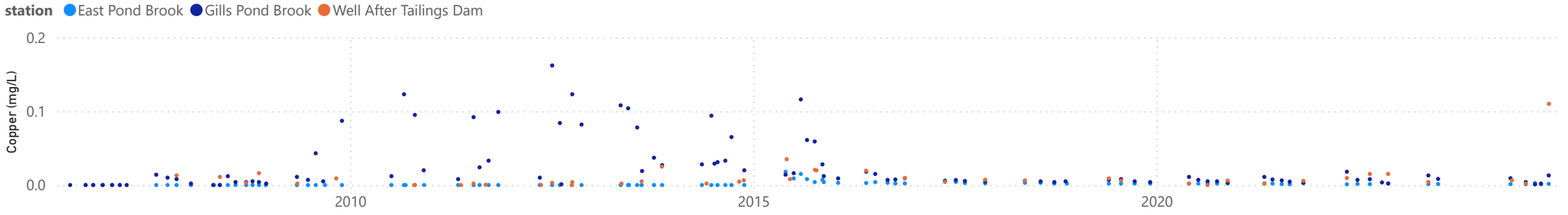


Appendix - Grab Sample Graphs

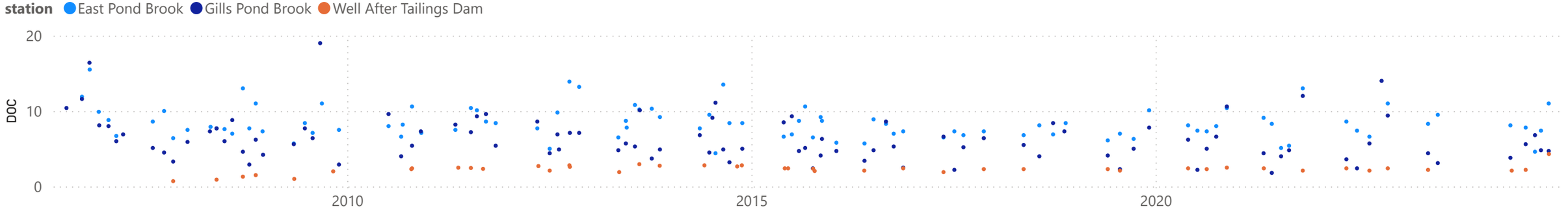
Grab Samples Color (mg/L)



Grab Samples Copper (mg/L)

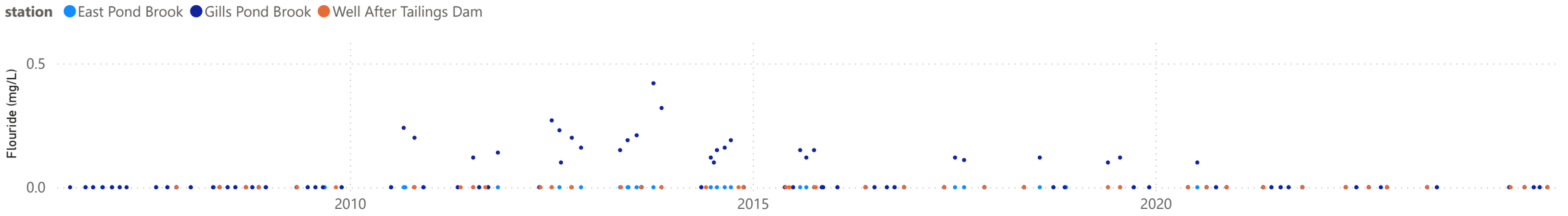


Grab Samples Chromium (mg/L)

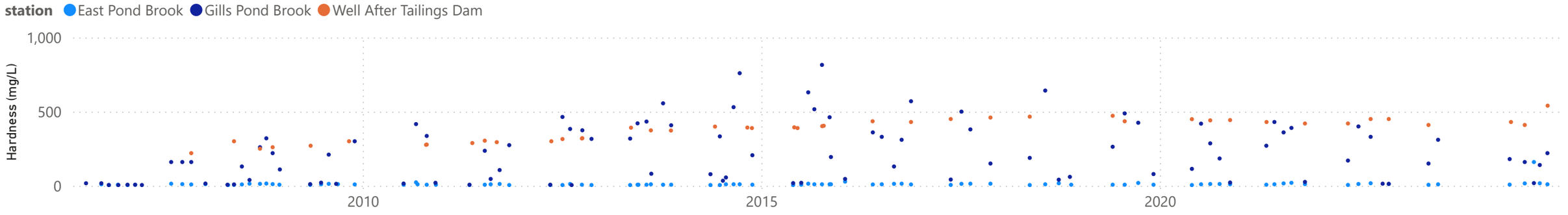


Appendix - Grab Sample Graphs

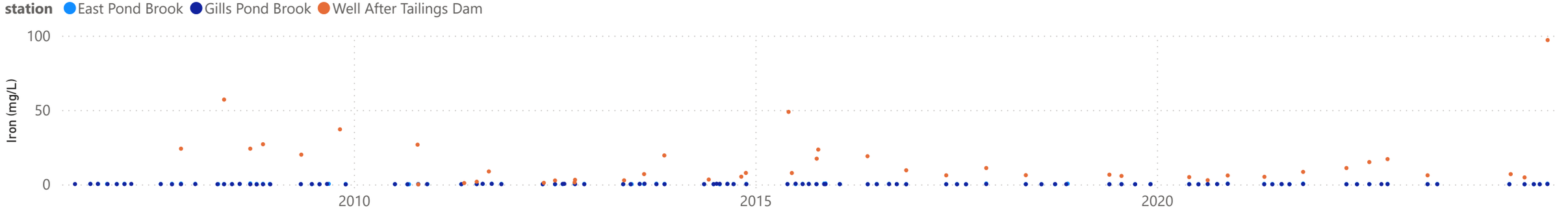
Grab Samples Flouride (mg/L)



Grab Samples Hardness (mg/L)

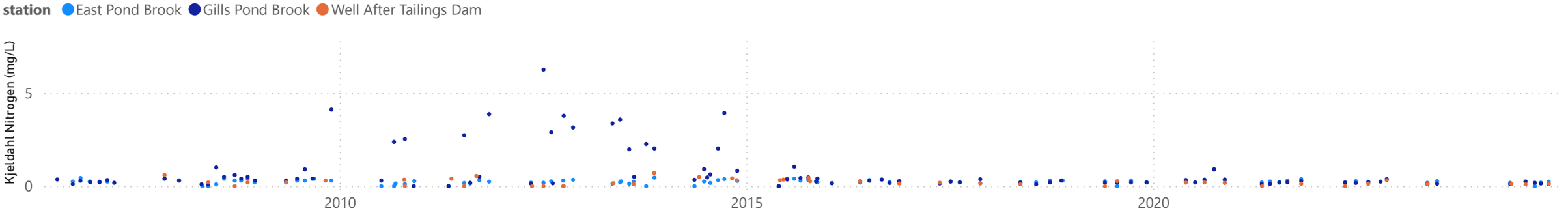


Grab Samples Iron (mg/L)

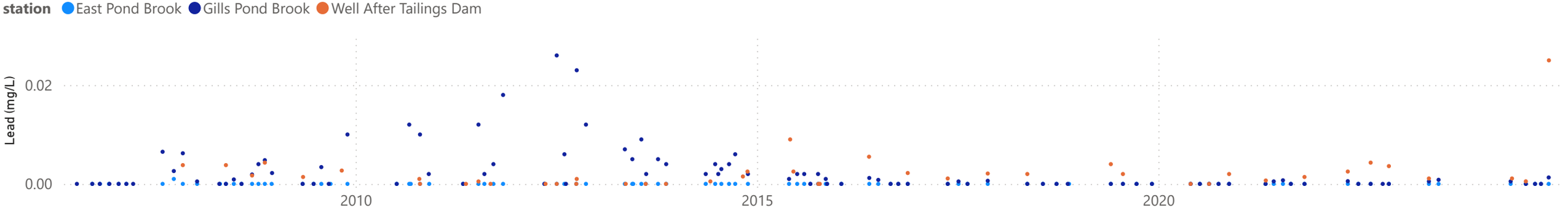


Appendix - Grab Sample Graphs

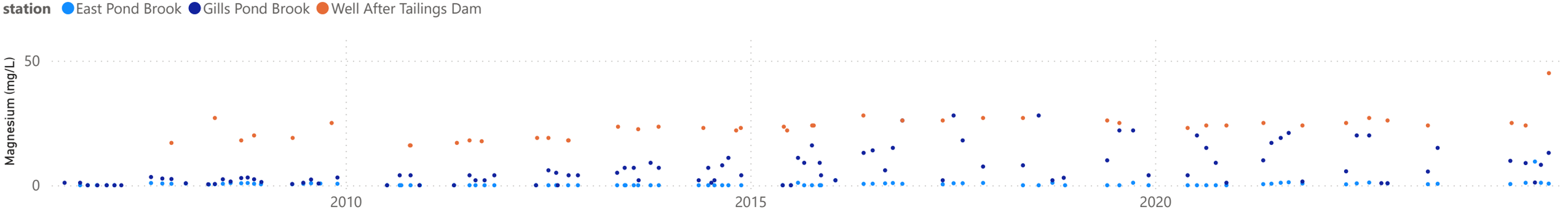
Grab Samples Kjeldahl Nitrogen (mg/L)



Grab Samples Lead (mg/L)

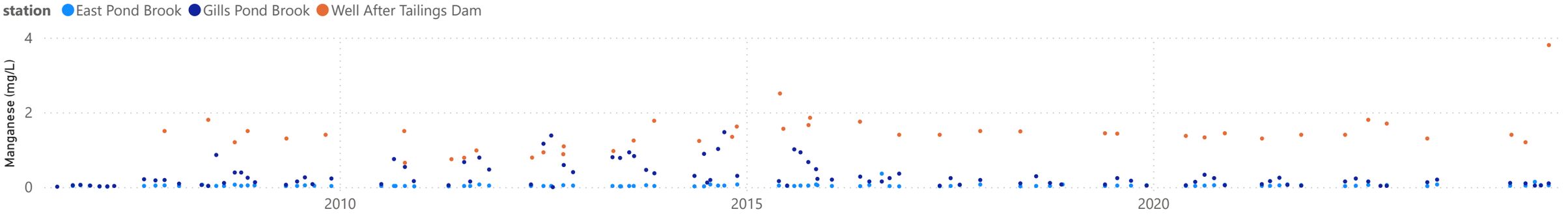


Grab Samples Magnesium (mg/L)

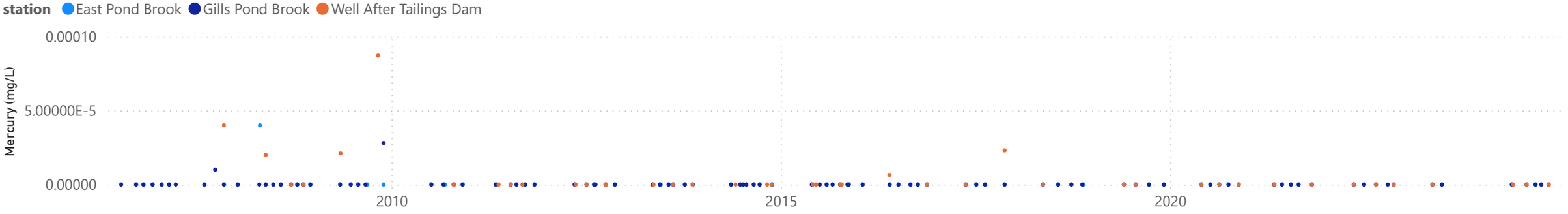


Appendix - Grab Sample Graphs

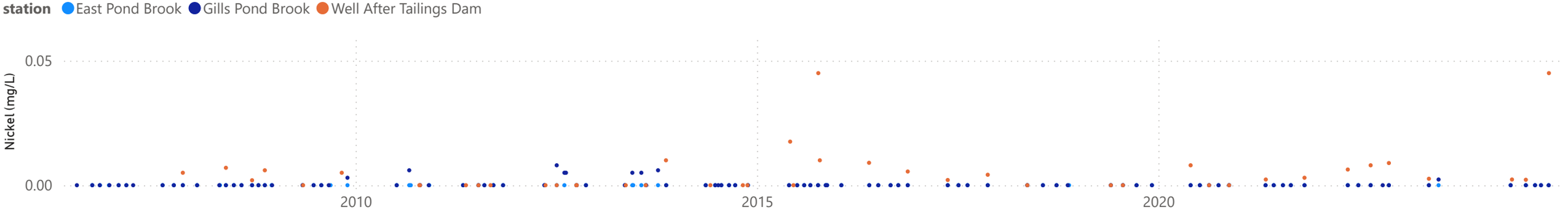
Grab Samples Manganese (mg/L)



Grab Samples Mercury (mg/L)

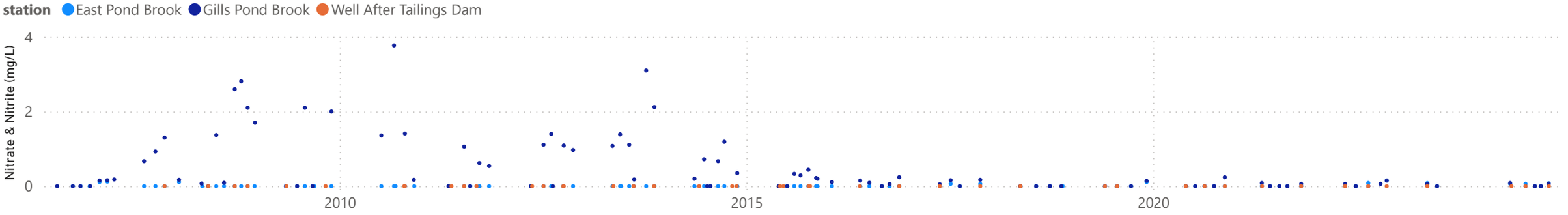


Grab Samples Nickel (mg/L)

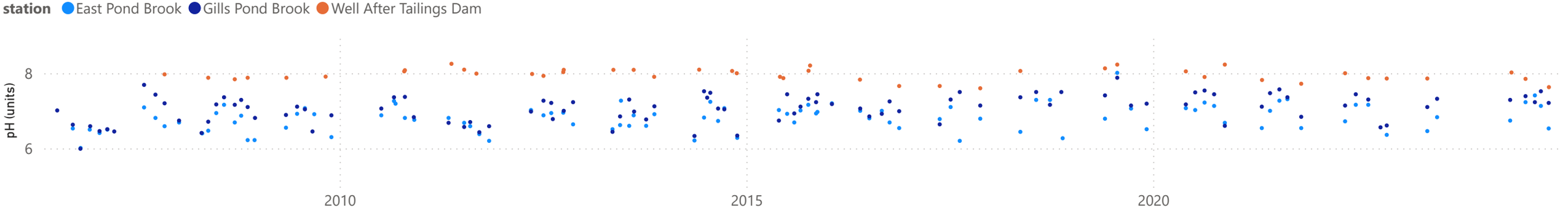


Appendix - Grab Sample Graphs

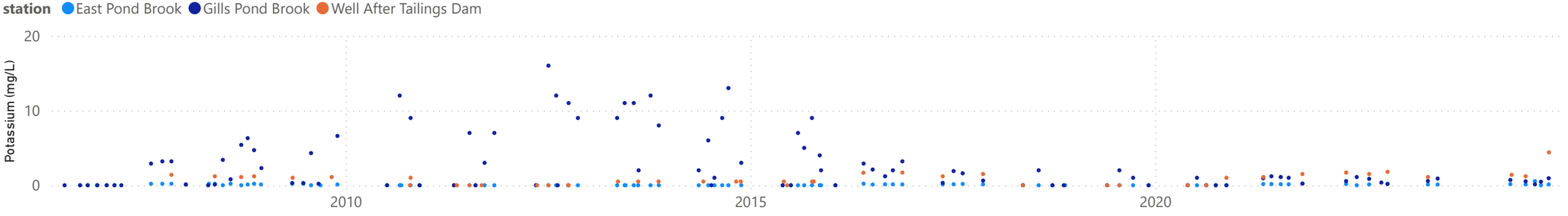
Grab Samples Nitrate & Nitrite (mg/L)



Grab Samples pH (units)

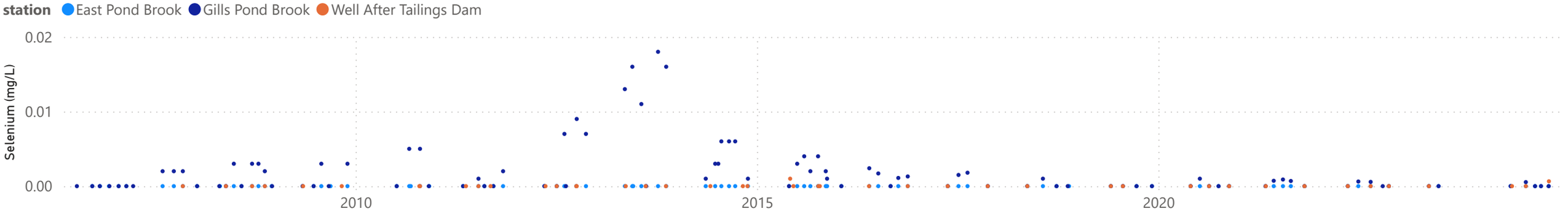


Grab Samples Potassium (mg/L)

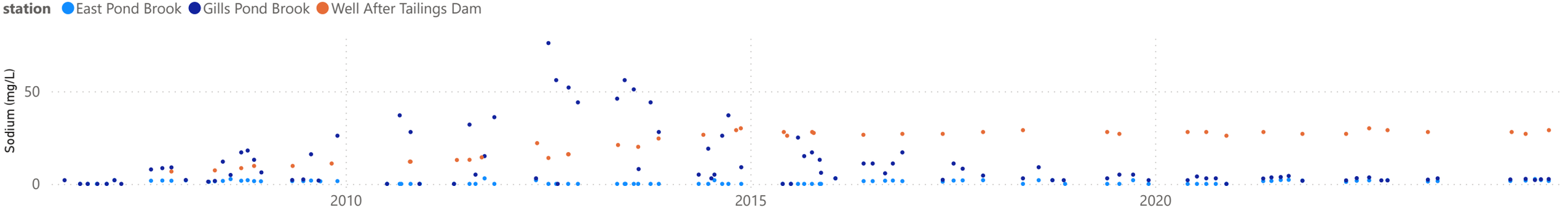


Appendix - Grab Sample Graphs

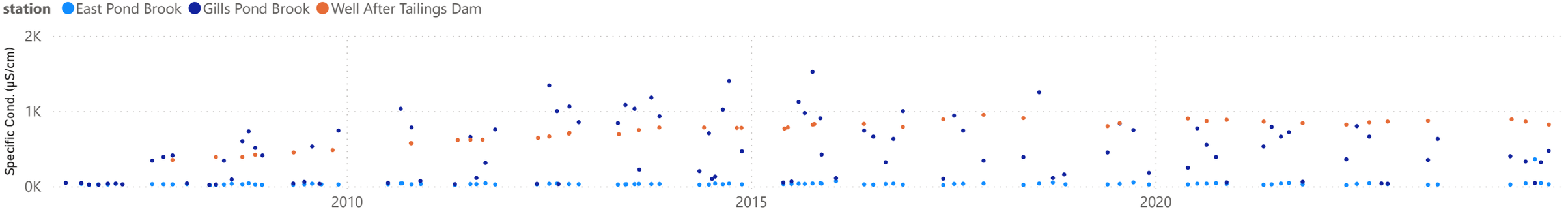
Grab Samples Selenium (mg/L)



Grab Samples Sodium (mg/L)

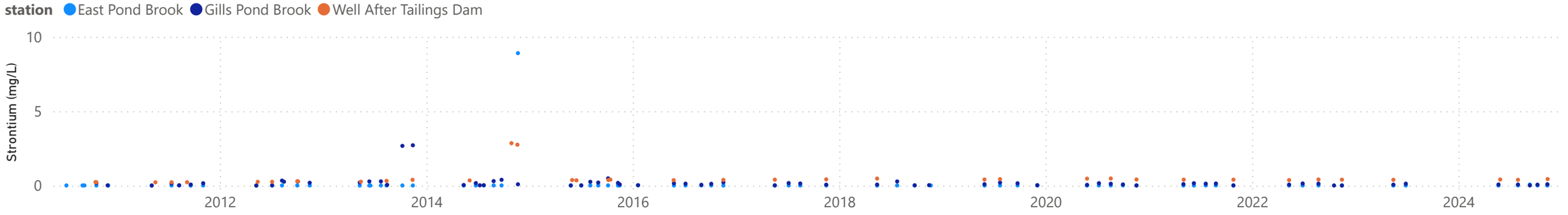


Grab Samples Specific Conductivity (µS/cm)

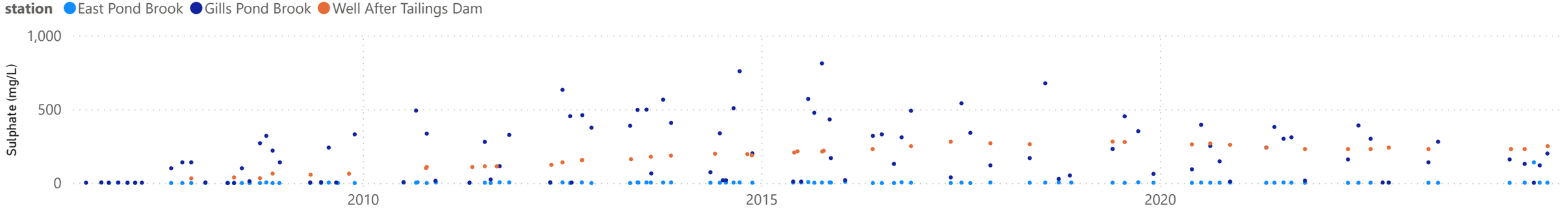


Appendix - Grab Sample Graphs

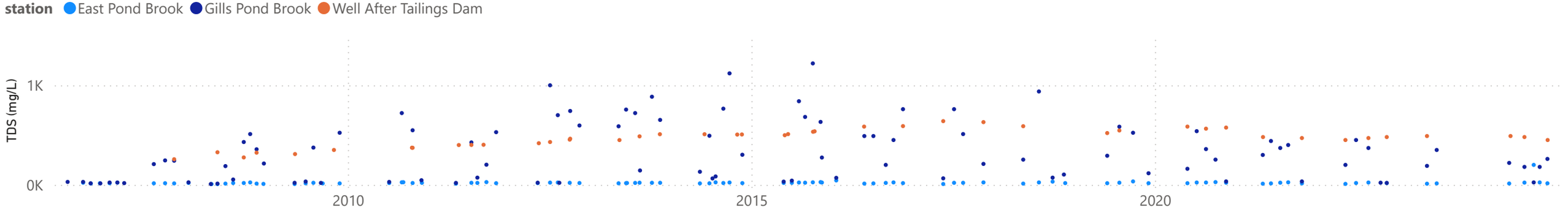
Grab Samples Strontium (mg/L)



Grab Samples Sulphate (mg/L)

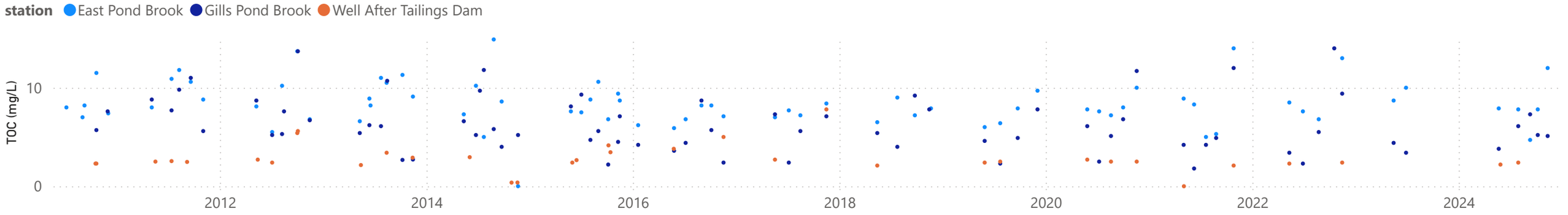


Grab Samples Total Dissolved Solids (mg/L)

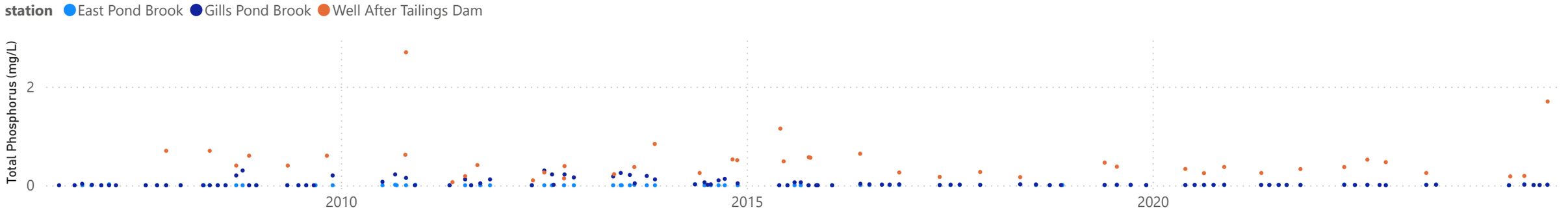


Appendix - Grab Sample Graphs

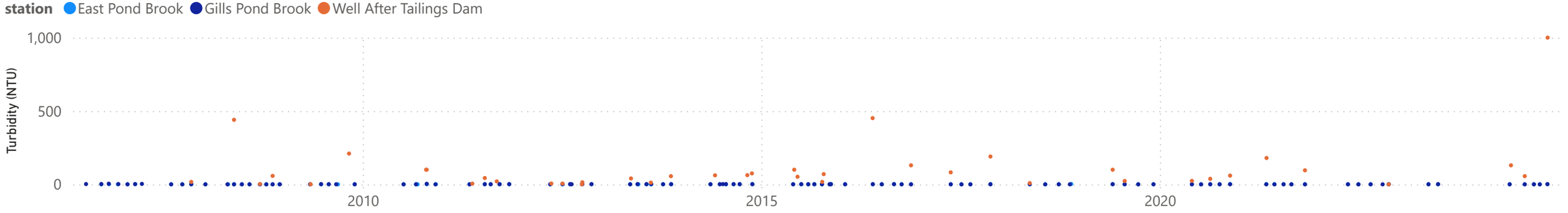
Grab Samples Total Organic Carbon (mg/L)



Grab Samples Total Phosphorus (mg/L)

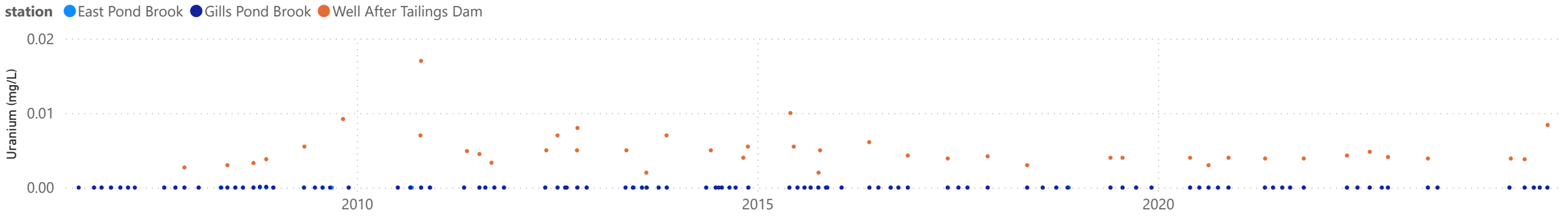


Grab Samples Turbidity (NTU)



Appendix - Grab Sample Graphs

Grab Samples Uranium (mg/L)



Grab Samples Zinc (mg/L)