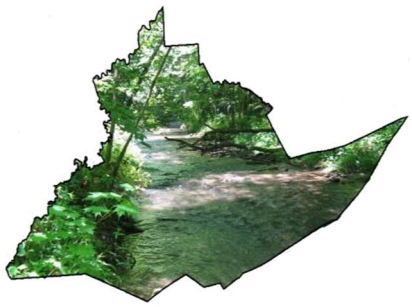


Centre County, Pennsylvania

Senior Environmental Corps

2021 Quality Report

The mission of the Centre County Pennsylvania Senior Environmental Corps (CCPaSEC) is to develop and to support teams of senior citizens who gather and publish data on the quality of water in the streams of Centre County. Through public outreach, with the assistance of the ClearWater Conservancy, the Centre County Conservation District, Nature Abounds™ and other environmentally concerned organizations, CCPaSEC seeks to keep the public informed of the importance of clean water and how the management of our civil and natural resources affects the quality of streams in the county.

CCPaSEC Quality Team
February 18, 2022 WES

We value the Quality of our data published on our website

CCPaSEC implemented a Quality Assurance Plan in preparation for the Nature Abounds™ quality plan distributed at the May 2016 training session. Basically, our plan calls for our quality team to conduct Team field reviews, perform duplicate test to determine our collective Relative Average Deviation (RAD). The average team RAD is expressed as a percentage (RPD) is one measure of the quality of our posted data on our website at CCPaSEC.org.

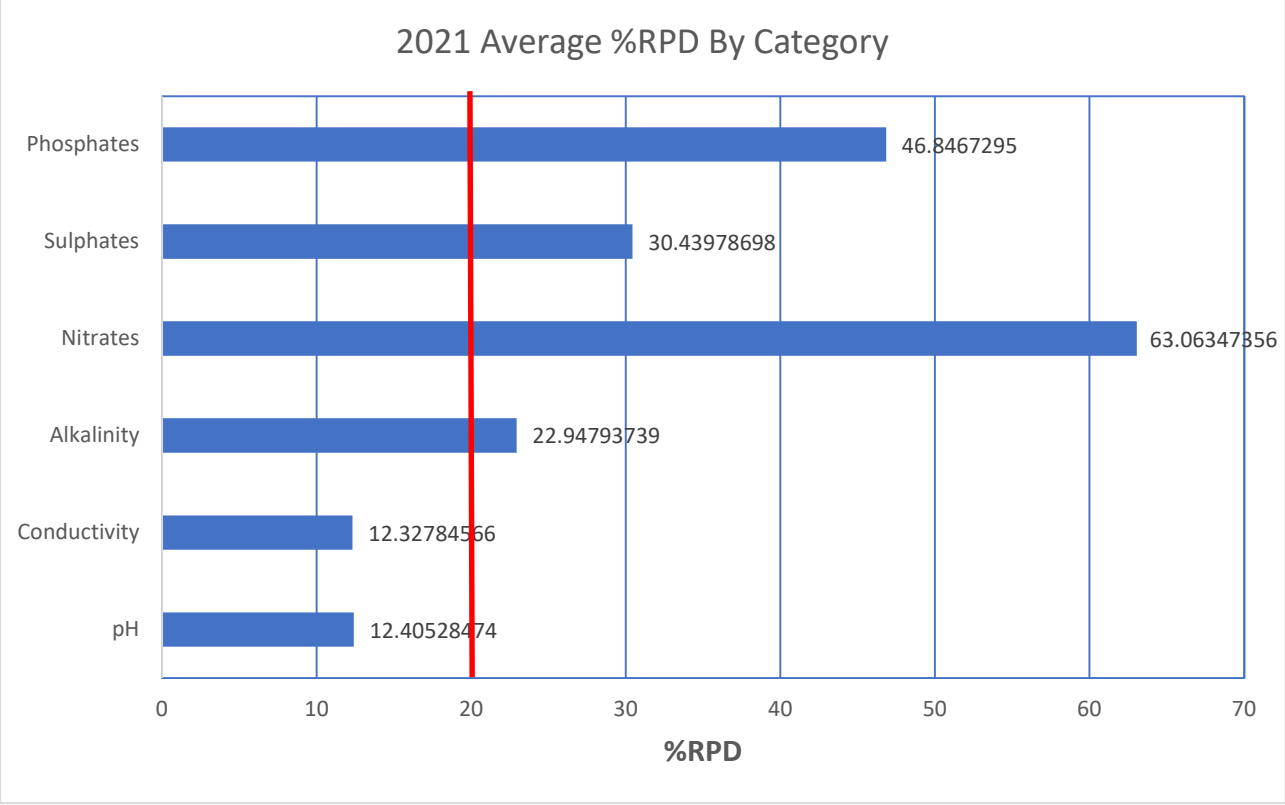
It is incumbent upon us to provide the RPD to users of our data for them to understand its significance.

Duplicate tests

The CCPaSEC RPD is determined by duplicate testing of our Field teams and the Quality team.

Relative Percent Deviation (RPD) 2021

Nature Abounds™ Quality Plan set a goal for the RPD to be less than 20%.



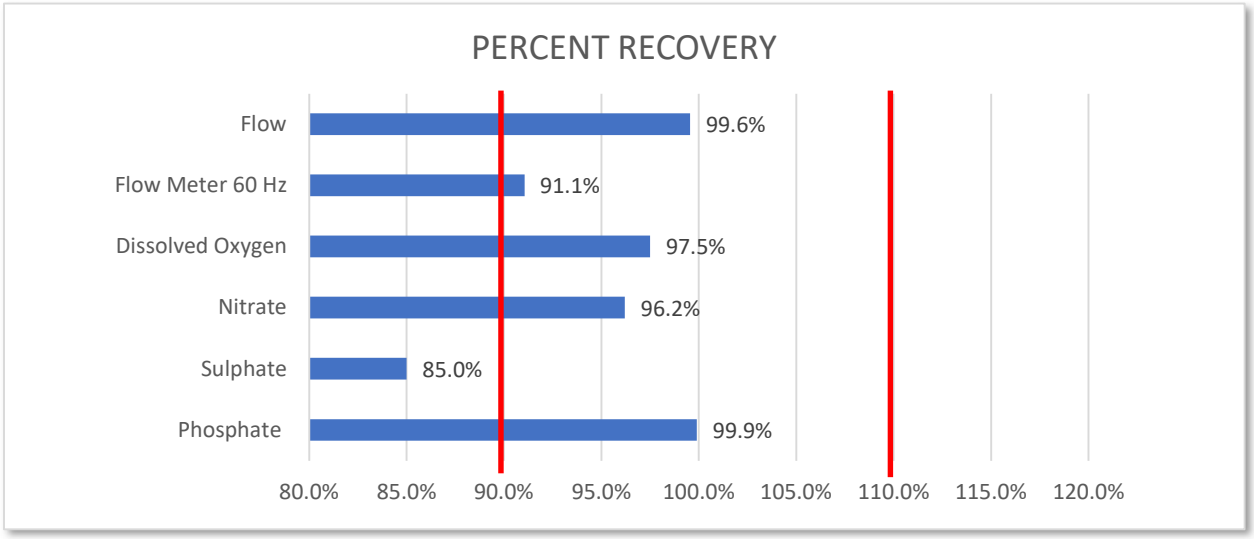
Equipment Percent Standard deviation (PD) 2021

Nature Abounds™ Quality Plan set a goal to be between 90% and 110%

We are not using Laboratory certified equipment and we cannot expect Laboratory level results. We perform a yearly evaluation of our equipment percent deviation from a known Standard. The relative standard deviation is widely used in analytical chemistry to express the precision and repeatability of an assay.

Percent Standard deviation (PD) is a measure of the capability of the data measurements of our equipment. Our Quality Control plan calls for testing all of our equipment each year. The Nature Abounds™ Quality Plan established PD goal is to be between 90% and 110% is used to quantify the amount of variation or dispersion of a set of data values.

The equipment tests are performed against standards for pH, nitrate, sulfate and phosphate. We use a common tap water sample for dissolved oxygen.



Conclusions & Results:

Relative Percent Deviation (RPD) 2021 (duplicate tests)

All of the eleven (11) teams were evaluated.

There has been a 12% improvement from 2020 for conductivity. pH degraded by 3% but still below the 20% acceptable limit. This was in spite of a faulty Oakton meter during August, which has been replaced, and retesting samples with a backup meter. There has been degradation of the following measurements since last year: phosphates (10%), sulphates (3%), nitrates (18%!), and alkalinity (9%), all exceeding the 20% acceptable limit. This may be attributed to micro-scratches on the sample cells or incomplete cleaning of the sample cells.

One team (Team 9) did not have available reagent for sulphate duplicate testing. All teams should check the amount of available test reagents before field testing.

Percent Standard deviation (PD) 2021 (equipment tests)

All PDs were within the acceptable margins except for the sulphate value which was below the acceptable margin by 5%.

Recommendations

We do not recommend any changes in our test procedures. Nature Abounds™ recognizes the capability of the equipment they have provided us. By maintaining our procedures our published data is consistent and can be compared over time.

Our report provides users a measure of the quality of the data. If there is a sudden or profound change in a stream, it should be reported to Susan Sapp (President), Justin Kozak (Centre County Watershed Specialist), and William Smith (QC Coordinator). The QC Team will follow up any unusual readings to ensure they are not due to procedural or equipment issues.

Practices

The nitrate test is highly sensitive. We need to continue to segregate the sample cells, and sample cell lids taking care not to interchange them. The sample cells, and the colorimeter, should be cleaned per our procedures. Foam swabs have been issued to the teams to facilitate the cleaning of the sample cells. Teams are reminded to use Dawn as the cleaning agent and use the supplied microfiber cloths to wipe the sample cells. It has been recommended that new sample cells for nitrates should be issued.

Teams should check that their test reagents, including the sulfuric acid bottle in the alkalinity kit, are not outdated by looking at the lot numbers and report them to Dan Delotto.

Teams have been instructed to orient the sample cells in the colorimeter, using the diamond for consistency of results, so that comparisons over a time period can be made.

We may improve our RPD results by assuring we completely empty the powder packets per the instructions. To assure all the reagent is used, we should carefully tear open the powder packs and empty any residue into the sample cell.

Appendix I

HACH Technical Support

Nitrate Percent Recovery (PR): The HACH Technical service was contacted as to why our initial PR equipment tests of the nitrate standard resulted in in the mean of 7.86 (above the standard).

The Support Tech's answer: "When testing the standard, you can get higher results on DR-850s using the Cadmium Reduction method."

The HACH Tech said the powder packets contain reagents for cadmium reduction that influence our data. These powders assume a concentration of cadmium in the sample that may not be in the general range of our field sample. Many of our Centre County streams have very low levels of Nitrate. The cadmium reduction method may account for some of the apparent increase in nitrate as measured with the colorimeter.

We cut our nitrogen standard in half to 5.0 mg/L for the 2016 Equipment Check, but recorded an average reading of 7.68 mg/L. The HACH recommended correction method (*see Appendix III*) implies that our website colorimeter nitrate data is skewed Hi (overstated).

A correction factor was determined for our current NitaVer-5 powder packets as 0.6 for our 2017 Equipment Check. The true NO3-N concentration of the field sample is the field reading times the correction factor. This indicates that our published colorimeter nitrate data is higher than the true values.

Our comparison of previous Color Wheel NO3 results correct for with our Colorimeter NO3-N results supports this conclusion.

We suspect all PaSEC users of the DR-800 series colorimeter will have the same issue.

Appendix II

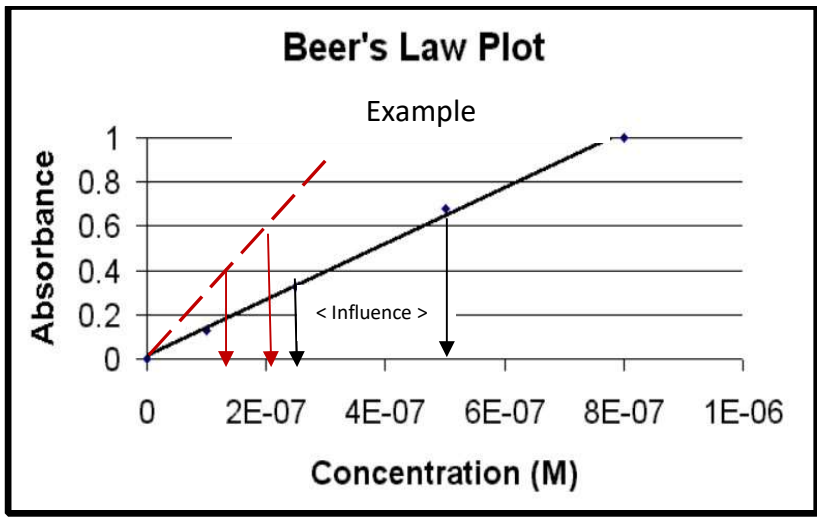
Why it is important that we completely empty the reagent powder packs

Not emptying the reagent powder pack would affect colorimeter reading. The influence of the amount of reagent used for our tests for phosphate and sulfate may be less critical than nitrate if the absorbance line for nitrate is greater than those chemicals.

Illustration:

If we use less than the prescribed amount of reagent, the field sample will absorb less light.

The slope of the absorbance line is different for each chemical. If the slope for the nitrate line is less than those for sulfate or phosphate; the proportion of reagent used would have a greater effect on the derived concentration.



Please tear open the powder pack and empty the remains into the field test sample cell before performing the colorimeter test.

Indicators of unused reagent:

Appendix III

HACH *recommended Formula for Correction of Differences for Cadmium Reduction Method of Nitrate Analysis;*

A=True Concentration of the Sample
B=Concentration of the Reagent Blank (what you get when you run Deionized water as a sample).
C=Observed Concentration of the Sample
D=True Concentration of the standard
E=Observed Concentration of the standard
*A = (C - B) * [D / (E - B)]*
So, when you get your new lot of NitraVer 5 Nitrate Powder packs, you should run a test on deionized water, to see what color the powder powders read as. This is your reagent blank (B). If you get a result of .5 mg/L, then B would be equal to .5 mg/L.

When you test your samples, you will also test a standard solution at the same time. Be sure to shake the sample cells all the same. Take a Hach standardized solution of Nitrate and run it through the test. The number you get is your (E) in this equation. Let's presume you got 12 mg/L. on a 10 mg/L standard. Because your standard is supposed to be 10 mg/L (that's what it says on the box), the true concentration of your standard (D) is 10 mg/L. This is your D value.

With all that in mind, run your sample (C). Imagine that you get a result of 15 mg/L. This is your C, or the Observed Concentration of your sample. So,

*A = (15 - .5) * [10 / (12 - .5)]*
*A = (14.5) * [10/11.5]*
*A = 14.5 * .87*
A = 12.6 mg/L

And THAT is the true concentration of the sample that initially read 15 mg/L.

If you decide not to determine the reagent blank value, then the formula is simply: A = C × D ÷ E