



# Centre County, Pennsylvania Senior Environmental Corps 2017 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  
December 2017

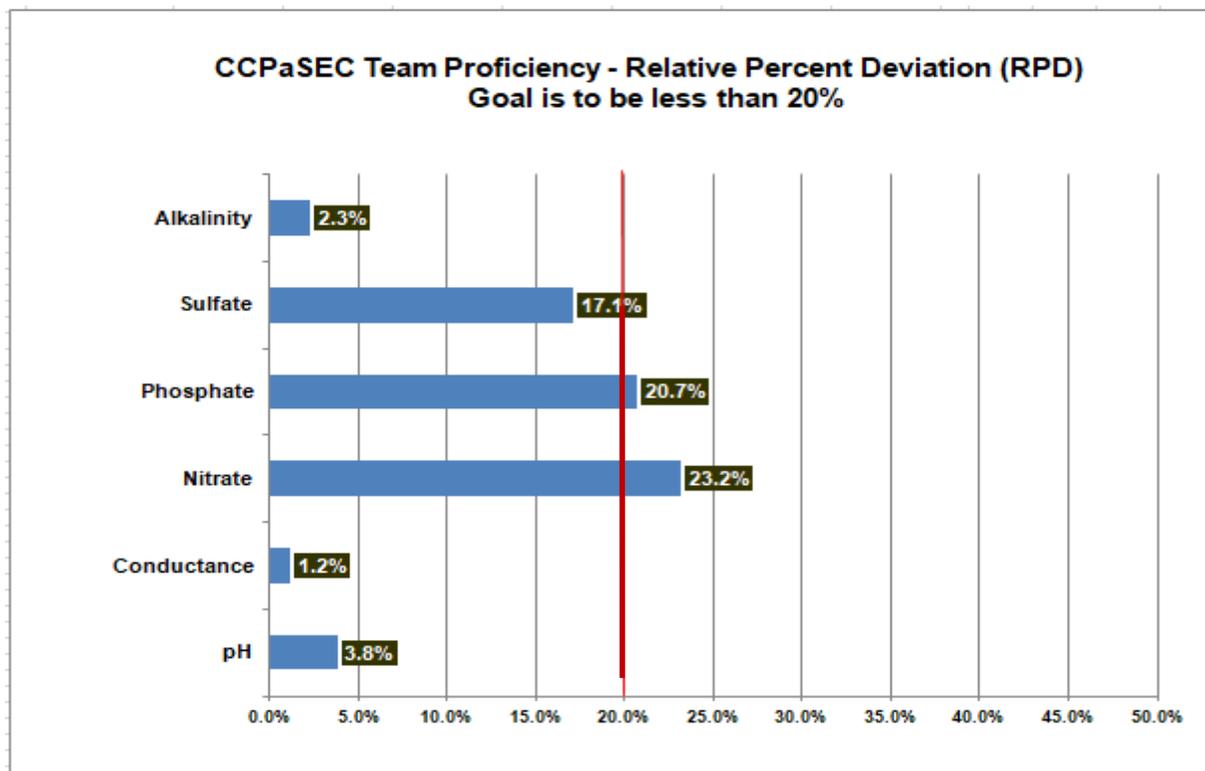
## We value the quality of our data published on our website

CCPaSEC has implemented a Quality Assurance Plan in preparation for the Nature Abounds™ plan distributed at the May Training Session. Basically, our plan calls for our Quality Team to conduct team field reviews, perform duplicate tests to determine our collective **Relative Percent Deviation (RPD)** and a yearly Equipment Check including a report on instrument Percent Deviation (PR).

The RPD is one measure of the quality of our posted data. We are not using laboratory certified equipment and we cannot expect laboratory level results. Nature Abounds™ Quality Plan set a goal for the RPD to be less than 20%. It is incumbent upon us to make available the RPD of our data to users.

The CCPaSEC RPD was determined from duplicate testing of our field teams and the Quality Team. The individual team RPD's were combined (averaged).

### Relative Percent Deviation (RPD) 2017



Our goal is to not exceed 20%

## Factors that may bias our Nitrate RPD results

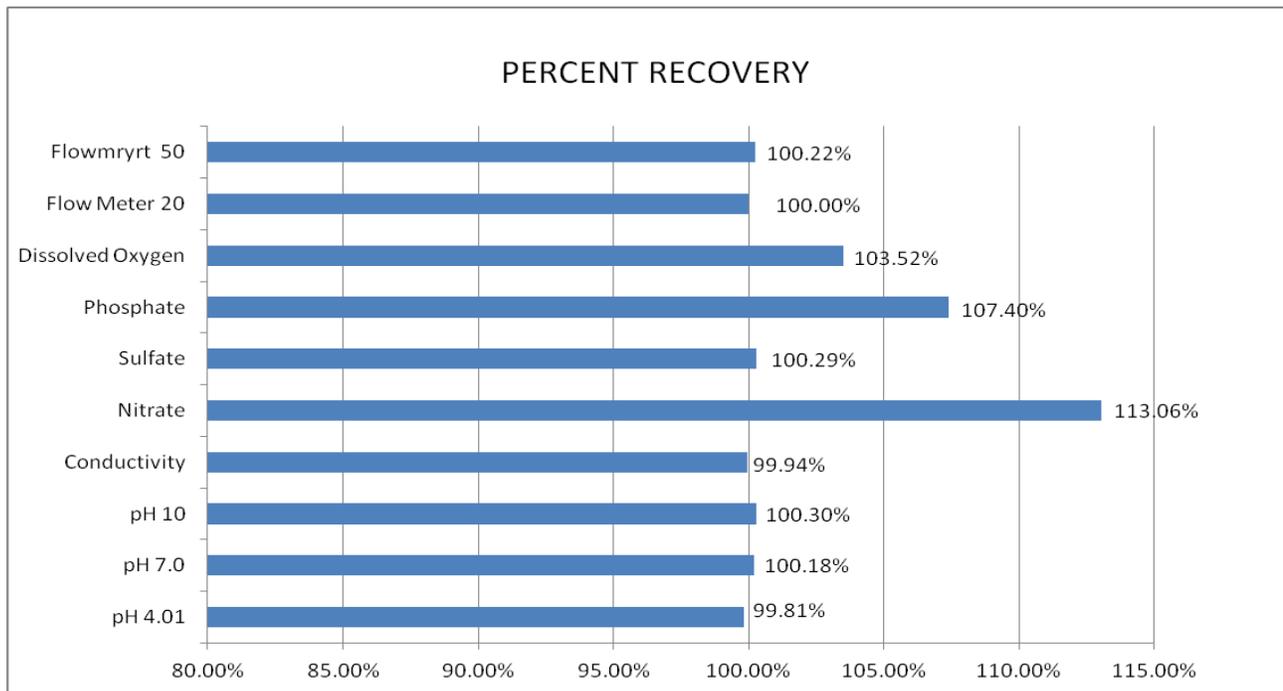
Our teams perform either High or Low nitrates tests using the DR-850 colorimeters. The comparisons are favorable. We are concerned about our nitrate RPD results.

- Our previous experiments with the sample cells have demonstrated that their orientation (rotation) with respect to the colorimeter LEDs affect the measurement. Because both the blank and field sample cells exhibit this variance we decided that for consistency all field team kits dedicate a sample cell to each test (sulfate, orthophosphate, or nitrate) and everyone should align the diamond on the blank cell and field sample cells the same way to the colorimeter.
- Our Quality Team noticed that it was difficult to completely empty the nitrate powder pillow. There were indications of nitrate reagent residue (*see Appendix II*). The amount left behind varied greatly between the field teams and the Quality Team. The tests are sensitive to the quantity of reagent. Using less than needed would produce a lower mg/L value and is one likely cause of the disparity in our duplicate tests.
- The previous Percent Recovery (PR) using our nitrate standard resulted in values much different from the stated value of the standard. This led to the realization those users of our published nitrate NO<sub>3</sub>-N data need to be aware that it is not factored to account for the colorimeter's cadmium reduction method and is therefore shown as greater than the actual value.
- Users of our website data need to recognize it is only intended to show historical changes. The phosphate and sulfate data do not require a correction factor.

## Percent Recovery 2017

**Percent Recovery (PR)** 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's established PR goal is to be between 90% and 110%.

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



\* *Note:* Since we use mixed lots of reagents during the year, we used the NitraVer-5 correction factor of 0.6 (reagent blank value) that was determined for our 2017 equipment check NitraVer-5 reagent to correct for the cadmium reduction test method (*Appendix III*).

## Results:

Our nitrate Percent Recovery and Relative Percent Deviation are in excess of Nature Abounds™ goal.

“The symbol NO<sub>3</sub>-N stands for “nitrate as nitrogen” which means this is a test for nitrate but the concentration units are being reported as nitrogen only. Since concentration is in units of mass per volume, such as mg/L, changing the way we report the formula changes the mass per volume and therefore changes the value of the concentration.” \*

We investigated the probable cause by comparing our previous history of NO<sub>3</sub> data, collected with the color wheel method to that for nitrate-nitrogen using the HACH DR-850 colorimeters (factored as NO<sub>3</sub>).

Our comparison of nitrate data for the range of 0.05 mg/L to 10 mg/L taken with the HACH color wheel (NO<sub>3</sub>) to that determined with the colorimeter (factored as NO<sub>3</sub>) imply the colorimeter values for nitrate-nitrogen posted on the CCPaSEC website may be higher than the actual levels.

We feel our nitrate data, is useful for seasonal and yearly comparisons. Although our data may be high, it is lower than Pennsylvania’s drinking water limits: NO<sub>3</sub>-N (colorimeter 10 mg/L) and the NO<sub>3</sub> (color wheel 45 mg/L).

Nature Abounds™ recognizes it is not practical to impose the nitrate-nitrogen correction of differences for cadmium reduction method on our field teams.

\*[http://hachcompany.custhelp.com/app/answers/answer\\_view/a\\_id/1000315/~/\\_/what-is-the-difference-between-no3-n-and-no3-in-the-units-and-chemical-form%3F](http://hachcompany.custhelp.com/app/answers/answer_view/a_id/1000315/~/_/what-is-the-difference-between-no3-n-and-no3-in-the-units-and-chemical-form%3F)

## Conclusion and 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, we can notify the proper authorities. Nature Abounds™ encourages and approves using the diamond marker for placement of the sample cells in the colorimeter.

- Our nitrate results appear to be consistently somewhat overstated. We believe much of it is inherent in the cadmium reduction method, amount of reagent used and the variation of the sample cell walls. We believe our duplicate testing method using a different set of sample cells from the field team also contribute to the observed differences and exacerbate the resulting RPD for all nitrate-nitrogen, sulfate & orthophosphate duplicate tests.
- Our Equipment Check's Percent Recovery (PR) for High nitrate-nitrogen needed to be corrected for our cadmium reduction test method. Since we use mixed lots of NitraVer-5 during the year, we've used the correction factor determined during our 2017 Equipment Check the NitraVer-5 reagent blank value. There is another correction factor for the Low nitrate test.
- We need to continue to clean the sample cells and the colorimeter per our procedures.
- We can improve our RPD results by assuring we completely empty the powder pillow per the instructions. To assure all the reagent is used we should carefully tear open the powder pillow and empty any residue into the sample cell.
- Calibration of the Oakton meter for ambient temperature is not needed as the Oakton meter is compensated for temperature.
- Quality Team: We have no control over the sample cells. We could see an improvement in our RPD if the Quality Team performs the duplicate tests with the teams' sample cells. The results may be more representative of the team's RPD performance. This will extend the onsite time but we would only need to do this once a year.

## *Appendix I*

### HACH Technical Support

**Nitrate Percent Recovery (PR):** The HACH Technical service was contacted to explain why our initial PR equipment tests of the standard resulted in results 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 pillows 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 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 colorimeter nitrate data is skewed high (overstated).

A correction factor was determined for our current NitaVer-5 powder pillows as 0.6 for our 2017 Equipment Check. The true NO<sub>3</sub>-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 NO<sub>3</sub> results with our colorimeter NO<sub>3</sub>-N results supports this conclusion.

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

## Appendix II

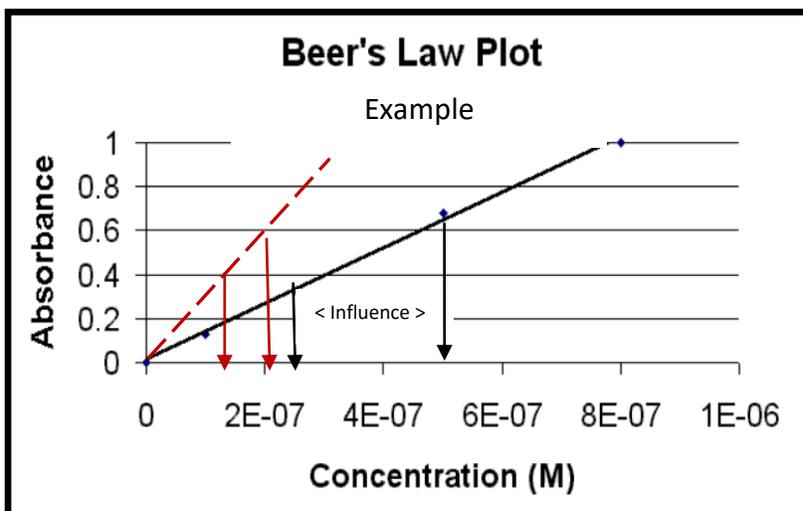
### Why it is important that we completely empty the reagent powder pillows

Not emptying the reagent powder pillow 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.



Indicators of unused reagent:



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

### *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 pillows, you should run a test on deionized water, to see what value the powder pillow reads 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 your reading is 12 mg/L with the 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,*

$$A = (15 - .5) * [10 / (12 - .5)]$$

$$A = (14.5) * [10/11.5]$$

$$A = 14.5 * .87$$

$$A = 12.6 \text{ mg/L}$$

*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:  $A = C \times D \div E$