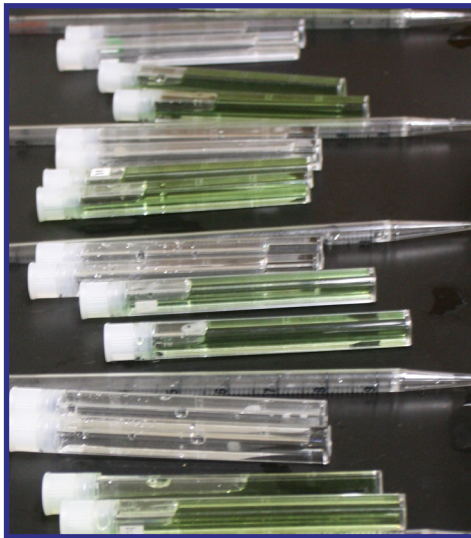
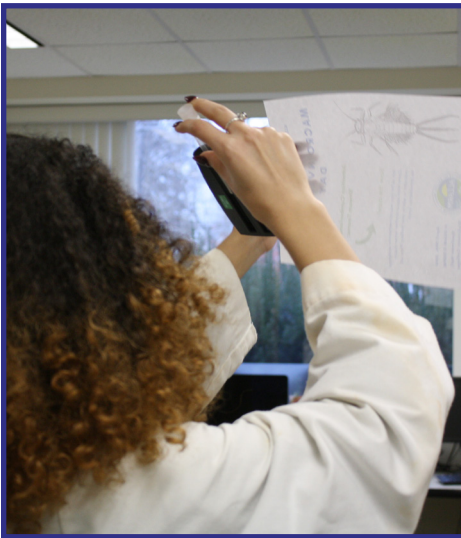


Stream Team Data Reminders

Guide to Equipment Precision and Recording Data



Dickinson

Acceptable Precision Ranges: QA/QC

Thank you for volunteering your time to participate in the Stream Team initiative. We greatly appreciate your role collecting data to help evaluate stream health. When collecting data there are several approaches to ensure that values are credible. This document will help to explore some of the practices you can use during your monthly analysis.

Quality Assurance/Quality Control (QA/QC)

Quality assurance and quality control are the backbone of any successful stream monitoring effort and are the measures taken to demonstrate the accuracy and precision of your data. Quality Assurance (QA) refers to the plan and general processes for maintaining quality in all aspects of a program. Quality Control (QC) consists of the specific steps taken to determine the validity of specific sampling and analytical procedures. This document will hone in on key Stream Team techniques to help ensure that the values obtained are close to reflecting the accurate values of stream health and that data points are comparable to each other. You can find out more about the key quality assurance and control measures Stream Team implements on page 4 of the Stream Team manual.

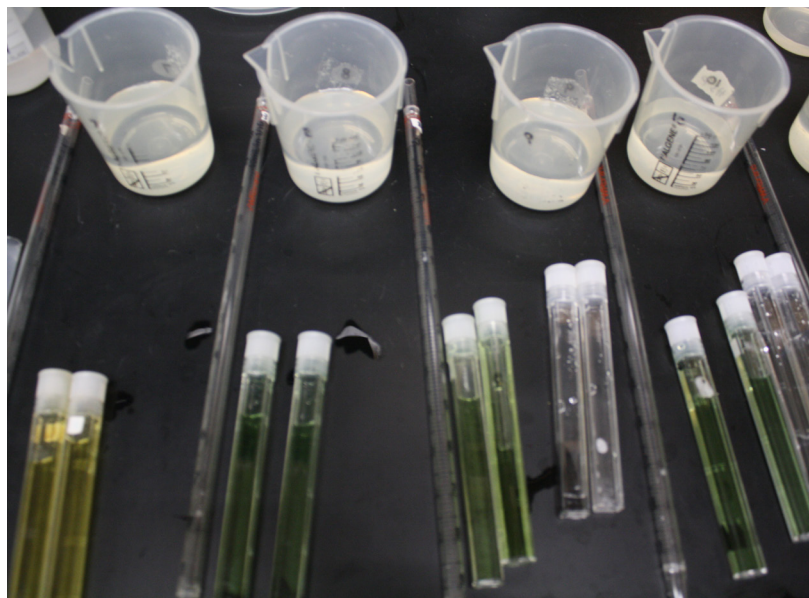
What is an acceptable precision range?

Replicates are important for catching potential errors that might occur while testing samples such as residue in test tubes, undissolved nitrate tablets, or expired reagents. When testing two replicates of the same water sample, you should expect the values to be relatively close together. When the two replicates are close to each other in value they are precise. When two values are close to each other and close to the true value of the water sample, they are considered both accurate and **precise**. The **acceptable replicate precision range** is an approach to, based on the sensitivity of the equipment, deciding if your two replicates are close enough to be precise. If two replicates are not within the acceptable precision range of each other than a third replicate is needed.

Table 1.0 Acceptable precision ranges by parameter

Parameter	Unit	Precision Range
Water Temperature	°C	± 0.5 °C
pH	pH unit	± 1 pH unit
Conductivity	µS/cm	± 10 µS/cm
Nitrate-Nitrogen	mg/L	0 – 2 mg/L = ± 1 mg/L 2 – 10 mg/L = ± 2 mg/L 10 – 15 mg/L = ± 5 mg/L

Acceptable Precision Ranges: Averaging



Left: Watershed Coordinators Abby Kaija '20 and Katherine Altamirano '20 cleaning lab equipment according to ALLARM's acid-washing protocol

Above: ALLARM's lab team conducts QA/QC on volunteer-provided samples for the parameter pH

What happens if my two replicates are not precise?

Firstly, double-check your values and whether or not they fall in the precision range according to the Stream Team parameter you are testing (**Table 1.0**). If two replicates are **not** within the acceptable precision range of each other, then a third replicate is needed. Once the third replicate is complete, determine which two replicates fall within the acceptable precision range of each other. Note which of the two replicates are in range of each other on the datasheet **and only enter these two values into the Chesapeake Data Explorer**.

What happens if, after my third replicate, have none within the acceptable precision range?

If after your third replicate, you still do not have two values within the acceptable precision range, **continue to a 4th or 5th replicate until two values fall within range**. As above, note which of the two replicates are in range of each other on the datasheet and enter **only these two values** in the Chesapeake Data Explorer. Often times, if you are needed a 3rd or 4th replicate, consider examining whether there could be a problem with dirty glassware or expired reagents.

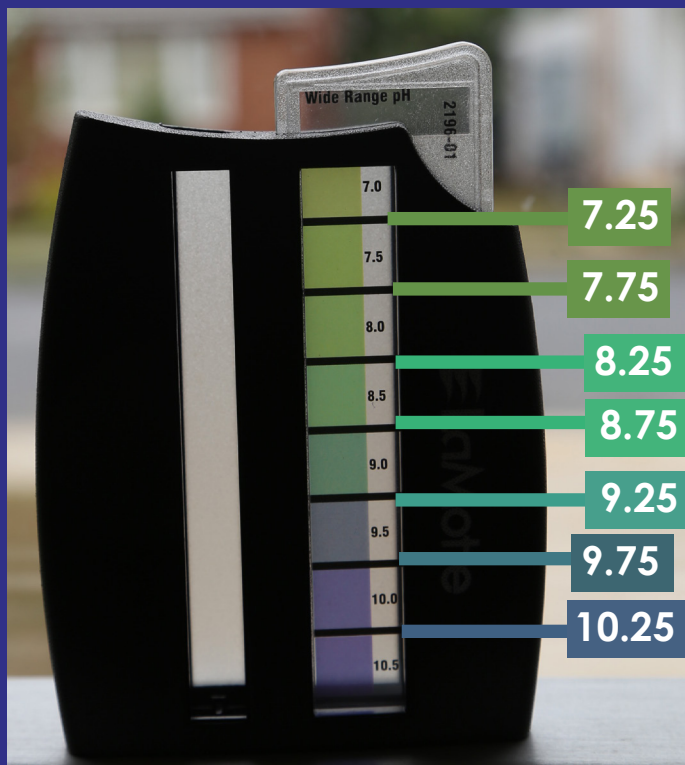
If you need a reagent replacement, please contact us at allarm@dickinson.edu

Averaging Replicates

Just as important as making sure replicates are **precise**, it is also important to ensure the average of those replicates reflect the **accuracy** of the equipment. This means rounding to **significant figures**. Rounding to significant figures is different for each parameter based on the precision and detection limit of the equipment.

Data Reminders: pH

Figure 1.0: pH values



When recording values for pH, you can select the number shown on the LaMotte color comparison slide or the values directly between, where the bold black line indicates the change in value (reference Figure 1.0 for those middle values).

Note: You should not be recording any number not listed in this graphic. If the average of your two replicates is not one of these numbers, round up to the next acceptable value listed in this diagram.

If the average of your two replicates is not one of these numbers, round up to the next acceptable value listed in this diagram. For pH, this means the number recorded should have a decimal unit of .25, .5 or .75.

If you and a partner are determining the color of a pH replicate together, write your values down and decide upon a single value for the replicate. Only record the agreed upon value on your datasheet. This value will then be uploaded to the Chesapeake Data Explorer.

Table 2.0: Examples of acceptable pH values

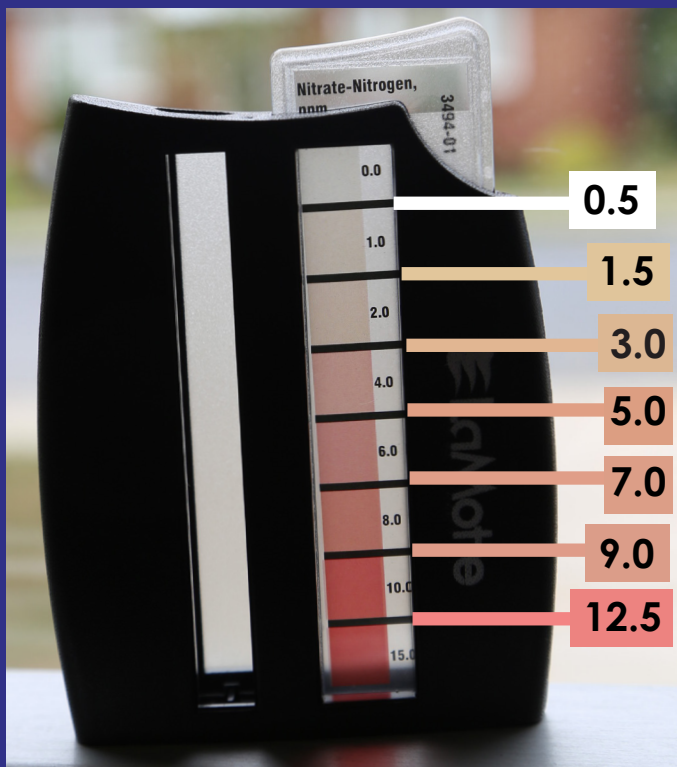
Replicate 1	Replicate 2	Within precision range/ Need another replicate?	Average
7.5	7.75	Yes/No	7.75 (rounded up from 7.625)
8.0	8.5	Yes/No	8.25
5	6.25	No/Yes	Third replicate needed before averaging

Data Reminders: Nitrate-Nitrogen

Similarly to choosing pH values, when recording values for nitrate-nitrogen, you can select the number shown on the LaMotte color comparison slide or the values directly between. Again, this is where the bold black line indicates the change in value (reference Figure 2.0 for those middle values).

Note: You should not be recording any number not listed in these graphics. If the average of your two replicates is not one of these numbers, round up to the next acceptable value listed in this diagram.

Figure 2.0: Nitrate-Nitrogen values



If you and a partner are determining the color of a nitrate replicate together, decided on a value for each replicate and only record the agreed upon value on your datasheet. This value will then be uploaded to the Chesapeake Data Explorer.

Table 3.0: Examples of acceptable Nitrate-Nitrogen values

Replicate 1	Replicate 2	Within precision range/ Need another replicate?	Average
1.0 mg/L	1.5 mg/L	Yes/No	1.5 mg/L (rounded up from 1.25 mg/L)
4.0 mg/L	5.0 mg/L	Yes/No	5.0 mg/L (rounded up from 4.5 mg/L)
12.5 mg/L	15.0 mg/L	Yes/No	15.0 mg/L (rounded up from 13.75 mg/L)
0.5 mg/L	2.0 mg/L	No/Yes	Third replicate needed before averaging

Data Reminders: Conductivity

When do I record a decimal place?

For measurements **under 200 $\mu\text{S}/\text{cm}$** , there is one decimal place. If your average of conductivity replicates is **under 200 $\mu\text{S}/\text{cm}$** and has two decimal places, round to one decimal place.

When do I record in whole numbers?

For measurements **above 200 $\mu\text{S}/\text{cm}$** , the meter reads in whole numbers. If your average of conductivity replicates is **over 200 $\mu\text{S}/\text{cm}$** has a decimal place, round to the nearest whole number.

Table 4.0: Examples of acceptable conductivity values

Replicate 1	Replicate 2	Within precision range/ Need another replicate?	Average
256 $\mu\text{S}/\text{cm}$	257 $\mu\text{S}/\text{cm}$	Yes/No	257 $\mu\text{S}/\text{cm}$ (rounded up from 256.5 $\mu\text{S}/\text{cm}$)
111.2 $\mu\text{S}/\text{cm}$	111.3 $\mu\text{S}/\text{cm}$	Yes/No	111.3 $\mu\text{S}/\text{cm}$ rounded up from 111.25 $\mu\text{S}/\text{cm}$)
198.8 $\mu\text{S}/\text{cm}$	201 $\mu\text{S}/\text{cm}$	Yes/No	200 $\mu\text{S}/\text{cm}$ (rounded up from 199.9 $\mu\text{S}/\text{cm}$)
510 $\mu\text{S}/\text{cm}$	525 $\mu\text{S}/\text{cm}$	No/Yes	Third replicate needed before averaging

Alliance for Aquatic Resource Monitoring

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