THE MEADOWS CENTER
FOR WATER AND THE ENVIRONMENT
TEXAS STATE UNIVERSITY

Texas Stream Team

ADDENDUM A TO THE WATER QUALITY MONITORING MANUAL

**Nitrate-Nitrogen, Orthophosphate, Turbidity,
Streamflow Monitoring and Analysis Procedures**

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Training Requirements

The advanced nonpoint source pollution monitor training will be offered to monitors who have completed the "core" training and have exhibited substantial dedication to continued monitoring. This advanced training covers the procedures for collecting and/or analyzing E. *coli* bacteria, streamflow, nitrate-nitrogen, orthophosphate, and turbidity. E. *coli* procedures can be found in Section 4 of the Texas Stream Team Water Quality Monitoring Manual.

Training Step 1: Introduction

Monitors receive instruction on the significance of monitoring for these parameters covering topics such as the sources of excessive quantities, standards, screening levels, and relevant natural processes.

Training Step 2: Site Visit

The group then travels to a suitable site for monitoring where the procedures for E. *coli* collection and the streamflow monitoring are demonstrated and practiced. These procedures are simulated indoors when weather hinders outdoor accessibility. For the streamflow monitoring procedure, tape is used to simulate the river boundary and a person walking simulates the whiffle ball flowing downstream.

Training Step 3: Demonstration of Procedures

Monitors then travel back indoors with their E. *coli* sample water and a bucket of sample water to learn the procedures for analyzing E. *coli,* nitrate-nitrogen, and orthophosphate. After practicing with the sample water, monitors perform their nitrate-nitrogen and orthophosphate tests against a standard with a value unknown to them.

Annual Training Refresher

Following the training, Texas Stream Team suggests that all monitors:

a) attend an annual quality control session with qualified staff of Texas Stream Team or partner agencies OR
b) participate in the online quality control self-assessment available on the Texas Stream Team website

Scope and Application

Goal

The goal of these tests is the determination of baseline conditions and to identify abnormal environmental events when they occur. Baseline conditions are the expected normal environmental conditions for that water body, including an expected range of values for each parameter established by substantial observation. Specialized monitoring plans may also be set up by partner groups and monitors to target data collection for locations and/or environmental conditions that do not serve as baseline environmental conditions data.

Monitoring Site Identification

Texas Stream Team and/or partner agencies assist monitors with determining the most appropriate monitoring site to perform nitrate-nitrogen, orthophosphate, turbidity, and streamflow tests. Monitors are encouraged to sample on water bodies large enough to be included in the Texas Water Quality Inventory that are on public land. Streamflow measurements are encouraged at sites far from existing USGS streamflow gages in order to encourage the collection of only the most useful data.

Abnormal Data Collection Results

Any drastic alteration from baseline or expected environmental conditions can lead to further research to determine the cause. The data collector should follow procedures laid out in the Communication Plan when abnormal data results occur. Any observed values consistently exceeding the standards designated by the Texas Commission on Environmental Quality (TCEQ) can be used to assist Clean Rivers Program Partners and watershed planners in identifying particular areas where sources of pollution may be a concern and/or additional professional data may need to be collected.

Data Communication

Data are communicated by the Texas Stream Team to partners and other relevant groups via data reports, an online data forum, presentations at steering committee meetings and regional meetings, and newsletter articles.

Summary of Variable Methods

Nitrate-Nitrogen

Nitrogen is present in terrestrial or aquatic environments as nitrates, nitrites, and ammonia. Nitrate-nitrogen tests are conducted for maximum data compatibility with the TCEQ and other partners. Nitrogen is a nutrient necessary for the growth of most organisms. However, excessive amounts can have a detrimental effect on aquatic life by lowering the concentration of dissolved oxygen. Nitrogen affects dissolved oxygen when excessive algae growth on the water surface starves subsurface vegetation of sunlight, thereby limiting the input of oxygen into a water body due to decreased photosynthesis. This process is enhanced when subsurface vegetation dies and decomposes, undergoing a process wherein oxygen is consumed from the water. Nitrogen inputs into a water body may be livestock and pet waste, excessive fertilizer use, failing septic systems, and industrial discharges that contain corrosion inhibitors. Nitrates dissolve more readily than phosphates, which tend to be attached to sediment, and therefore can serve as a better indicator of the possibility of sewage or manure pollution during dry weather.

Method Overview

The LaMotte Nitrate-Nitrogen Kit (Zinc-Reduction Octa-Slide Method) enables the user to reduce nitrate-nitrogen to nitrite with zinc, which then undergoes diazotization/coupling to form a pink color in a test tube. The test tube is then inserted in an "Octa-Slide Viewer" and compared to a color standard. The value of the closest color to the sample is recorded in milligrams per liter (mg/L).[i]

Data Range and Accuracy

Nitrate-nitrogen measurements can be read from 0-15 mg/L nitrate-nitrogen-nitrogen. Measurements are accurate to +/- 0.5 mg/L. Values which appear to be below 1 mg/L are recorded as <1 because it is the lowest readable quantity of the color comparator. Texas Stream Test performed accuracy tests using a lab-certified Nitrate-Nitrogen Standard Solution of 1 mg/L and one of 10 mg/L. Fifteen tests total were performed by four staff members, and every result was equal to the standard solution.

Reason for Method Selection

Aside from the accuracy described above, the LaMotte Nitrate-Nitrogen Zinc Reduction Method is employed because it is the only practical test available for volunteer programs due to the lack of hazardous waste and the low cost of supplies. It has been used by the CRWN for many years, and the need for cross-program consistency is very important for Texas Stream Team since it is the hub for a network of partners, including CRWN.

Orthophosphate

Orthophosphate is the phosphate molecule all by itself. Phosphorus almost always exists in the natural environment as phosphate, which continually cycles through the ecosystem as a nutrient necessary for the growth of most organisms. Testing for orthophosphate detects the amount of readily available phosphate in the water itself, excluding the phosphate bound up in plant and animal tissue. There are other methods to retrieve the phosphate from the material to which it is bound, but they are too complicated and expensive to be conducted by a volunteer monitors. Testing for orthophosphate gives us an idea of the degree of phosphate in a water body. It can be used for problem identification, which can be followed up with more detailed professional monitoring if necessary. Orthophosphate can have the same detrimental effect as nitrate-nitrogen, which is described above. Phosphorus inputs into a water body may be from the weathering of soils and rocks, discharge from wastewater treatment plants, excessive fertilizer use, failing septic systems, livestock and pet waste, disturbed land areas, drained wetlands, water treatment, and some commercial cleaning products.

Method Overview

The Hach Orthophosphate Test Kit (Ascorbic Acid Method) enables the user to reduce a phosphomolybdate complex with ascorbic acid to produce a blue color in a test tube. One test tube is filled with the untreated sample, and another with the treated sample. The sample test tube is then inserted in a color comparator and compared to a color standard, which is viewed through the untreated sample so that any initial coloration of the sample is accounted for. The value of the closest color to the sample is recorded in mg/L.[ii]

Data Range and Accuracy

Orthophosphate measurements can be read at values ranging from 0-50 mg/L polyatomic ion orthophosphate. Measurements are accurate to +/- 0.02 mg/L.[iii] Values which appear to be below 0.02 mg/L are recorded as <0.02 because it is the lowest readable quantity of the color comparator. Texas Stream Test performed accuracy tests using a lab-certified Orthophosphate Standard Solution of 1 mg/L. Fifteen tests total were performed by four staff members, and every result was equal to the standard solution.

Reason for Method Selection

The Hach Orthophosphate Test Kit was chosen because it enables the user to detect values as low as 0.02 mg/L. This is the lowest detection limit offered for field testing methods. Most water bodies in the state of Texas will exhibit very low values for orthophosphate, so volunteers need the lowest detection limit possible.

Turbidity

Turbidity is the cloudiness or haziness of a fluid caused by suspended solids such as soil, algae, plankton, microbes, or other substances. Highly turbid waters are mostly the result of runoff carrying any soils exposed as a result of tilling, mining, drought, or other conditions. Other factors causing turbidity may be excessive algae growth, a large number of bottom feeders disturbing sediment, swimmers disturbing sediment, or eroding stream banks. High turbidity increases the water temperature because suspended particles absorb more heat. Higher temperatures then reduce the dissolved oxygen because warm water holds less dissolved oxygen than cold water. This process is intensified because turbid water limits sunlight penetration, which limits photosynthesis and therefore reduces the amount of dissolved oxygen in the water body. Highly turbid water also poses a risk to wildlife by clogging gills, reducing resistance to disease, lowering growth rates, and affecting egg and larval development. As suspended particles settle, they can blanket the stream bottom and smother fish eggs and any organisms living on or near the bottom of the water body. Contaminants tend to attach to sediment, so highly turbid waters serve as an indicator of other problems as well.

Method Overview
The Turbidity Dropper Pipette Method involves adding one drop at a time of a standard turbidity solution to turbidity-free water in a test tube until it matches the sample. The number of drops is multiplied by a dilution factor to calculate the turbidity.

Data Range and Accuracy
Turbidity measurements can be read from 5-200 JTUs. [iv] Results are recorded in Jackson Turbidity Units (JTU).[v] According to the USGS *National Field Manual for the Collection of Water-Quality Data*, Jackson Turbidity Units are roughly equivalent to the industry standard: Nephelometric Turbidity Units.[vi]

Reason for Method Selection
This method was chosen because it is the only practical, affordable method to achieve quantitative turbidity measurements. Other options involve using spectrometers, which are very expensive.

<u>Streamflow</u>
Streamflow is the volume of water that moves over a designated point over a fixed period of time. Substantial streamflow dilutes the effect of pollution on aquatic organisms. When streamflow is limited, the effect of pollution is increased due to decreased dilution.

Method Overview
The streamflow measurement involves taking width, depth, and velocity measurements using a measuring tape, a stop watch, and a whiffle ball and multiplying these values to determine discharge. Results are recorded in cubic feet per second (cfs).

Data Range and Accuracy
Streamflow measurements will vary over a wide range for each water body. The accuracy of streamflow measurements is limited so it is more manageable to perform by volunteers. Volunteer measurements will however give us a ballpark estimate of streamflow.

Reason for Method Selection
This method was chosen because it is the only practical, affordable method. Other options involve flow meters, which are very expensive. Also, more measurements could be taken and coupled with more complicated calculations to achieve greater accuracy, but this is not included so that this process can be performed by all willing citizens.

Monitoring Supplies & Equipment

Equipment List

Nitrate-nitrogen Tablet Kit made by LaMotte[vii] comes with:

1) 50 Nitrate #1 Tablets
2) 50 Nitrate #2 CTA Tablets
3) 2 plastic test tubes with caps
4) nitrate-nitrogen Octa-Slide
5) Octa-Slide Viewer.

Orthophosphate Test Kit made by Hach for turbid waters with the addition of the Low Path Viewing Adapter for low-range readings comes with:

1) 2 square mixing bottles
2) color comparator box
3) color disc
4) 2 color viewing tubes
5) glass dropper
6) 12.5 cm. filter paper
7) Filtration Aid Solution
8) plastic funnel
9) Long Path Viewing Adapter
10) PhosVer 3 Phosphate Reagent Powder Pillows
11) 2 stoppers

Turbidity Test Kit made by LaMotte[viii] comes with:

1) 60 mL Standard Turbidity Reagent
2) 2 Turbidity Columns
3) test tube brush
4) 0.5 mL plastic pipette with cap
5) plastic stirring rod

Streamflow measurements require:

1) whiffle ball
2) marked pole
3) measuring tape
4) stop watch
5) in some cases, waders.

Sample Media Storage

Reagents should be stored at room temperature, around 77°F, away from the heat, humidity, moisture, direct sunlight and the cold. Storage temperature should be kept as constant as possible. Be careful to avoid large fluctuations in temperature. Do not refrigerate any reagents unless specifically directed to do so. Divergence from any of these directions will compromise the quality and stability of reagents and shorten their shelf lives[ix]. The table below shows the shelf life for all reagents and tablets used in these procedures. These should be referenced to the date of manufacture listed on the product.

Product	Shelf Life[x]
Nitrate-nitrogen #1 Tablet	3 years
Nitrate-nitrogen #2 CTA Tablets	3 years
Phos Ver 3 Phosphate Reagent	5 years
Filtration Aid Solution	4 years
Standard Turbidity Reagent	2 years

Sample Media Disposal

Orthophosphate Filtration Aid Solution

To dispose of the Orthophosphate Filtration Aid Solution, open cold water tap completely and slowly pour material to the drain. Allow cold water to run for 5 minutes to completely flush the system.

PhosVer3 Reagent Pillows

To dispose of the PhosVer 3 Phosphate Reagent Pillows, work in an approved fume hood and dilute material with excess water to make a weaker than 5% solution. Adjust the pH to between 6 and 9 with an alkali such as soda ash or sodium bicarbonate. Then, open the cold water tap completely and slowly pour the material down the drain. Allow the water to run for 5 minutes to completely flush the system.[xi]

All Other Sample Media

All other supplies may be disposed of normally. Please note that these reagents can be disposed of by pouring down the drain with water after the procedure is performed. These disposal procedures apply only to the raw reagents.

Monitoring Procedures

1.0 Sample Site Location – These procedures should be performed at the monitor's usual Texas Stream Team "core" parameter monitoring site most of the time, the selection of which is demonstrated in the Texas Stream Team Water Quality Monitoring Manual. Other site selections may be chosen by the Texas Stream Team or program Partners and will depend on suitability of each site to reach the intended monitoring goal. Texas Stream Team staff will check for USGS flow gauges to determine the necessity of conducting flow measurements at a site.

1.1 Collecting the Sample –The most appropriate sample depth is 0.33 m. If the water body is too shallow to reach this depth, sample half way down the water column. When submerging the sample container, be sure to avoid contamination by material on the surface. The surface of the water is enriched with particles and bacteria not representative of the water mass. Also, be careful not to collect sediment from the bottom of the water body. The bucket should be held upside down and shoved, not thrown, directly outward in order to minimize the amount of surface water in the sample. Then, allow the bucket to submerge completly before removing it from the water.

1.2 Sample Preservation & Holding Times – All testing should begin immediately after collecting the sample. However, if transporting is absolutely necessary due to harsh weather or other extreme conditions, samples may be transported immediately after collection on ice to a safer sampling location. Please record in the comments field if the sample was transported.

- **Nitrate:** Samples can be stored for up to 2 days at 4^oC.[xii,] Check the temperature of your refrigerator with a thermometer and adjust to 4^oC. Transport samples to the refrigerator on ice.
- **Orthophosphate:** Samples can be preserved by freezing at or below -10^oC. Check the temperature of your freezer with a thermometer and adjust to -10^oC. Transport samples to the freezer on ice. 40 mg of $HgCl_2$/L may be added for storage for long periods. Samples should not be kept in plastic bottles unless in the frozen state because orthophosphates may be absorbed onto the walls of the plastic medium.[xiii] Samples should be filtered prior to transport in most cases. Highly turbid water may take up to thirty minutes to filter. If a monitor is sampling highly turbid water in unfavorable conditions, it is permitted but not recommended that monitors transport samples prior to filtration. At least two studies have been performed to compare field filtered samples and samples filtered in a lab following transport. Texas Stream Team believes that samples will be minimally affected based on the findings of the "Investigation into the Necessity of Dissolved Orthophosphate-Phosphorus Field Filtration" conducted by the University of Texas at Arlington and "Comparing Field and Laboratory Filtration for Low-Level Dissolved Ortho-Phosphorus Samples" conducted by B.C. Environment.[xiv,xv]
- **Turbidity:** Samples can be stored for up to 2 days at 4^oC.[xvi,xvii] Check the temperature of your refrigerator with a thermometer and adjust to 4^oC. Transport samples to the refrigerator on ice.[xviii]

Analyzing Turbidity

2.0 Rinse the turbidity columns twice with sample water.

2.1 Fill one turbidity column to the 50 mL line with the sample water.

2.2 If the black dot on the bottom of the tube is not visible when looking down through the column of liquid, pour out a sufficient amount of the test sample so that the tube is filled to the 25 mL line. Make sure the bottom of the meniscus is resting on the top of the line.

2.3 Fill the second turbidity column with an amount of turbidity-free water that is equal to the amount of sample being measured. Make sure the bottom of the meniscus is resting on the top of the line. Distilled water is preferred; however, clear tap water may be used. This is the "clear water" tube.

2.4 Place the two tubes side by side and note the difference in clarity. If the black dot is equally clear in both tubes, the turbidity is zero. If the black dot in the sample tube is less clear, proceed to Step 4.5.

2.5 Shake the standard turbidity reagent vigorously. Add 0.5 mL to the "clear water" tube. Use the stirring rod to stir contents of both tubes to equally distribute turbid particles.

2.6 Check for amount of turbidity by looking down through the solution at the black dot. If the turbidity of the sample water is greater than that of the "clear water", continue to add standard turbidity reagent in 0.5 mL increments to the "clear water" tube, mixing after each addition until the turbidity equals that of the sample. Be sure to keep track of the number of measured additions and refer to the table below and record the results as # JTU on the data form.

Turbidity Test Results		
Number of Measured Additions (0.5 mL)	**50 mL Graduation**	**25 mL Graduation**
1	5 JTU	10 JTU
2	10 JTU	20 JTU
3	15 JTU	30 JTU
4	20 JTU	40 JTU
5	25 JTU	50 JTU
6	35 JTU	60 JTU
7	40 JTU	70 JTU
8	45 JTU	80 JTU
9	50 JTU	90 JTU
10	55 JTU	100 JTU
15	75 JTU	150 JTU
20	100 JTU	200 JTU

2.7 Dispose solution into the waste container and rinse turbidity columns twice with distilled water.[xix] Use brush if necessary.

Analyzing Orthophosphate

If you recorded either "cloudy" or "turbid" under water transparency when conducting your field observations, the sample must first be filtered to obtain accurate test results. Filtering samples may take up to thirty minutes, so filtering should be performed first and other samples should be processed while sample is being filtered. If the sample is not turbid, proceed without filtering.

Filtration

3.0 Put on gloves and safety goggles.

3.1 Rinse one mixing bottle twice with sample water. Rinse one mixing bottle twice with deionized water. If performing the low range test, rinse one test tube twice with deionized water.

3.2 Fill the square mixing bottle which was rinsed in sample water to the shoulder with the sample water.

3.3 Add one drop of Filtration Aid Solution to the bottle. Swirl to mix.

3.4 Place funnel in the other square mixing bottle. Insert a folded filter into the funnel.

3.5 Pour the water sample into the filter paper and allow the sample to filter through. Test this clear water sample for phosphate.

3.6 If performing the low range test, you will need to filter another sample directly into a test tube to be the blank. If you are not performing the low range test, proceed to step 3.12.

3.7 Rinse the available square mixing bottle twice with sample water.

3.8 Fill the square mixing bottle to the shoulder with the sample water.

3.9 Add one drop of Filtration Aid Solution to the bottle. Swirl to mix.

3.10 Place funnel in the test tube. Insert a folded filter into the funnel.

3.11 Pour the water sample into the filter paper and allow the sample to filter through.

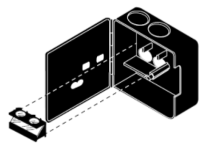
3.12 Pour excess water out until the bottom of the meniscus rests on the top of the top line in the test tube. This is your blank.

3.13 Rinse the bottle and funnel twice with distilled water.

Low Range (0-1 mg/L)

4.0 Put on gloves and safety goggles.

4.1 Insert the long path viewing adapter into the color comparator.



4.2 Insert the color wheel into the color comparator.

4.3 Rinse both test tubes and the square mixing bottle twice with the sample water unless the sample was filtered. If the sample was filtered, proceed to step 4.5.

4.4 Fill one test tube to the top line with sample water. Make sure the bottom of the meniscus is resting on the top of the line. This is the blank. Place this tube in the top left opening of the color comparator.

4.5 Fill the square mixing bottle to the 20 mL mark with the sample water. If using a filtered sample, pour out excess water. Make sure the bottom of the meniscus is resting on the top of the line.

4.6 Add the contents of one PhosVer 3 Phosphate Reagent Powder Pillow into the bottle. Swirl to mix.

4.7 Wait eight minutes for full color development. If phosphate is present, a blue-violet color develops. Read the result within 10 minutes of the addition of the powder.

4.8 Fill another test tube to the top line with the prepared sample. Make sure the bottom of the meniscus is resting on the top of the line.

4.9 Place the second tube in the top right opening of the color comparator.

4.10 Hold the color comparator with the tube tops pointing toward a light source, such as the sky, a window or a lamp, against the white background provided on the Field Reference Guide. Look through the openings in the front of the comparator.

4.11 Rotate the color disc until the color matches in the two openings. If the observed color is darker than the color standards shown on the color wheel, repeat with the mid-range test.

4.12 If the two colors match, divide the reading in the scale window by 50 and record the result on the data form.

4.13 Dispose of the solution into the waste container, and rinse test tubes and the bottle twice with distilled water.

Mid. Range (0-5 mg/L)

5.0 Put on gloves and safety goggles.

5.1 If the color comparator has the long path viewing adapter in place, remove it.

5.2 Insert the color wheel into the color comparator.

5.3 Rinse both test tubes twice with the sample water.

5.4 Fill a test tube to the first line with sample water. Make sure the bottom of the meniscus is resting on the top of the line. This is the blank.

5.5 Place this tube in the top left opening of the color comparator.

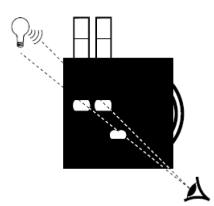
5.6 Fill another test tube to the first line with sample water. Make sure the bottom of the meniscus is resting on the top of the line.

5.7 Add the contents of one PhosVer 3 Phosphate Reagent Powder Pillow to the second tube.

5.8 Place the cap on and invert and re-invert until powder has dissolved. Wait at least one minute for full color development. If phosphate is present, a blue-violet color develops. Complete the test and read the result within five minutes of the addition of the powder.

5.9 Place the second tube in the top right opening of the color comparator.

5.10 Hold comparator up to a light source such as the sky, a window or a lamp. Look through the openings in front.



5.11 Rotate the color disc until the color matches in the two openings. If the observed value is darker than the color standards shown on the color wheel, repeat with the high range test.

5.12 If the two colors match, divide the reading in the scale window by 10 and record the results on the data form.

5.13 Dispose into the waste container and rinse the test tubes twice with distilled water.

High Range (0-50 mg/L)

6.0 Put on gloves and safety goggles.

6.1 Rinse both test tubes twice with distilled water.

6.2 Fill a test tube to the first line with distilled water. Make sure the bottom of the meniscus is resting on the top of the line. This is the blank.

6.3 Place this tube in the top left opening of the color comparator.

6.4 Rinse the plastic dropper several times with the sample water.

6.5 Fill the dropper to the first mark with the sample water. Put this water in the second test tube.

6.6 Add distilled water to the first line on the second tube. Make sure the bottom of the meniscus is resting on the top of the line.

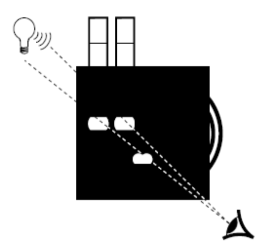
6.7 Invert and re-invert a few times to mix.

6.8 Add the content of one PhosVer 3 Phosphate Reagent Powder Pillow to the second tube.

6.9 Place the cap on and invert and re-invert until powder is dissolved. Wait at least one minute for full color development. If phosphate is present, a blue-violet color develops. Read the result within five minutes of the addition of the powder.

6.10 Place the second test tube in the top right opening of the color comparator.

6.11 Hold comparator up to a light source such as the sky, a window or a lamp. Look through the openings in front.



6.12 Rotate the color disc until the color matches in the two openings.

6.13 Read the mg/L phosphate in the scale window and record the result on the data form.

6.14 Dispose in the waste container and rinse the test tube which held the reagent twice with distilled water.

Analyzing Nitrate-Nitrogen

If you recorded either "cloudy" or "turbid" under water transparency when conducting your field observations, the sample must first be filtered to obtain accurate test results. Filtering samples may take up to thirty minutes, so filtering should be performed first and other samples should be processed while sample is being filtered. If the sample is not turbid, proceed without filtering.

Filtration

7.0 Put on gloves and safety goggles.

7.1 Rinse one mixing bottle twice with sample water. Rinse one mixing bottle twice with deionized water.

7.2 Fill one square mixing bottle to the shoulder with the sample water.

7.3 Add one drop of Filtration Aid Solution to the bottle. Swirl to mix.

7.4 Place funnel in the other square mixing bottle. Insert a folded filter into the funnel.

7.5 Pour the water sample into the filter paper and allow the sample to filter through. Test this clear water sample for nitrate-nitrogen.

7.6 Rinse the bottle and filter twice with distilled water.

Analysis

8.0 Put on gloves and safety goggles.

8.1 Rinse a test tube and cap twice with sample water.

8.2 Fill a test tube to the 5 mL line with the water sample. Ensure the bottom of the meniscus, not the side of the water column, is resting on the top of the 5 mL line.

8.3 Make sure you are in the shade because sunlight, even sunlight filtered through leaves or a window, will skew the results.

8.4 Add one Nitrate #1 Tablet.

8.5 Cap and mix until tablet disintegrates.

8.6 Add one Nitrate #2 CTA tablet.

8.7 Cap and mix until tablet disintegrates.

8.8 Wait 8 minutes.

8.9 Insert Nitrogen Octa-Slide Bar into the Octa-Slide Viewer.

8.10 Insert test tube into Octa-Slide Viewer.

8.11 Hold up to the white background provided on the Field Reference Guide and match the sample color to a color standard and record the result on the data form. If the sample appears to be between two values, estimate the increment to choose the most appropriate value. If the color appears to be 0, record as <1. Zeros should not be recorded because of the detection limits of this test.

8.12 Dispose solution into the waste container, and rinse test tube and cap twice with distilled water.[xx]

Measuring Streamflow

TO ENSURE YOU DO NOT LOSE YOUR FOOTING,
NEVER TRY TO MEASURE STREAMFLOW IN SWIFTLY MOVING OR DEEP WATER.
IF YOU ARE CONCERNED FOR YOUR SAFETY,
DO NOT CONDUCT STREAMFLOW MONITORING.

9.0 Measure the width of the stream in feet with the measuring tape. Measure only the water, not the wetted perimeter (banks). Round to the nearest ¼ in.

9.1 Take one depth measurement for every two meters. If the water body is less than six meters wide, take three evenly spaced measurements. Average the measurements.

9.2 Measure 10 ft. in the stream upstream to downstream (parallel to the current) in the sample area.

9.3 Have one person stand at the upstream end of the 10 feet and drop the whiffle ball into the current, if the water body is safe to retrieve the ball from. Another person should stand at the downstream end and note the time it takes the float to travel the 10 feet. If you are sampling by yourself or the water body is unsafe to enter, a dry stick a couple of inches in length or orange peel may be used to note the float time so that you do not litter. Repeat the process three times and average the time.

9.4 Divide distance (10 feet) by the average time.

Trial 1 time + Trial 2 time + Trial 3 time / 3 = Average time

Distance (10 feet) / Average time = Average velocity ft/sec

8.5 Record velocity in feet per second.

8.6 Avg. velocity x width x avg. depth = discharge (ft^3/sec).[xxi]

First Aid Considerations

A few chemicals used in these procedures are considered health hazards. For this reason, monitors are instructed to use gloves and safety goggles. The following First Aid instructions are taken directly from the manufacturer's Material Safety Data Sheets (MSDS).

LaMotte Nitrate-Nitrogen Kit

Nitrate # 1 Tablets

- Poses a slight health risk.
- May be irritating to skin.
- May be harmful if swallowed.
- If eye contact occurs, flush with water for 15 minutes. Consult a physician if eye appears irritated.
- If skin contact occurs, flush skin thoroughly with water. Wash with soap and water.
- If ingested, drink plenty of water. Consult a physician if more than a few have been swallowed or if signs of mouth or throat irritation develop.
- If inhaled, remove to fresh air.[xxii]

Nitrate #2 CTA Tablets

- Not considered hazardous.
- May cause irritation of the eyes, skin, and respiratory tract.
- May cause gastrointestinal discomfort if consumed in large amounts.
- If eye contact occurs, flush with water for 15 minutes. Consult a physician if eye appears irritated.
- If skin contact occurs, flush skin thoroughly with water. Wash with soap and water. If skin irritation persists, call a physician immediately.
- If inhaled, remove to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Call a physician immediately.
- If ingested, drink plenty of water. Clean mouth with water. Never give anything by mouth to an unconscious person. Consult a physician.[xxiii]

Hach Orthophosphate Test Kit

Filtration Aid Solution

- Not considered hazardous.
- If eye contact occurs, flush eyes with water and call a physician if irritation develops.
- If skin contact occurs, wash skin with plenty of water.
- If ingested, drink large quantities of water. Call physician immediately.[xxiv]

PhosVer 3 Phosphate Reagent

- Considered a hazardous substance.
- Causes eye burns.

- May cause respiratory tract irritation.
- If ingested, may cause copper deficiency, anemia, gout, loss of coordination, loss of appetite, listlessness, diarrhea, and liver damage. It may also affect enzyme activity.
    - Do not induce vomiting. Give 12 glasses of water. Call a physician immediately. Never give anything by mouth to an unconscious person.
- If inhaled, it may cause respiratory tract irrigation and effects similar to those of ingestion.
    - Remove to fresh air. Give artificial respiration if necessary. Call a physician.
- If eye contact occurs, immediately flush eyes with water for 15 minutes. Call a physician.
- If skin contact occurs, wash skin with plenty of water.[xxv]

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