

e. Turbidity

i. Why is this test important/What does it measure

Turbidity is a measure of the relative clarity of water: the greater the turbidity the murkier the water. The amount of suspended matter in water will reduce the penetration of light into the water. As light decreases, so does photosynthesis by deeper plants. That decreases the plant growth for food for herbivores and also results in decreases in oxygen production. High turbidity can also make it difficult for predators that use sight to see and capture their prey. A rain event leading to high turbidity can also lead to bad fishing until the water clears back up again. High turbidity may be caused by soil erosion, waste discharge, urban runoff, abundant bottom feeders (such as carp) that stir up bottom sediments or algal growth.

ii. Water Quality Standards

The drinking water standards for turbidity are 5 JTUs, although most drink water providers strive for less than .1 JTU. Michigan does not have a set surface water standard for turbidity, but “settable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life”. That means that the water should not reduce light penetration by more than 10% of what is “normal”

iii. How to conduct the test

This test compares the turbidity (or clarity) of the water from the river with the clarity of distilled water. This test works by adding a substance to the distilled water to make it “dirtier” or cloudier. The readings are made by looking down through the water at a black dot. The amount of turbidity in the water will make it more difficult to see the dot.

1. Fill one Turbidity column to the 50 mL line with the sample water. If you cannot see the dot when looking through the water, pour out the water until you reach the 25 mL line.
2. Fill the second turbidity column with an amount of turbidity free water (distilled, deionized, or reverse osmosis water) equal to the amount being sampled.
3. Place the tubes side by side and notice the difference in clarity. If both tubes are equally clear, the turbidity is zero.
4. Shake the Standard Turbidity Reagent vigorously. DO NOT FORGET TO SHAKE IT UP. Add .5mL of Standard Turbidity Reagent to the “clear water” tube, then stir the tube to equally distribute turbid particles. Keep adding Standard Turbidity Reagent in .5ml intervals and stirring until the “clear water” tube is as cloudy as the river water. Record the amount of Standard Turbidity Reagent added.
5. Each .5ml addition equals 5 Jackson Turbidity Units in the 50mL size sample. If a 25mL sample is used, each .5L addition of Reagent equals 10 JTUs.

---Note: This section will be reviewed in more detail prior to the 2012 Flint River GREEN testing. The following information was supplied by the City of Flint, Sewer & Waste Water Treatment Center. ---

Turbidity Units:

What is the difference between the turbidity units?

The turbidity units NTU, FNU, FTU, and FAU are all based on calibrations using the same formazin primary standards. Therefore when a formazin standard is measured, the value for each of these units will be the same, however the value on samples may differ significantly.

Formazin: a measure of water turbidity equivalent, but not equal, to Jackson Turbidity Units (JTU).

FAU

Formazin Attenuation Units: signify that the instrument is measuring the decrease in transmitted light through the sample at an angle of 180 degrees to the incident light. This type of measurement is often made in a spectrophotometer or colorimeter and is not considered a valid turbidity measurement by most regulatory agencies.

FNU

Formazin Nephelometric Units: like NTU, also signifies the instrument is measuring scattered light from the sample at a 90-degree angle from the incident light. FNU is most often used when referencing the ISO 7027 (European) turbidity method.

*FNU: An industry standard unit measurement used in the European Union, equivalent to NTU.

FTU

Formazin Turbidity Units: formazin was initially adopted as the primary reference standard for turbidity, units of FTU were used. These units, however, do not specify how the instrument measures the sample.

* FTU: an measure of water turbidity equivalent, but not equal, to Jackson Turbidity Units (JTU).

JTU

Jackson Turbidity Unit: is a historical unit used when measurements were made visually using a Jackson Candle Turbidimeter. Water was poured into a tube until a flame underneath the tube could no longer be distinguished.

A measure of the turbidity of water, proportional to the ppm silica, where the 100 ppm silica equals 21.5 JTU. This method was the standard for turbidity for many years; it applied the use of a candle, measuring tube, and the human eye for determining the value. This method has since been replaced by the use of a known turbidity standard, **Formazin**, and the use of analytical instruments that will detect forward-scattered light and light scattered at 90 degrees.

Nephelometer: an instrument that measures scattered light in a liquid.

NTU

Nephelometric Turbidity Unit: signifies the instrument is measuring scattered light from the sample at 90-degree angle from the incident light. NTU is most often used when referencing the *USEPA Method 180.1* or *Standard Methods For the Examination of Water and Wastewater*.

* NTU: A standard unit of turbidity measurement, equivalent to FNU.

Turbidimeter: an instrument for measurement of turbidity in which a standard suspension is used for reference.

Turbidity:

1. A condition in water or wastewater caused by the presence of suspended matter, resulting in the scattering and absorption of light rays.
2. A measure of fine suspended matter in liquids.
3. An analytical quantity usually reported in turbidity units (NTU/FNU, FTU, JTU) determined by measurements of light diffraction.

Measurement	Equivalency
NTU	Equal to FNU
FNU	Equal to NTU
FTU	Not equal to JTU

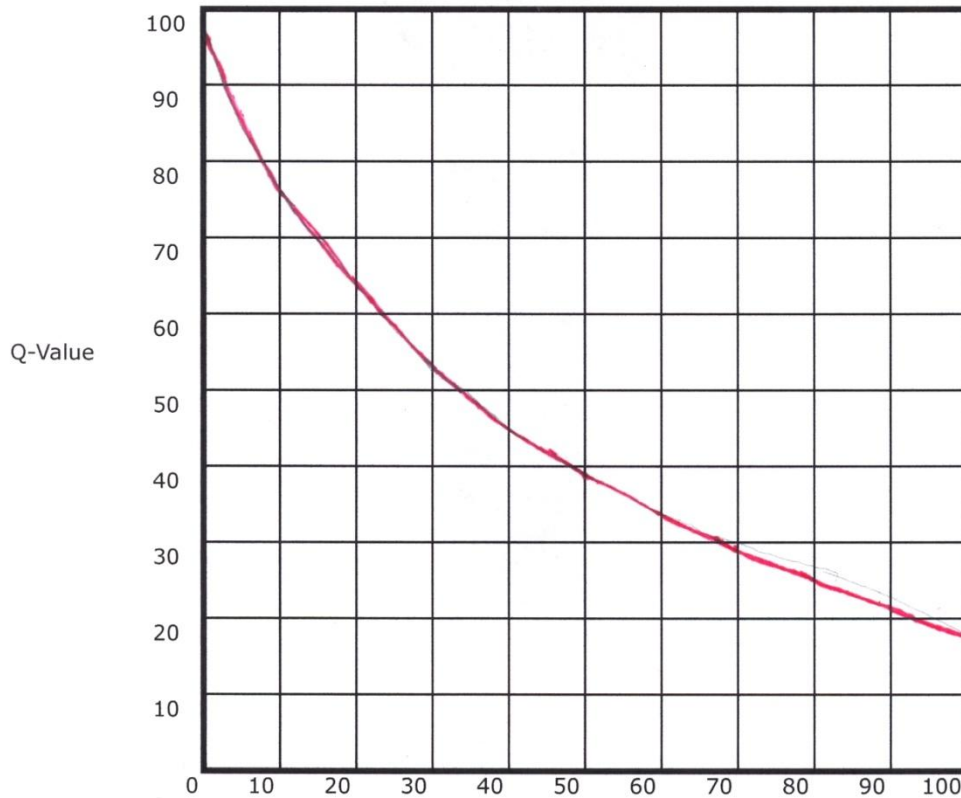
TURBIDITY TEST RESULTS

Number of Measured Additions	Amount in mL	50 mL Graduation	25 mL Graduation
1	0.5	5 JTU	10 JTU
2	1.0	10 JTU	20 JTU
3	1.5	15 JTU	30 JTU
4	2.0	20 JTU	40 JTU
5	2.5	25 JTU	50 JTU
6	3.0	30 JTU	60 JTU
7	3.5	35 JTU	70 JTU
8	4.0	40 JTU	80 JTU
9	4.5	45 JTU	90 JTU
10	5.0	50 JTU	100 JTU
15	7.5	75 JTU	150 JTU
20	10.0	100 JTU	200 JTU

iv. Determining the Q-Value

Calculating The Results

Chart 8: Turbidity Test Results



Turbidity: NTU / JTU (JTU & NTU are interchangeable.)

Note: If turbidity is > 100.0, Q-Value = 5.0

v. What to Watch Out For: Common Mistakes

- One of the most common mistakes in this test is adding the Standard Turbidity Reagent to the river water instead of to the “clear water”
- Do not forget to shake up the Standard Turbidity Reagent vigorously before you add it to the “clear water”. Failure to do so will lead to an incorrect result.
- Do not forget to stir the river water after each .5mL addition of Standard Turbidity Reagent.
- Make sure you are checking for the clarity of the water, not the color of the water when you are doing the test. Sometimes it is easy to confuse the two.
- Attempt to get your water sample from a part of the stream that others have not been walking around in yet. If necessary, go upstream from the rest of the students to take your sample.

vi. Consistency When Doing Multiple Tests

- If you are conducting multiple tests, use the average (arithmetical mean) of all the results.
- If you have a wide variety in your test results, talk to your mentor or FRWC staff about those results.

vii. How to Analyze Why The Results is Good or Bad

Turbidity can vary widely based on what part of the watershed you are in. Proximity to a rain or runoff event can also greatly affect turbidity. If you have a turbidity reading of over 25 JTUs, try to explain why this is the case. If there has been a recent rain event, that may be “normal”. If there has not been a recent runoff event, you may want to see what is causing the turbidity.