Iowa Department of Natural Resources

Leading Iowans in caring for our natural resources

Chapter 1: Locally-led Volunteer Water Monitoring

Locally-Led Volunteer Water Monitoring: Mission

To protect and improve Iowa's water quality

by raising citizen awareness about Iowa's watersheds,

supporting and encouraging

the growth and networking of Iowa's volunteer water monitoring communities, and

promoting water monitoring activities

as a means of

assessing and understanding

Iowa's aquatic resources.

About Locally-Led Volunteer Water Monitoring

Citizen-based

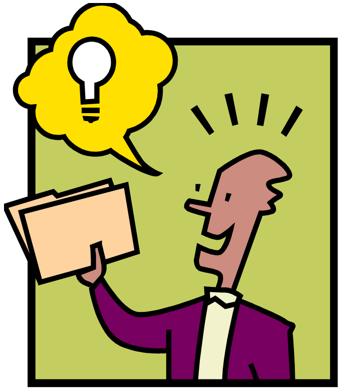
This is YOUR program

About Locally-Led Volunteer Water Monitoring

Focuses on

SOLUTIONS

NOT problems

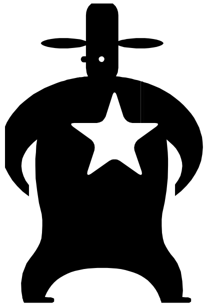


About Locally-Led Volunteer Water Monitoring

Focuses on

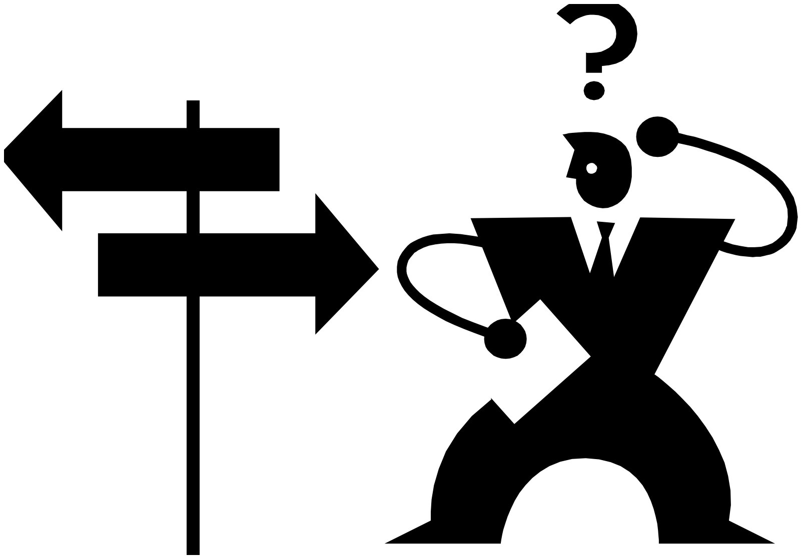
RESULTS

NOT regulation



About Locally-Led Volunteer Water Monitoring

Flexible

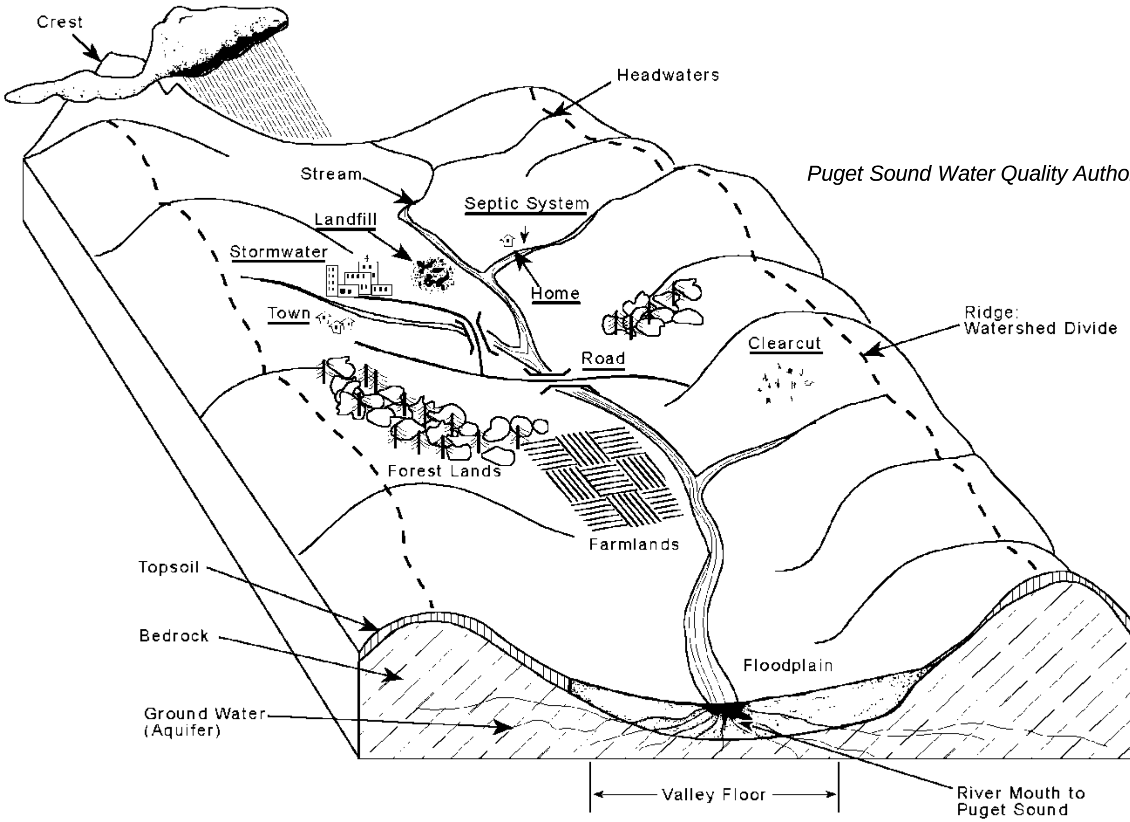


You decide where, when, what, and why

About Locally-Led Volunteer Water Monitoring

Focuses on

Watersheds



Puget Sound Water Quality Authority, 1989

Watersheds

What's your watershed address?

(What's a watershed…?)

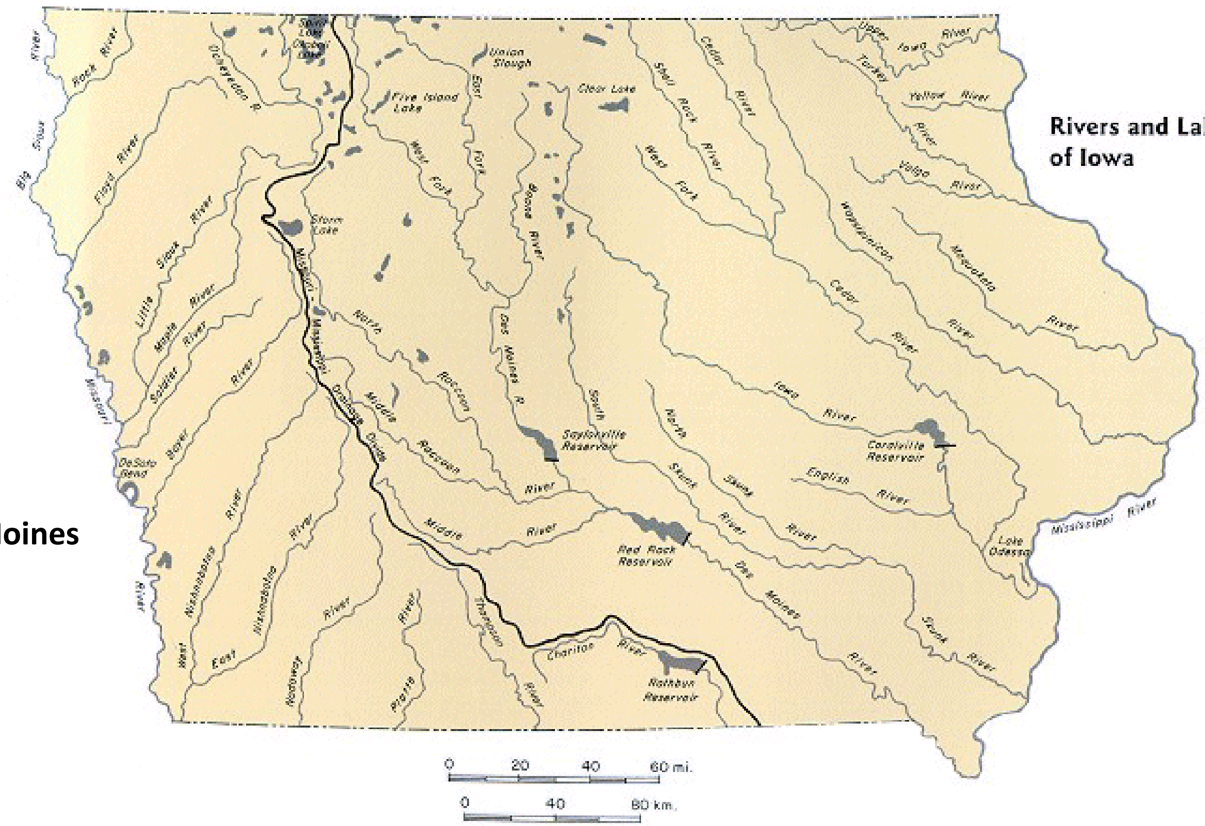
Mississippi River Watershed = United States

Upper Mississippi River Watershed = Iowa

Des Moines River Watershed = Central Iowa

Middle Des Moines River Watershed = Des Moines

Saylor Creek = State Capital

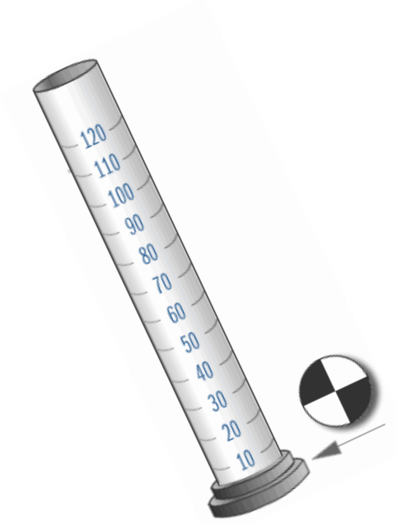


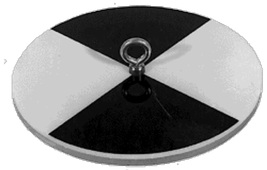
Rivers and Lakes of Iowa

What can be Monitored?

- Physical Parameters
  - Water clarity
  - Flow
  - Habitat
- Chemical Parameters
  - Nitrogen
  - Phosphorus
  - Dissolved oxygen
  - Chloride
  - pH
- Biological Parameters
  - Aquatic macroinvertebrates
  - Others

Photo from University of Iowa Hygienic Lab





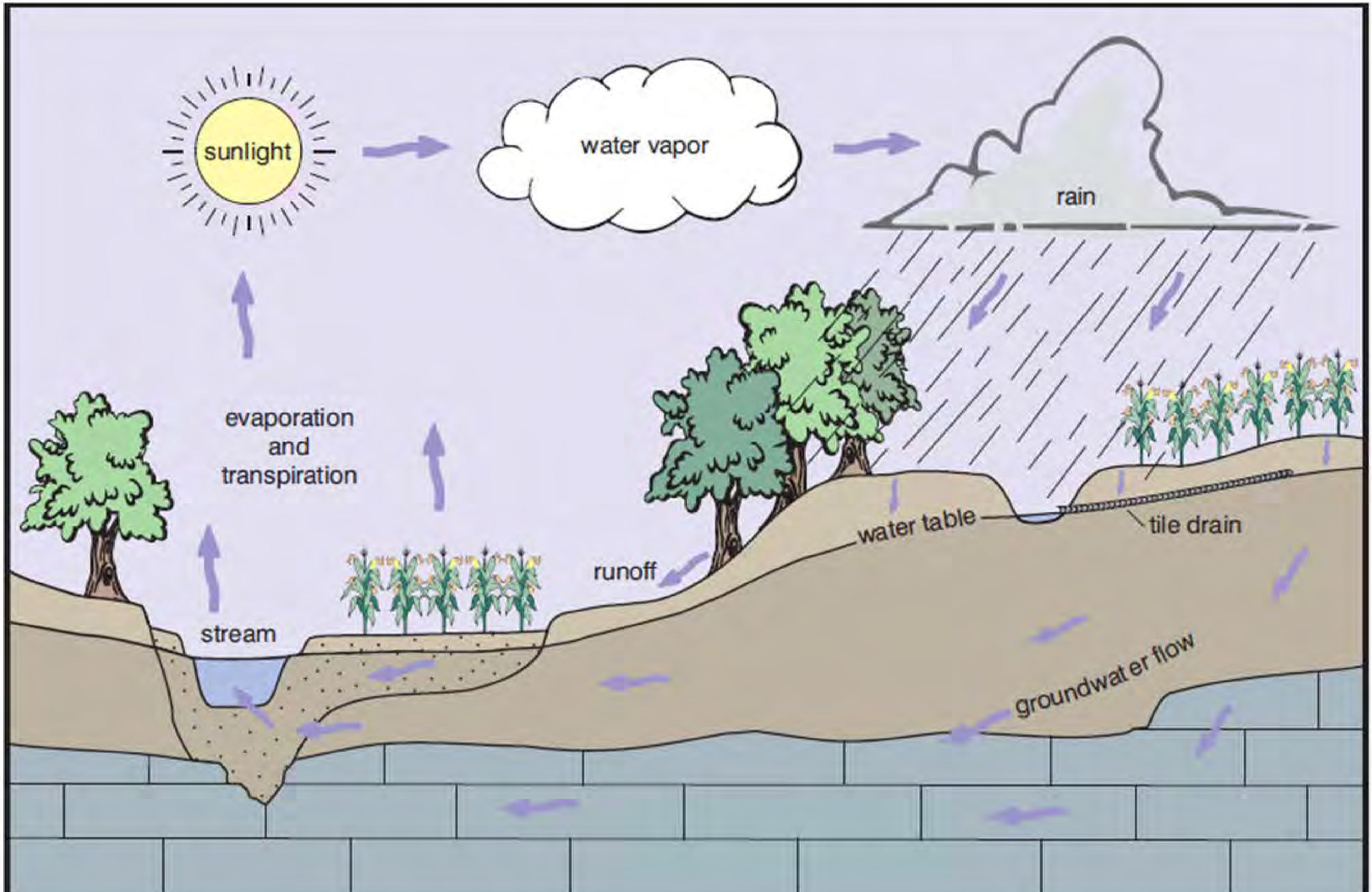
Monitoring Safety

- Have a "Buddy" or a team
- Let someone know where you are going & how long you will be gone
- Use caution when entering the water and walking down steep slopes
- Watch for High Flows!
- Only sample during daylight hours
- Wear waders or "river shoes"
- Watch for poison ivy, ticks, etc.
- Dress for the weather
- Wash up when you are done!

Other Volunteer Activities

Chapter 1: Water Quality in Iowa

The Hydrologic Cycle in Iowa

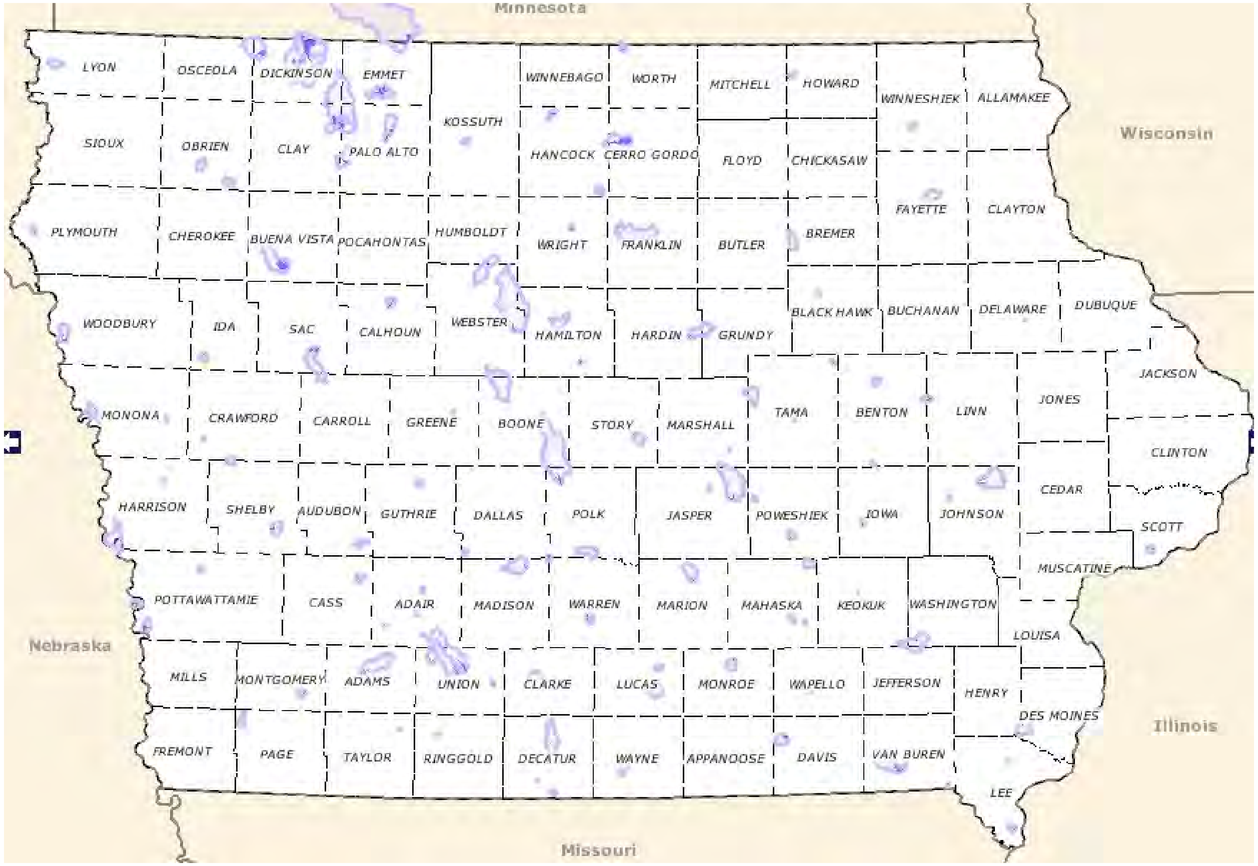


Iowa's Water

- Rivers & Streams
  - 72,000 miles!!
    - 26,600 miles are Perennial
    - 42,957 miles are Intermittent
    - 1,418 miles are Drainage Ditches
    - 660 miles are our large border Rivers

Iowa's Water

- 125,000 acres Lakes, Reservoirs & Ponds
- 50,500 acres of marshes



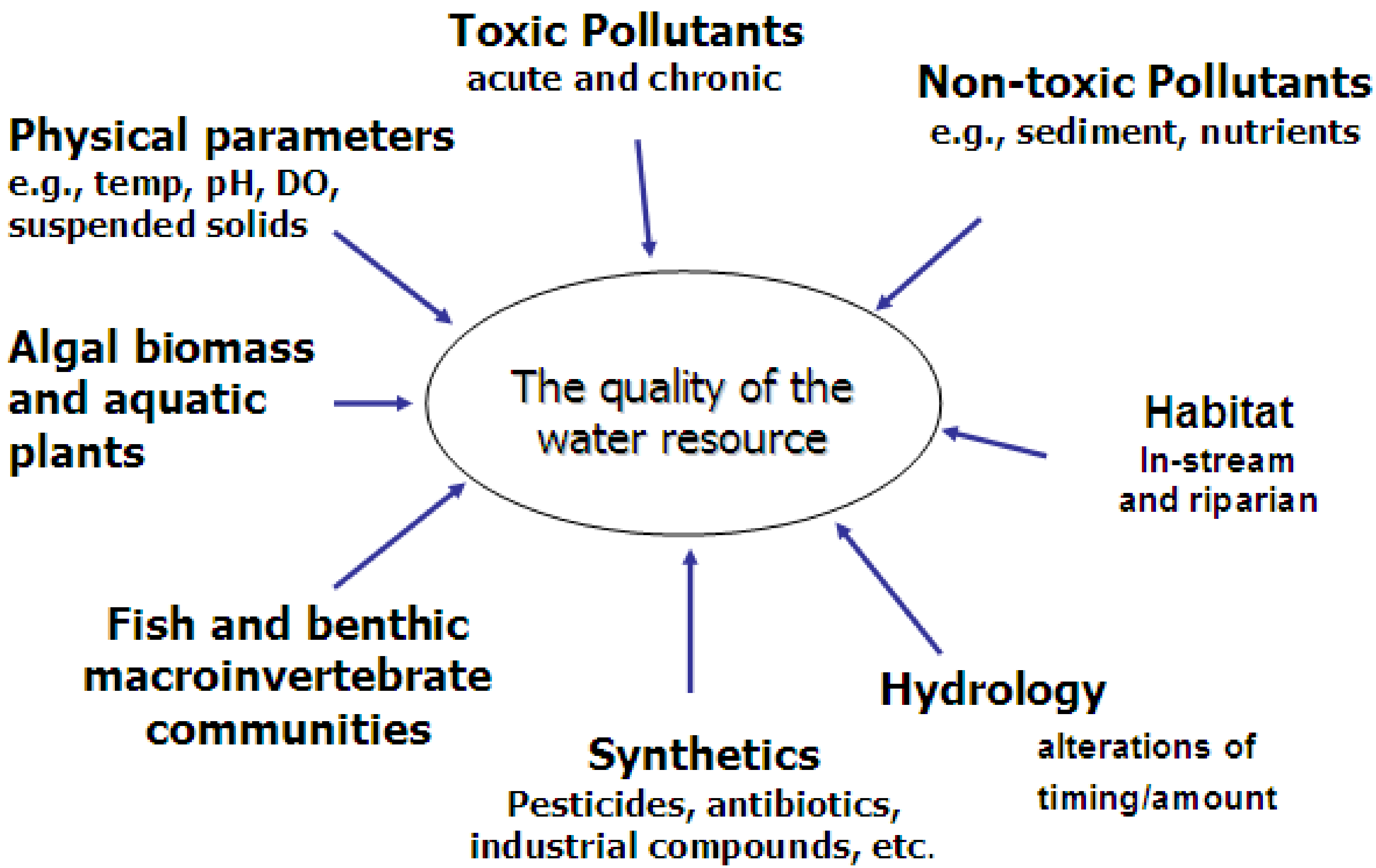
Water Quality Monitoring

What is it? Why is it important?

'...I tried to recreate their natural habitat...'

What is Water Quality??

Biological *Chemical* *Physical*



Water Quality in Iowa

Point (●) Source Pollution

Photo by Dave Ratliff

USGS photo

Water Quality in Iowa

Nonpoint (⊘) Source Pollution

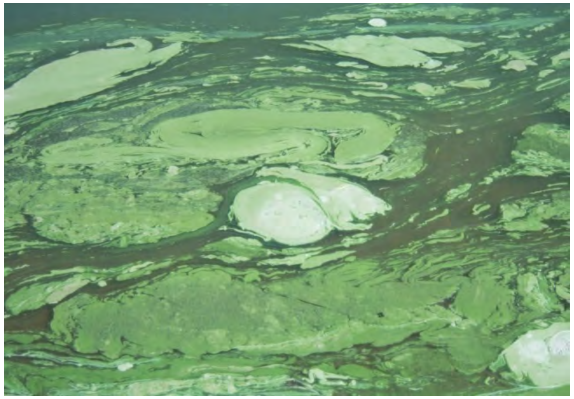
Sediment

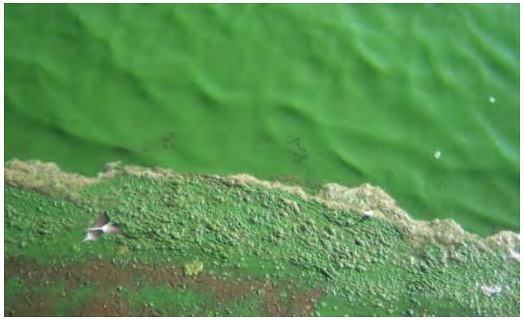
NRCS photos

Water Quality in Iowa

Nonpoint (⊘) Source Pollution

Nutrients – they are essential for life, but *it is possible to have too much of a good thing*





Why is Water Quality Important?

- Monitoring is the only way we will know the status of our water & how it has changed over time

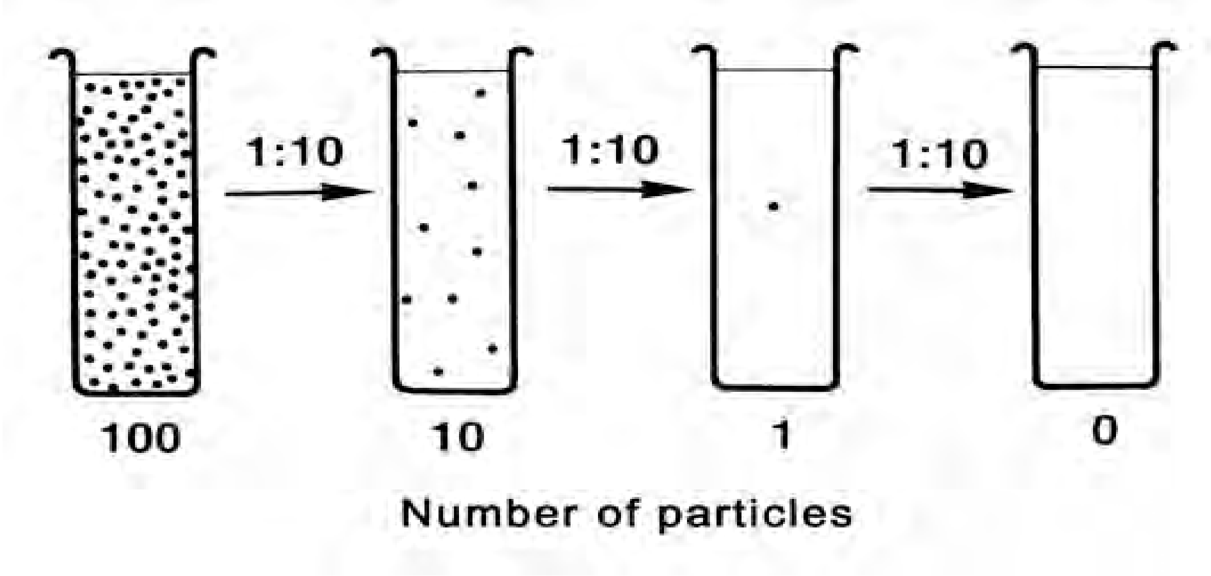
How to Monitor Water Quality?

- Step Right In! The Basics:
  - Collect from the middle of the stream flow
  - Move slowly to avoid stirring sediments
  - Face upstream

Understanding Test Results

- Concentration: weight or mass of the measured chemical per volume of water

Concentration Units			
abbreviation	definition	mass ratio description	mass ratio
mg/L	milligrams per liter	parts per million	1:1,000,000
ug/L	micrograms per liter	parts per billion	1:1,000,000,000
ng/L	nanograms per liter	parts per trillion	1:1,000,000,000,000



Chapter 3: Getting Started with Volunteer Monitoring

Parts of the Plan

- *Why do you want to monitor?*
- *Where are you going to go?*
- *When are you going to go?*
- *Who will do the monitoring?*
- *What are you going to test for?*
- *How will the data be used?*

Why do you want to monitor?

- **Citizen engagement and outreach?**
- **Establish or track project goals?**
- **Educate landowners?**
- **Track pollution?**
- **Discover problems?**

Where are you going to go?

- **Guidelines for site selection**
  - Ease of access and safety
  - Representative area of the water body
  - Position in watershed
  - Proximity to area of interest
  - Historical dataset

Who will Monitor?

- **Coordination required**
  - Staff
  - Volunteers
  - Landowners
- **Safety**
- **Training**
- **Value of “snapshots”**

Monitoring Frequency

I know where to go and what to do…now when do I go there?

- **Time of Year**
- **Frequency**
- **Time of Day**
- **Weather Conditions**

Important Questions

How will the data I collect be used?

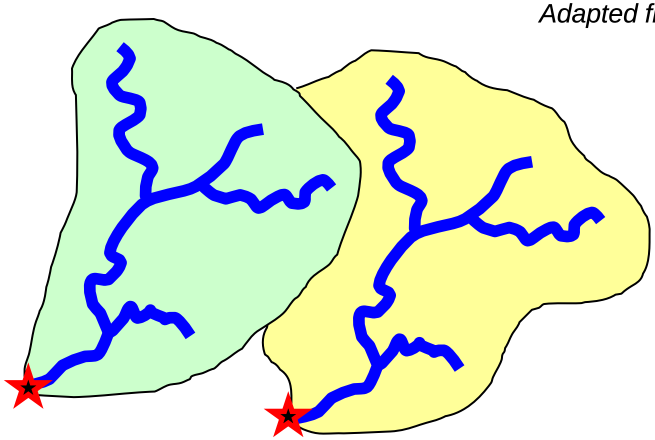
- Local project goals are first priority
- Coordinator as data organizer
- Part of historic dataset
- Opening data to others

Examples of Monitoring Plans

- Paired
- Nested
- Single Station
- Upstream/Downstream

Example: *Paired Watershed*

Adapted from North Carolina State University

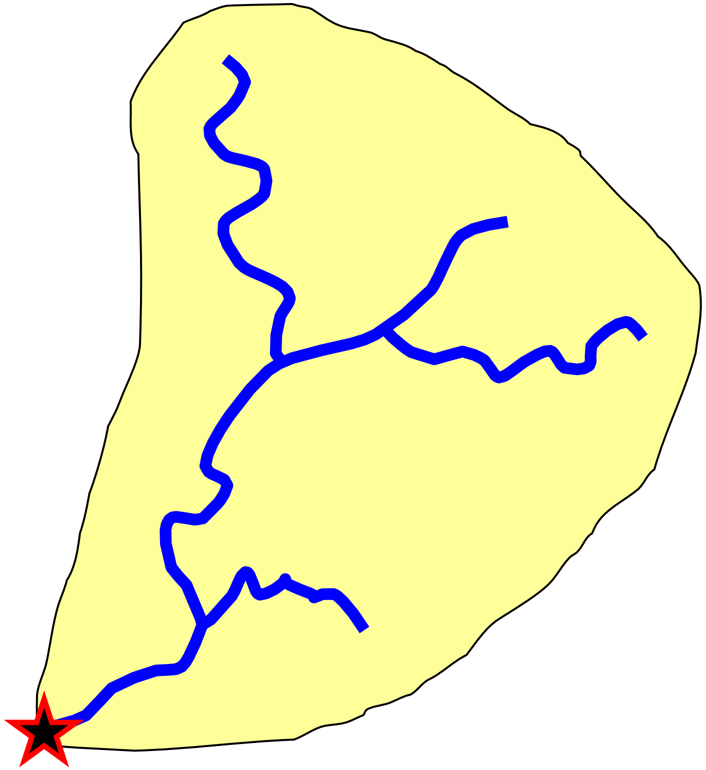


Site may be compared based on:

- Control/variable experiment
- Different land uses/landforms
- Other activities

Example: *Single Station*

Adapted from North Carolina State University



Site may be tested before and after changes in:

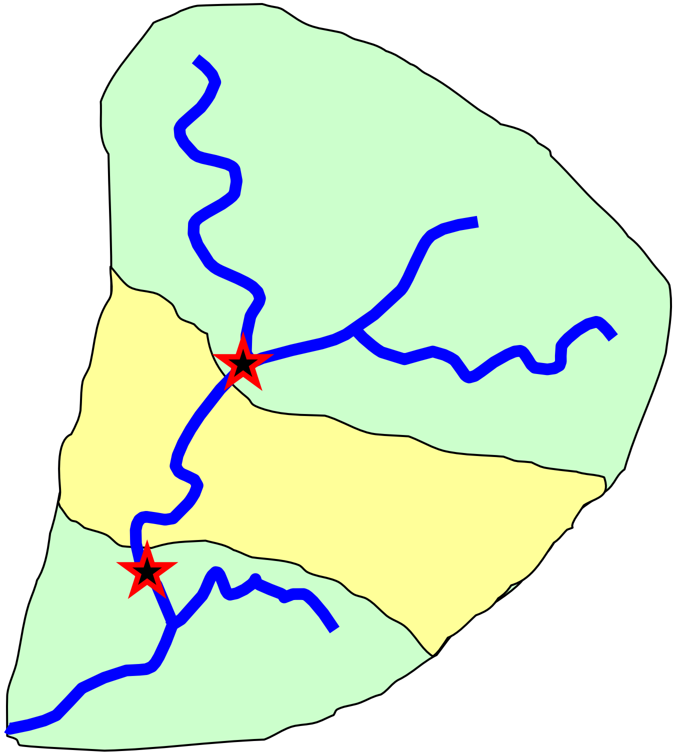
- Land use
- Season
- Other activities

Example: *Upstream/Downstream*

Adapted from North Carolina State University

Sites isolate a specific areas to measure:

- Differences above and below a specific location
- Impacts of sub-watershed activity & improvements



Important Considerations

Do I have to monitor for everything?

- **Monitored parameters**
  - Align parameters with project goals
  - Some things are better tested in labs that may add cost
  - Use of indicators can save money
  - Comfort level of coordinator and samplers

What if I don't know what or where?

- Iowa DNR technical assistance
- Look to other programs
- Connect with a local conservation professional
- Connect with a local educator

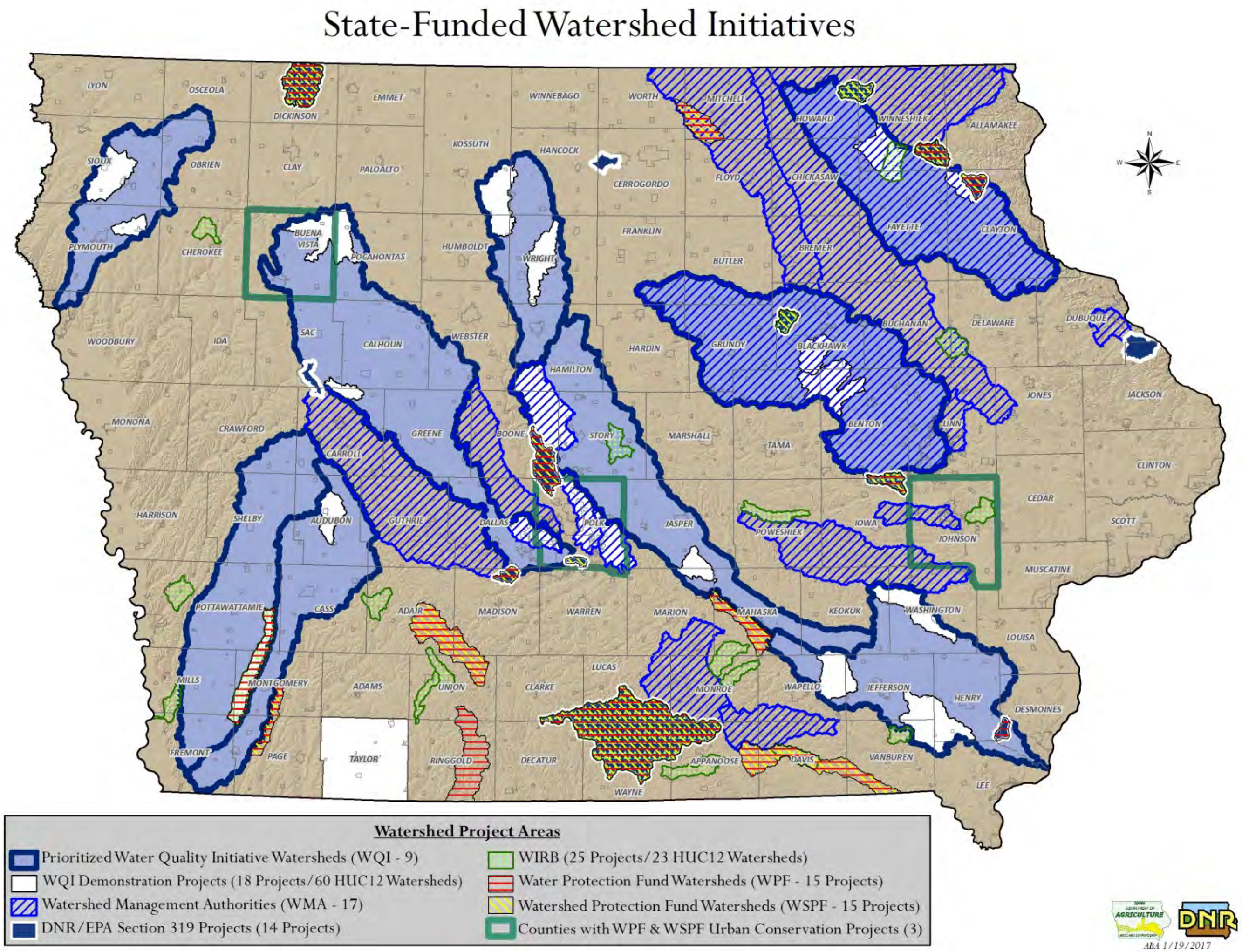
- Many online resources

What if my site is dry?

- Zeroes are important data points
- Goals: a new site may be more indicative of water body
  - Remember: where are you in the watershed?
- Change should be documented regardless

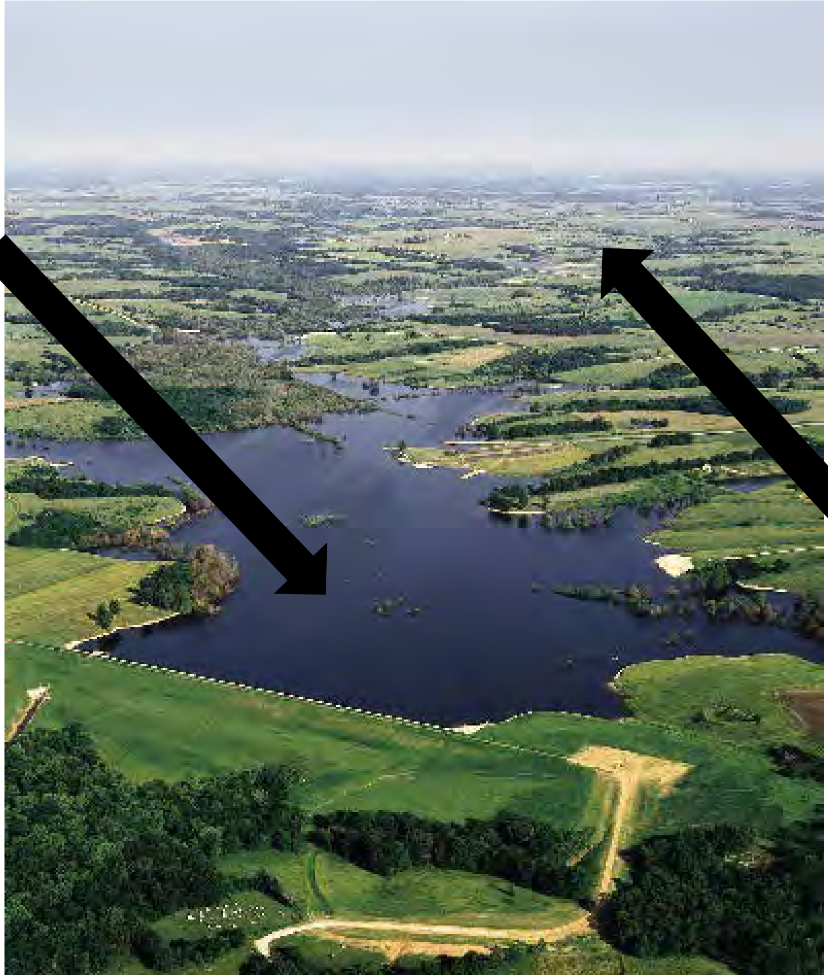

View of an Intermittent Stream

Chapter 4: Watershed Mapping

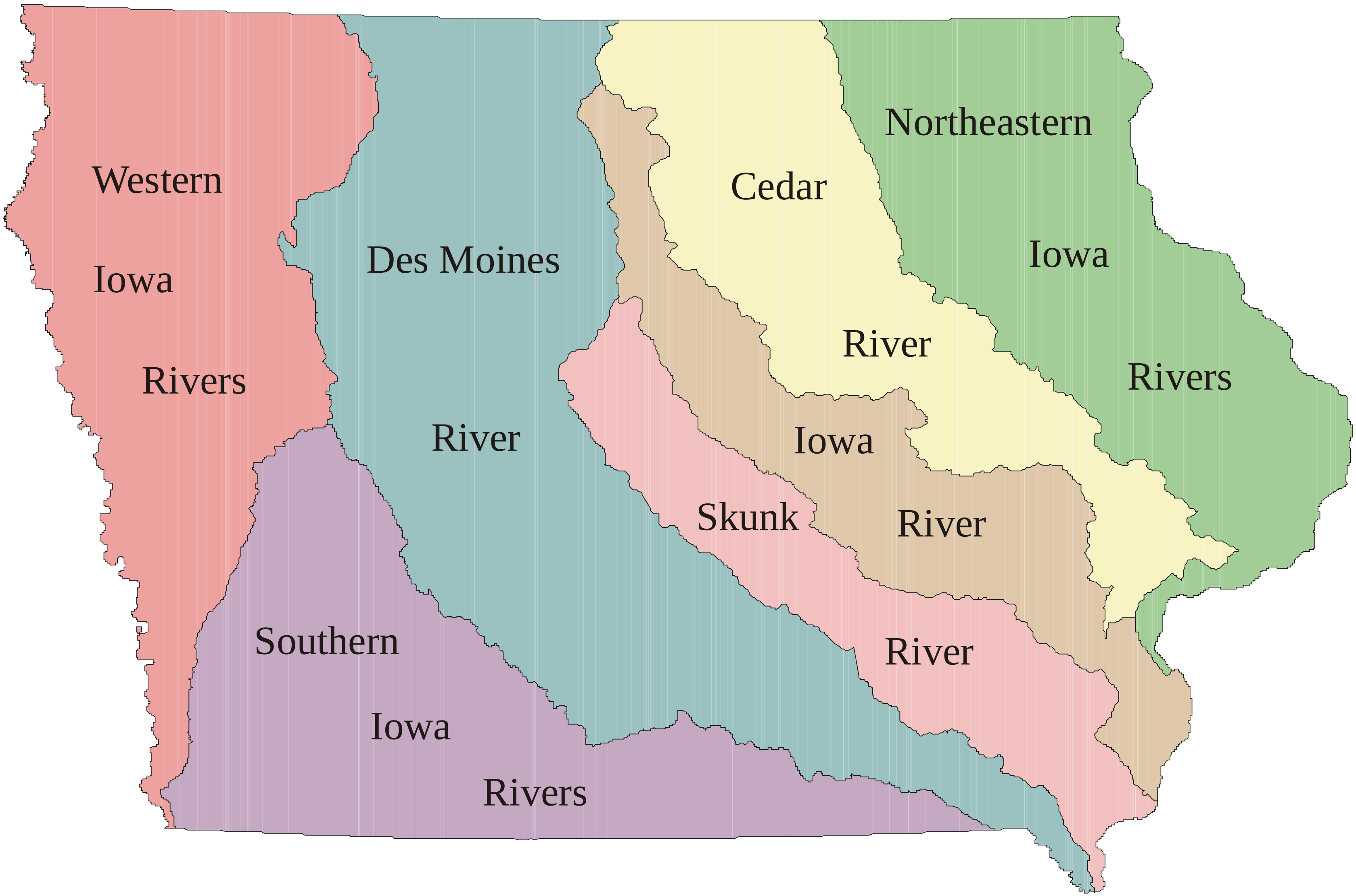


Watersheds

If you want to know what's in here



Look up here

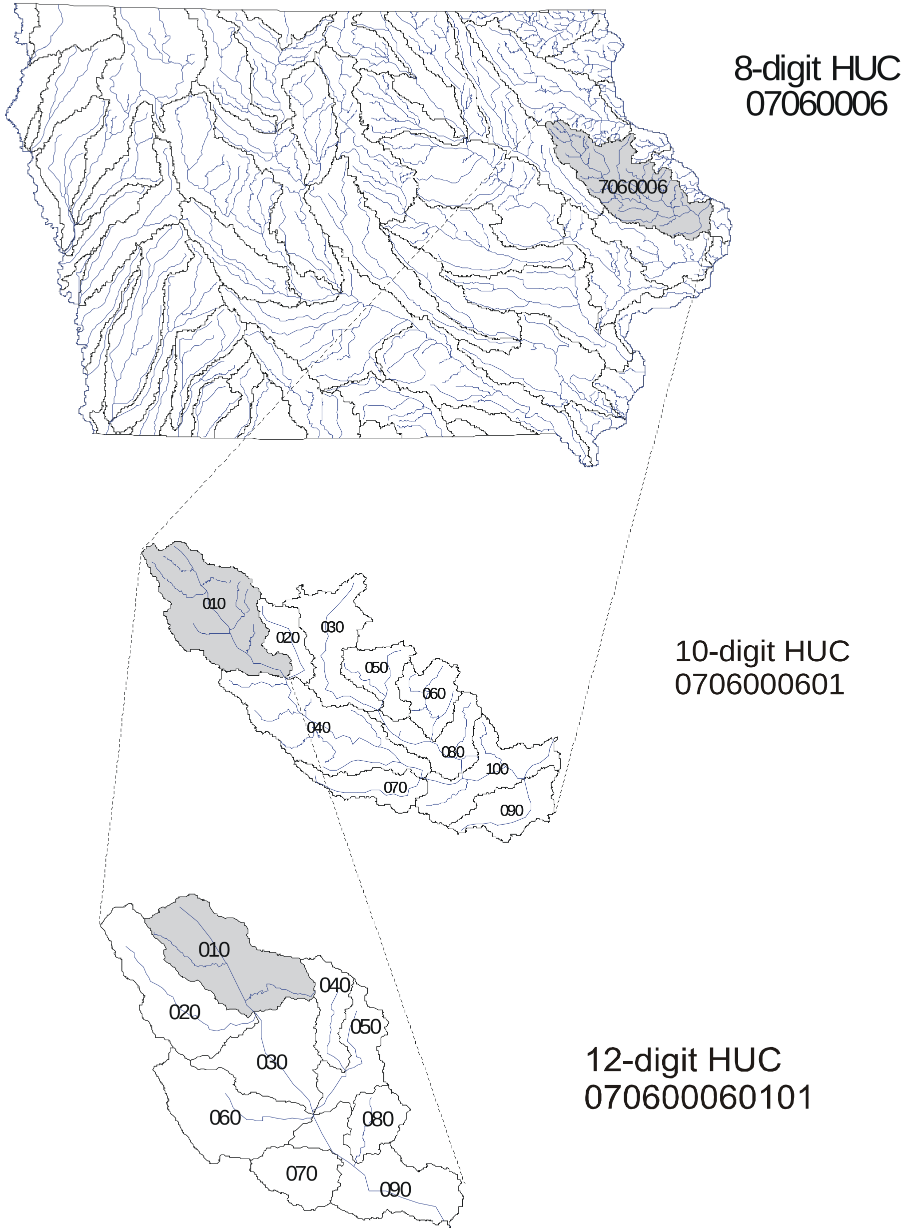

Western
Iowa
Rivers
Des Moines
River
Cedar
River
Northeastern
Iowa
Rivers
Iowa
River
Skunk
River
Southern
Iowa
Rivers

Defining Your Location

- Location
  - What is the exact location to monitor – and why?
  - Can I map the location? (paper, electronic)
- Importance of watershed position
  - What does this area mean to the water quality at the site?

Hydrologic Unit Codes (HUC)

- Unique identification number for each watershed
- Is an indication of watershed scale (the greater #, the smaller the watershed)
  - 8-digit HUC
  - 10-digit HUC
  - 12-digit HUC



Get to know your watershed

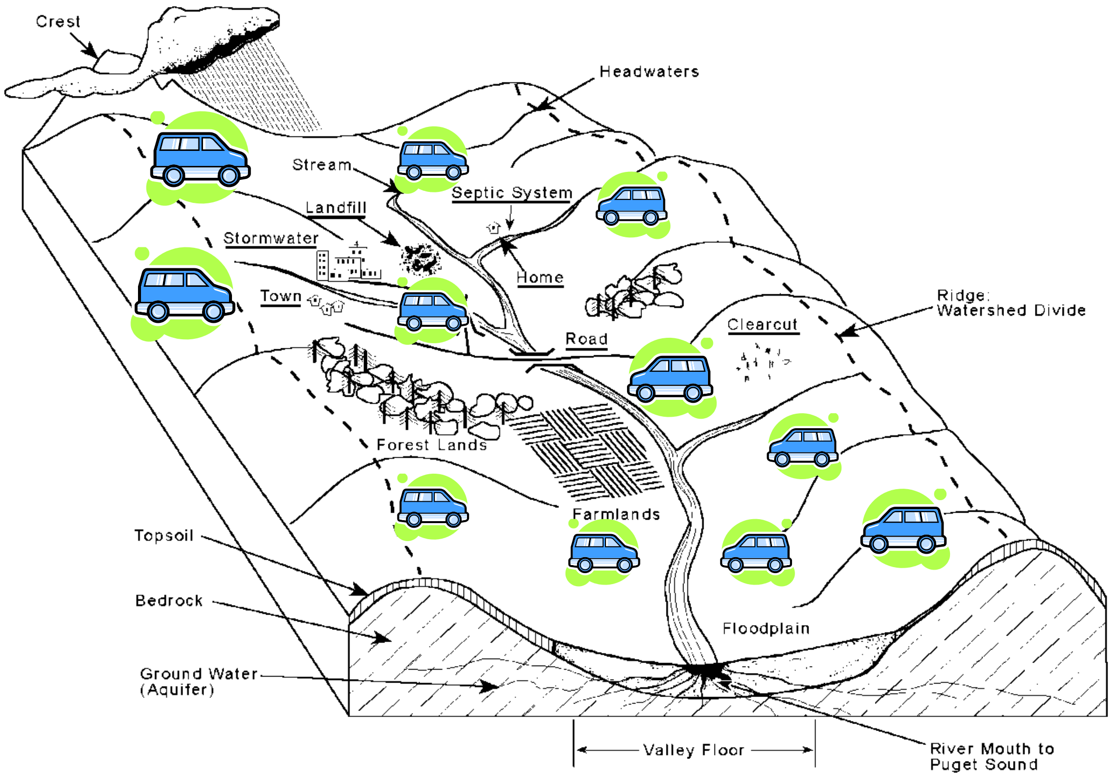
Watershed Tours

- Aerial/satellite imagery
- Topographic maps
- Windshield survey
- Walking survey

DNR GIS Resources

Other Resources

Reach out to local mapping resources in your region for more advanced analysis



Puget Sound Water Quality Authority, 1989

Chapter 5: Habitat Assessment

Habitat Assessment

Habitat Assessment

- Conduct once a year preferably in the summer
- May be helpful after a major land use change
- Observations & documentation
- Pictures help tell the story:

View to the North

View to the South

Photos by Ed Engle

Stream Transect & Reach

- Observations and parameters measured throughout most stream assessments are done at two scales; the **stream transect** and the **stream reach**

Transect

Photo by Dave Ratliff

A stream transect is the exact location across the stream that you are going to monitor.

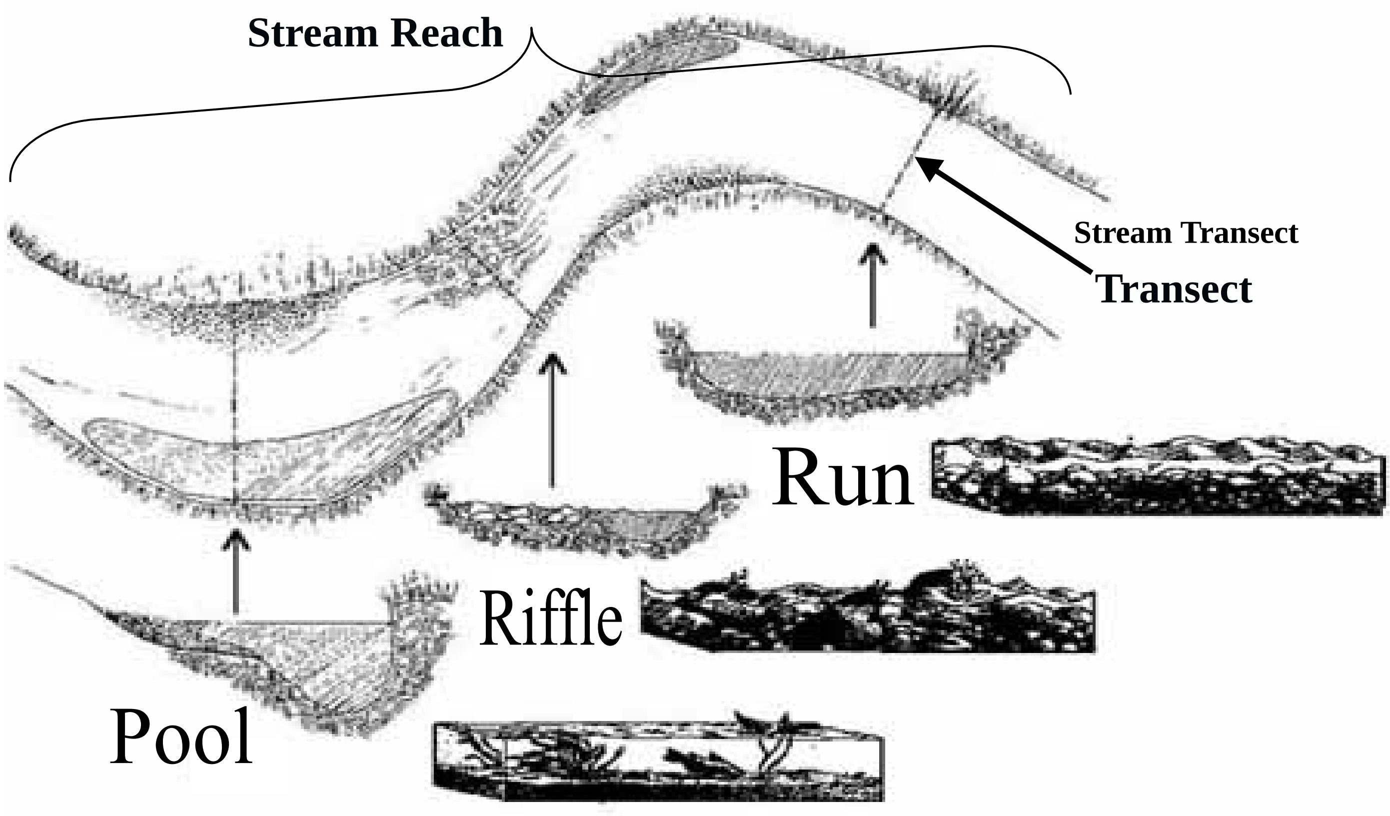
Your transect should "represent" your stream.

Stream Reach

- The stream reach is one set of riffle, run, and pool habitat OR
- A set distance from your transect.
    - We recommend 25 meters upstream and 25 meters downstream of the transect.

Habitat Type - *Estimated at Stream Transect*

Stream habitats are divided into three main types: riffles, runs, and pools.



A variety of habitats within a stream usually enhances the **diversity** of aquatic life that you may find there.

Figure adapted from: *Volunteer Stream Monitoring: A Methods Manual*. EPA 841-B-97-002

Habitats Influence Water Quality

- Physical features
- Water quality parameters
- Biological parameters

Riffle

Photo by Ben Petty

- Swift moving current and water that is normally "bubbling" due to a rocky streambed
- Promotes relatively high dissolved oxygen levels, high numbers of **invertebrates,** and specific fish

Photo by Dale Lindquist

Run

- Moderate current, medium depth, and a smooth water surface

Pool

- Slow current
- Usually found at stream channel bends, upstream of riffles, or on the downstream side of obstructions (scours)
- Great areas for fish such as bass, catfish, northern pike and trout.

Streambed Substrate

Estimated at Stream Transect

Photo by Jacklyn Gautsch

What's on the bottom of the stream?

Bedrock, boulders, cobbles, gravel, sand, mud/silt, other…

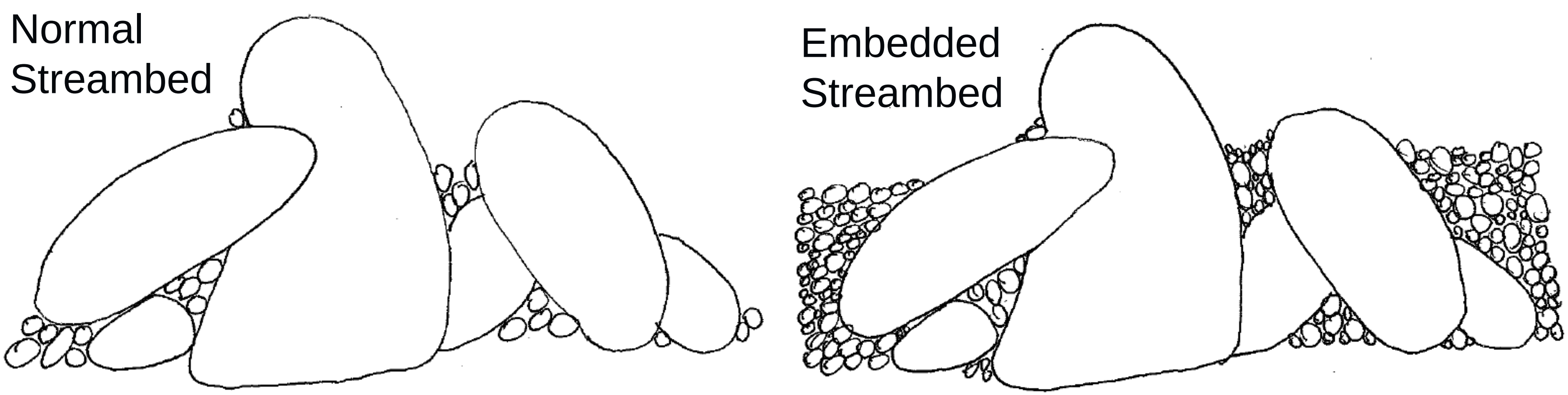
Photo by Troy Martens

Photo by Terry Moran

Photo by Dave Ratliff

Streambed Substrate

- Important to habitat quality and aquatic life
- Natural **geology** is responsible for the original substrate, human activities that increase erosion can cover the existing substrate with a layer of sand or silt.
  - Embeddedness
  - Reduces biodiversity by destroying aquatic habitats



Microhabitats

Found in Stream Reach

- Microhabitats ensure stream diversity by supporting a variety of aquatic life.
  - Algae Mats
  - Logjams
  - Rootwads
  - Fallen Trees
  - Silt/Muck
  - Sand
  - Junk
  - Leaf Packs
  - Rocks
  - Weed Beds / Aquatic Vegetation
  - Undercut Banks
  - Rip Rap
  - Overhanging Vegetation

Photo by Rick Dietz

Photo by Troy Martens

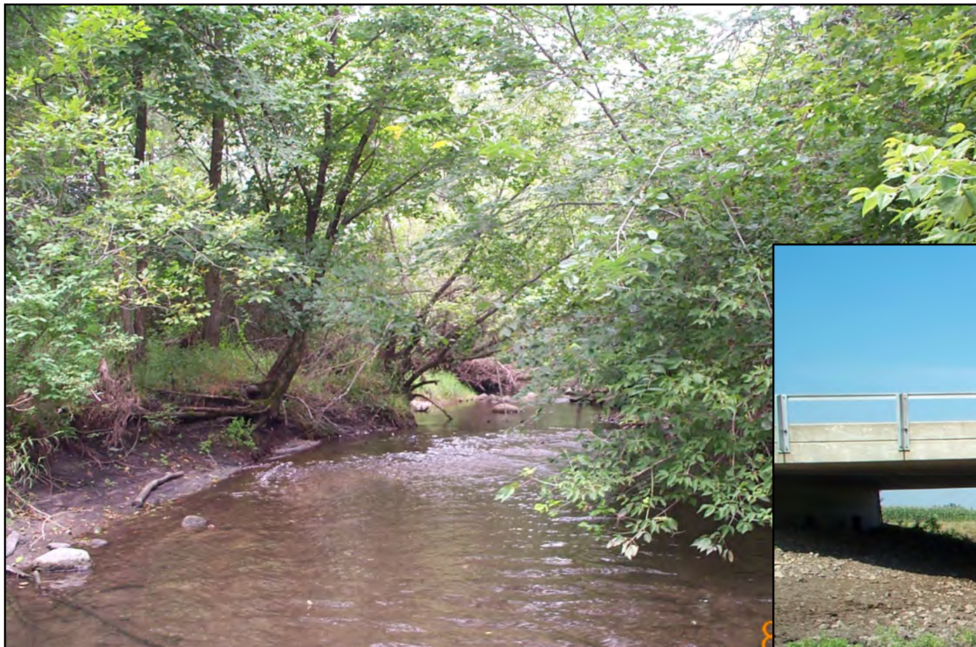
Basically, ANYTHING – natural or unnatural

Stream Banks

Conditions at Stream Transect

A stable stream bank is a sign of a stable stream.

Upstream



Downstream

What influences streambank stability?

- Channelization
- Soil Types
- Stream Bank Vegetation
- Livestock
- Tiles or Storm Drain Outlets

USGS

Cut Bank – Eroding

Photo by Gary Shaner

Photo by Gary Shaner

Photo by Tom Griep

Photo by Steve Veysey

Photo by Byron Bohnen

Photo by Byron Bohnen

Cut Bank – Vegetated

Photo by Greg Hoversten

Photo by Greg Hoversten

Photo by Greg Hoversten

Photo by Gary Shaner

Photo by Mark Brecht

Sloping Bank

Photo by Troy Martens

Photo by Dave Ratliff

Photo by Greg Hoversten

Photo by Tom Isenhart

Sand/Gravel Bar


Photo by Troy Martens


Photo by Troy Martens

Photo by Mark Brecht


Photo by Gary Shaner

Rip Rap

Photo by Tom Davis

Photo by Dave Ratliff

Photo by Del Holland

Photo by Dave Ratliff

Photo by Del Holland

Constructed Bank (i.e., Drainage Ditch)

Photo by Greg Hoversten

Drainage Ditch, North-Central Iowa, NRCS photo

Photo by Pam Simmons

Drainage Ditch, North-Central Iowa, NRCS photo

Photo by Pam Simmons

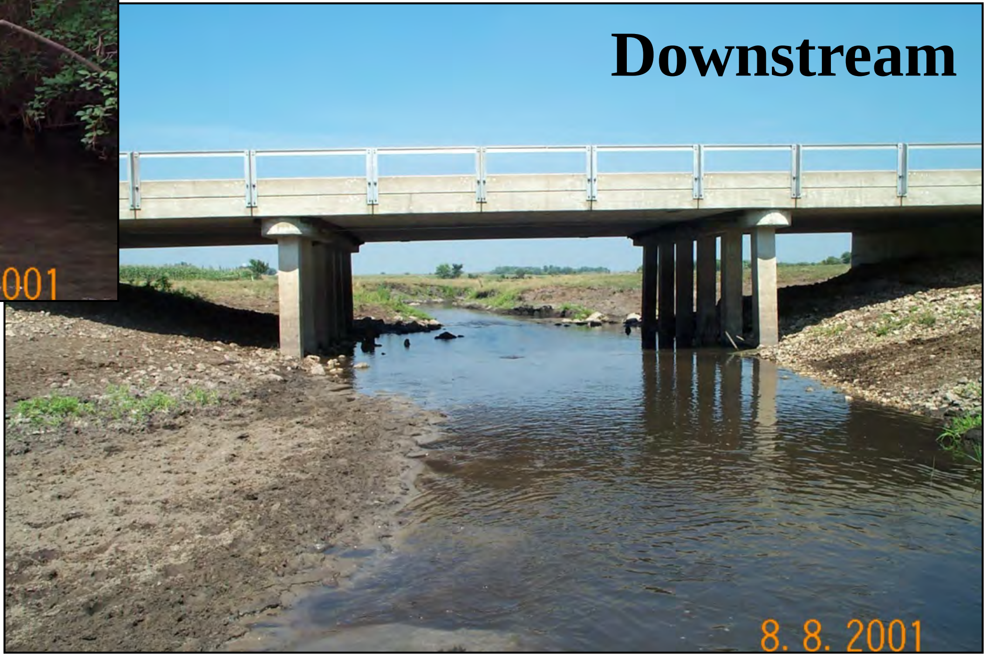
Canopy Cover

Estimated at Stream Transect

- The canopy can help protect the stream from extreme fluctuations in water temperature

72-80° F

65-89° F



Stable/lower temperature required by some species like trout

Riparian Zone

Estimated at Stream Transect

- Area of land that is in "natural" vegetation directly adjacent to the stream banks
- This zone is extremely important to the health and protection of the stream
  - Trees help stabilize the bank during flood events and may provide habitat for both aquatic and terrestrial organisms
  - Shrubs, grasses, and other plants can slow and filter runoff water before it enters the stream

Adjacent Landuse

Estimated at Stream Transect

- It may be important to document the land uses in the watershed that might influence water quality

Human Use

Recorded at Stream Reach

Human Use

Recorded at Stream Reach

Perennial or Intermittent

Recorded at Stream Reach

- Perennial Streams
  – Water flowing in a channel year-round……**EXCEPT** during periods of extreme drought
- Intermittent Streams
  – Contain water only part of the year
  – If the stream regularly dries up between July & September (typical dry times in Iowa)
- Losing Streams
  – Found in the karst topography of Northeast Iowa
  – Sinkholes can appear and fill "fast" (for geology)

Pictures

- These are extremely useful for tracking changes over time.
  - Take photos looking upstream & downstream every year

Photo by Dave Ratliff

Chapter 6: Chemical Assessment

Chemical Assessment

- Most complicated, but easiest to do
- Extreme natural variations
- What is normal?





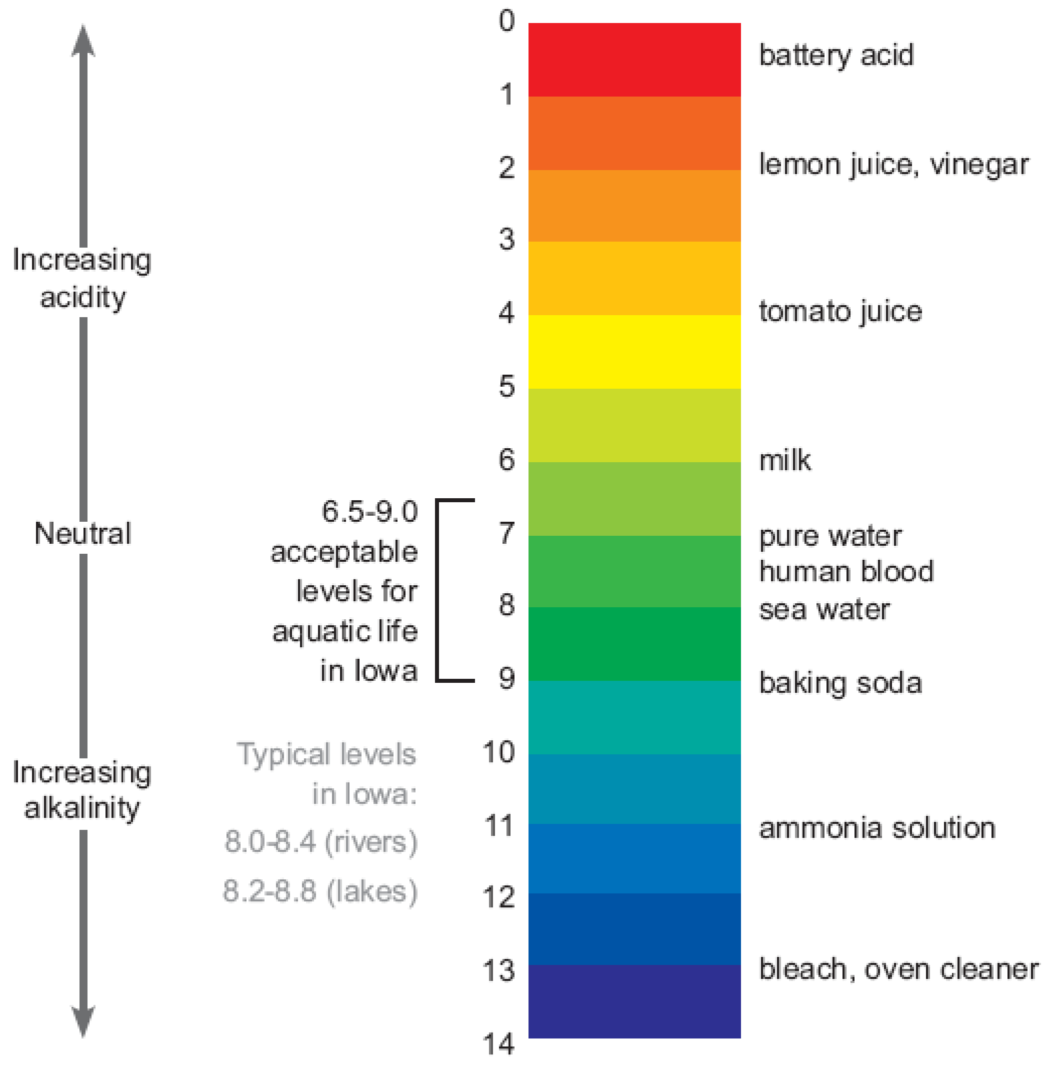
Chemical Assessment

- Check expiration dates
- Face upstream at transect
- Monitor from area of greatest flow, but err on the side of safety

pH

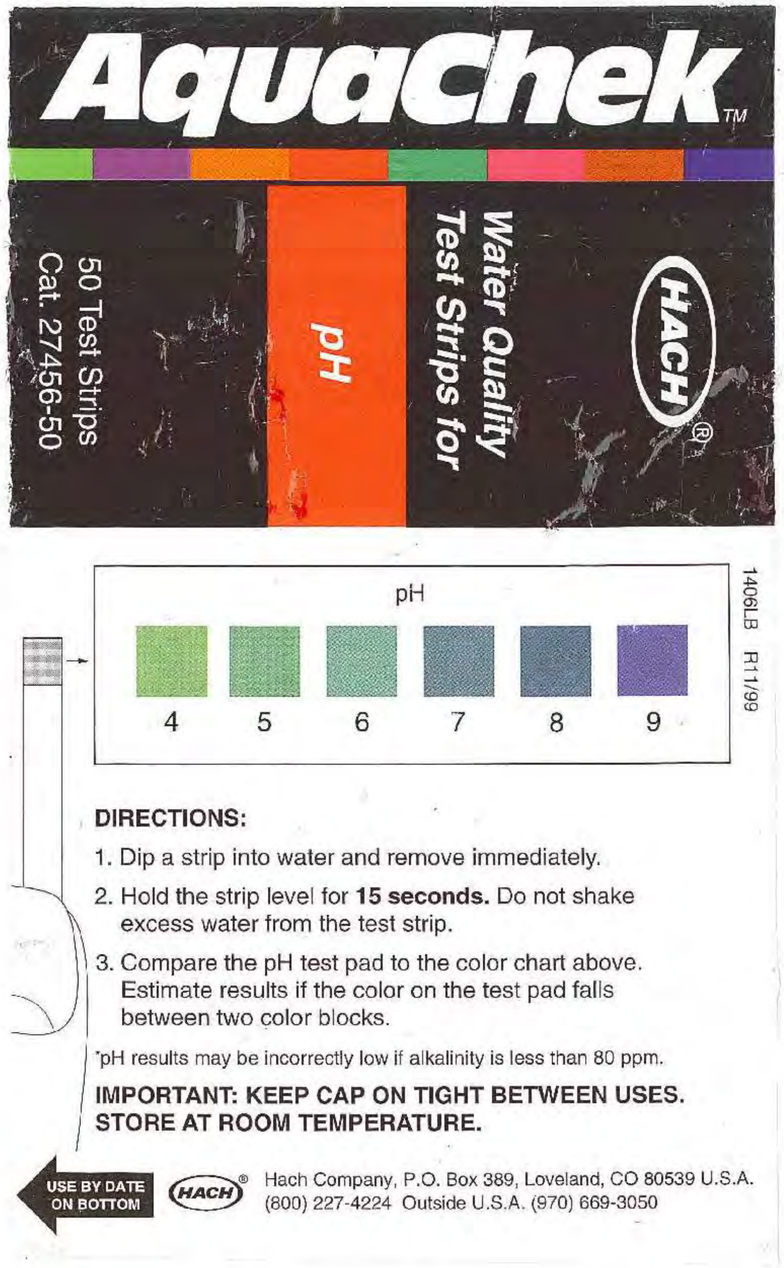
- Water's acid/base content
- Measured on scale from 0 to 14
- pH affected by
  - Acids in rain
  - Types of soils/bedrock in area
- Low pH can be harmful to aquatic life
- Low pH can cause ammonia and heavy metals to be more soluble

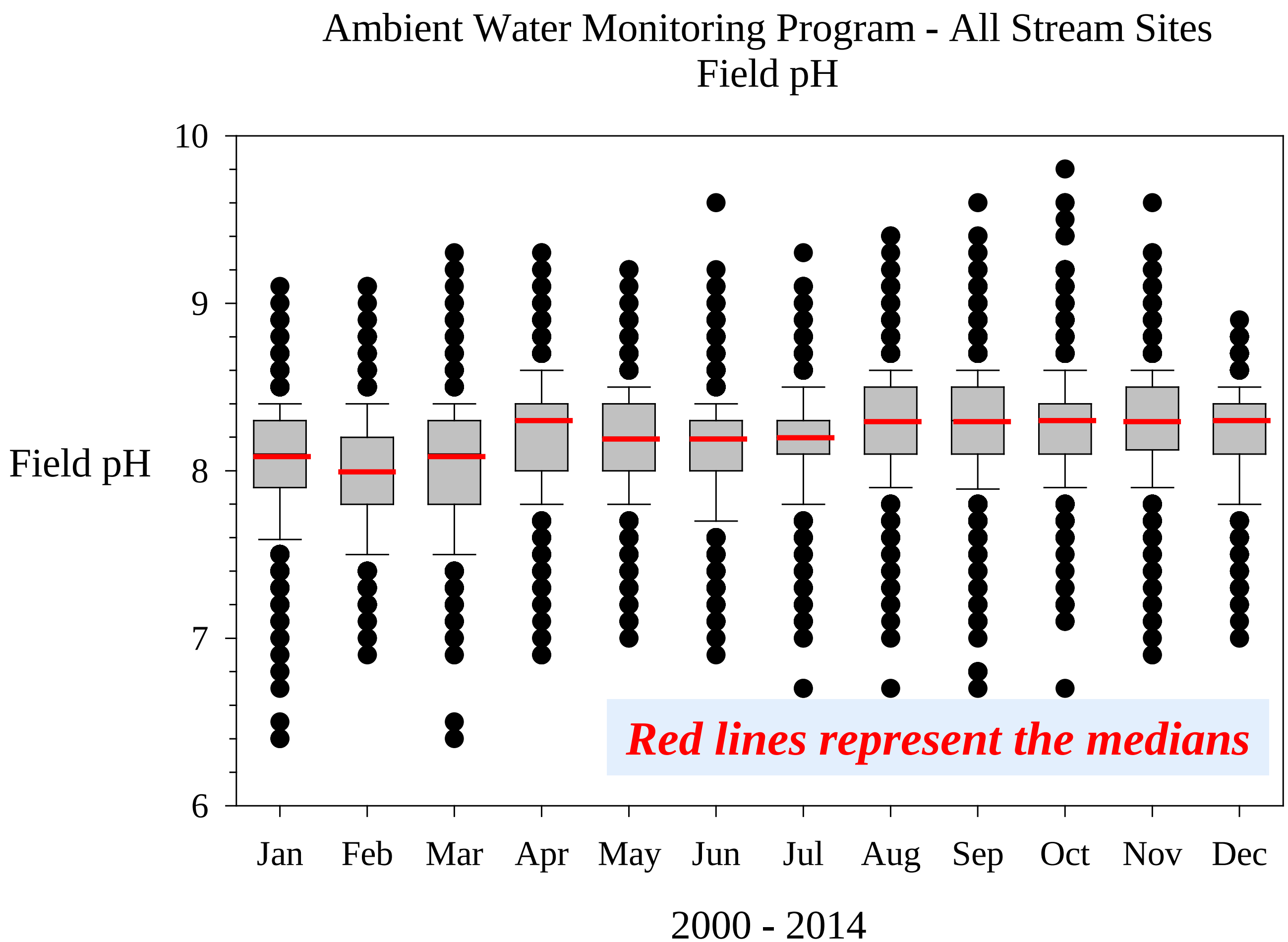
pH scale



Increasing acidity
Neutral
Increasing alkalinity
6.5-9.0 acceptable levels for aquatic life in Iowa
Typical levels in Iowa:
8.0-8.4 (rivers)
8.2-8.8 (lakes)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
battery acid
lemon juice, vinegar
tomato juice
milk
pure water
human blood
sea water
baking soda
ammonia solution
bleach, oven cleaner

Measuring: pH





Typical range for pH = 8.0 to 8.4 (rivers); 8.2 to 8.7 (lakes)

Iowa average = 8.2 (rivers); 8.5 (lakes)

Iowa's water quality standard - pH shall not be less than 6.5 nor greater than 9.0

Dissolved Oxygen

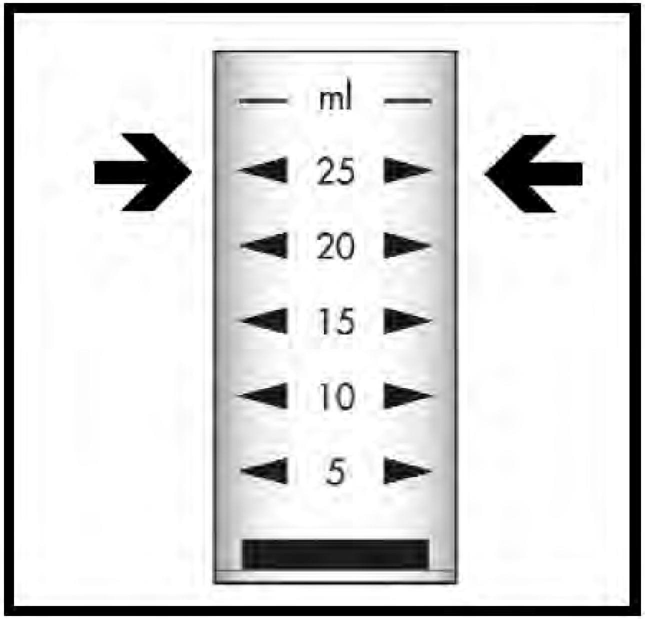
- Necessary for aquatic life
- Affected by:
  – Water temperature
  – Season
  – Time of day
  – Stream flow
  – Aquatic plants
  – Dissolved or suspended solids
  – Human impacts

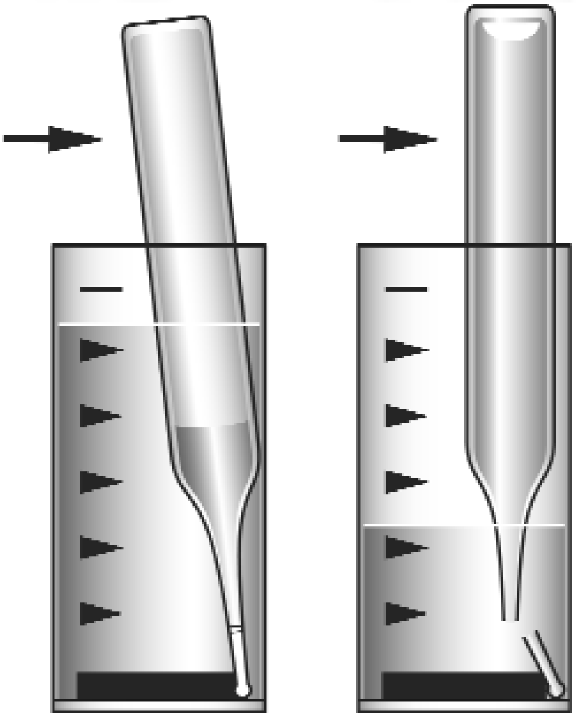
Photo by NRCS

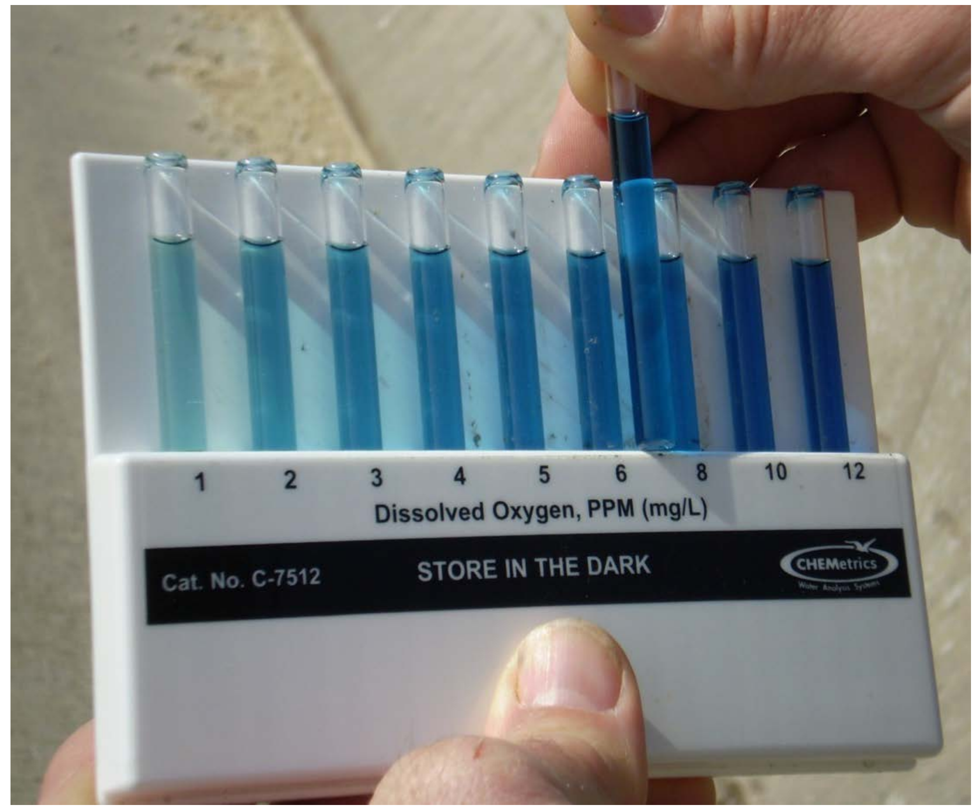
Photo by IOWATER volunteer

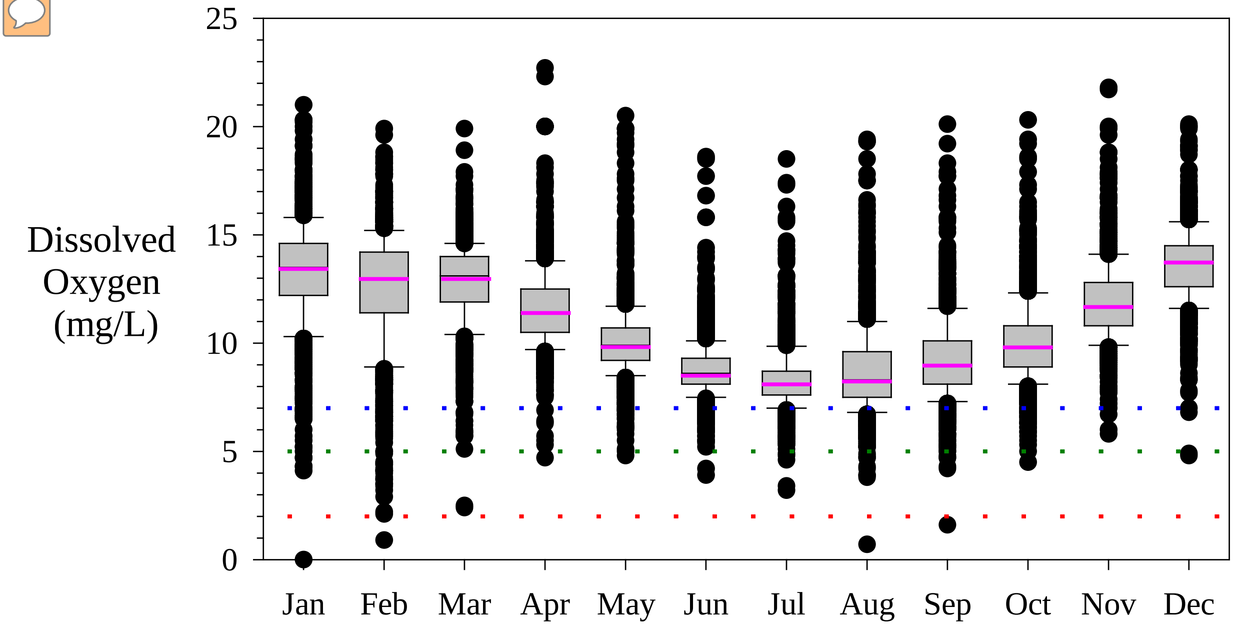
Dissolved Oxygen

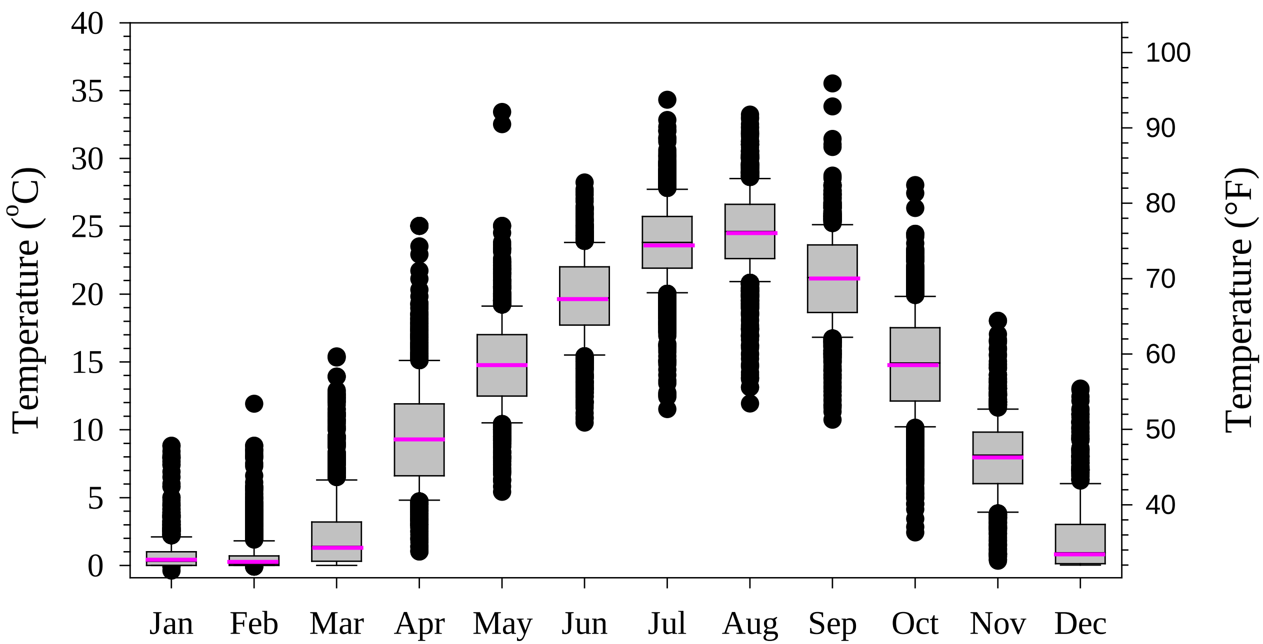
Dissolved Oxygen











Blue line = Coldwater aquatic life criteria (7 mg/L)

Green line = Warm water aquatic life criteria (5 mg/L)

Red line= hypoxic condition (2 mg/L & lower)

Pink line = medians

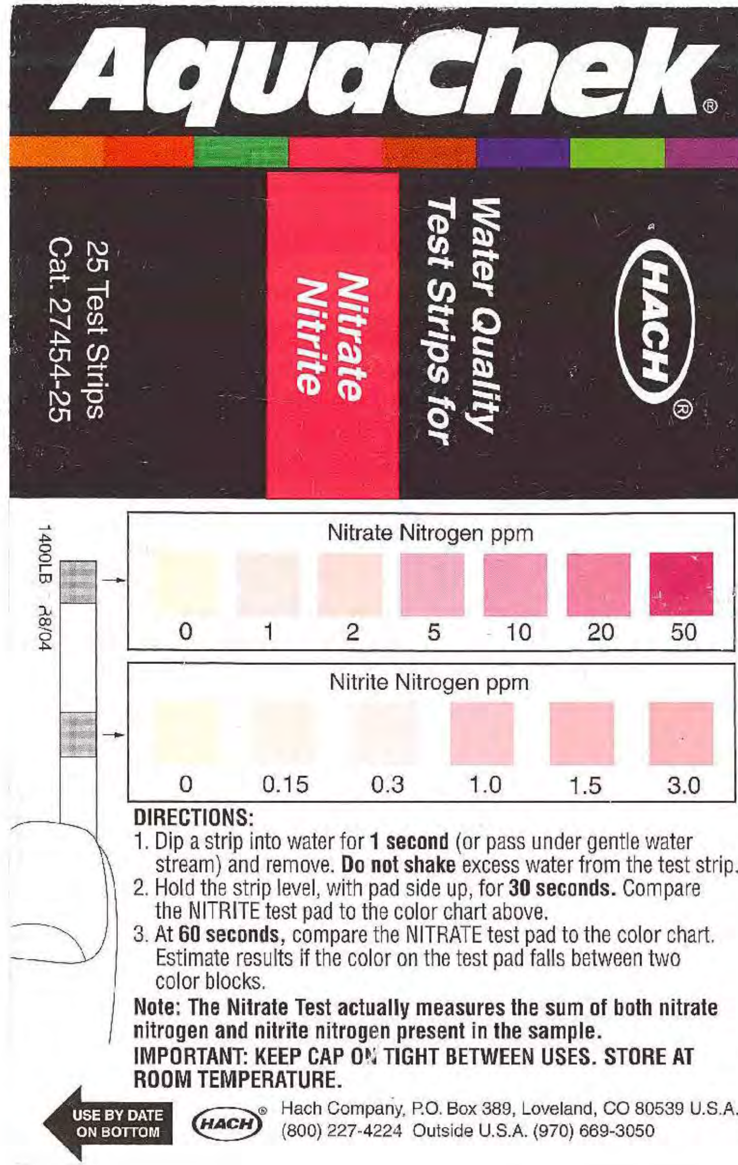
Dissolved Oxygen

- Dissolved Oxygen levels of 5 mg/L or less can be a concern

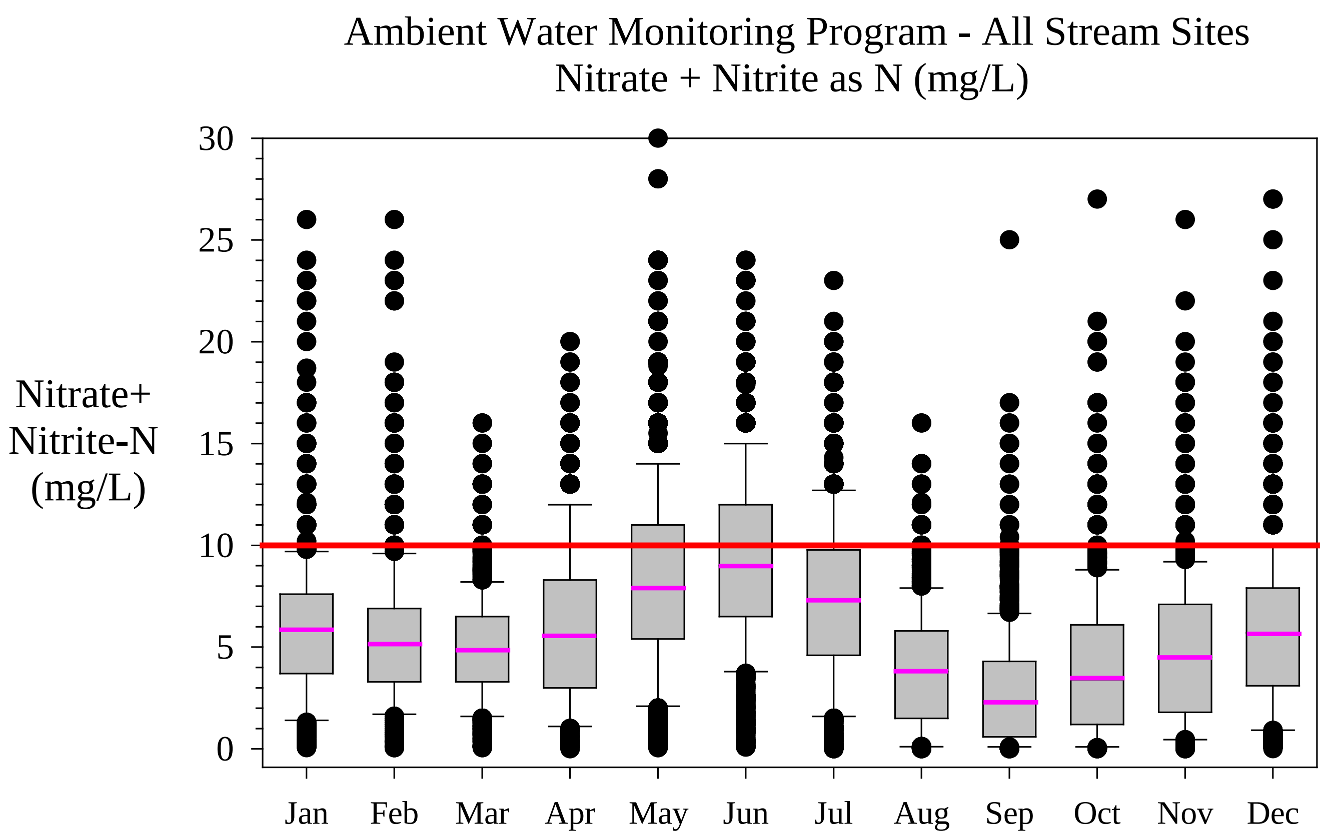
Nitrate-N and Nitrite-N

- Nitrogen is an essential plant nutrient
- Excess levels can cause nutrient enrichment
- Nitrate and nitrite are two forms of nitrogen
  - Nitrate is very water soluble and is more common
  - Nitrite is less stable and quickly converts
- Sources include:
  - Soil organic matter
  - Animal wastes
  - Decomposing plants
  - Sewage
  - Fertilizers
- Levels higher in late spring/early summer

Nitrogen



AquaChek
Water Quality Test Strips for
Nitrate Nitrite
25 Test Strips
Cat. 27454-25
HACH
Nitrate Nitrogen ppm
0 1 2 5 10 20 50
Nitrite Nitrogen ppm
0 0.15 0.3 1.0 1.5 3.0
DIRECTIONS:
1. Dip a strip into water for 1 second (or pass under gentle water stream) and remove. Do not shake excess water from the test strip.
2. Hold the strip level, with pad side up, for 30 seconds. Compare the NITRITE test pad to the color chart above.
3. At 60 seconds, compare the NITRATE test pad to the color chart. Estimate results if the color on the test pad falls between two color blocks.
Note: The Nitrate Test actually measures the sum of both nitrate nitrogen and nitrite nitrogen present in the sample.
IMPORTANT: KEEP CAP ON TIGHT BETWEEN USES. STORE AT ROOM TEMPERATURE.
USE BY DATE ON BOTTOM
HACH
Hach Company, P.O. Box 389, Loveland, CO 80539 U.S.A.
(800) 227-4224 Outside U.S.A. (970) 669-3050



Pink lines represent the medians

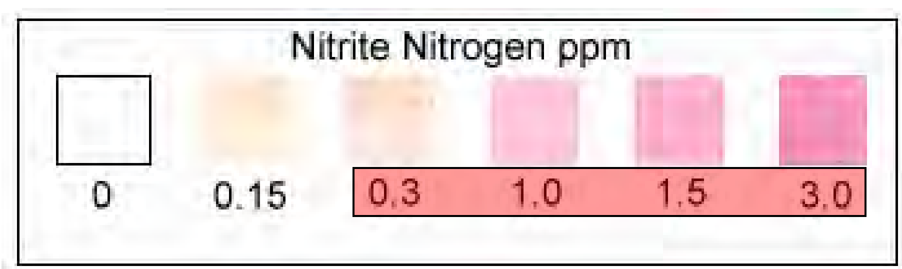
2000 - 2014

Typical range for Nitrate + Nitrite-N = 2.6 to 7.9 mg/L (rivers); 0.05 to 0.4 mg/L (lakes)
Iowa average = 5.4 mg/L (rivers); 0.19 mg/L (lakes)

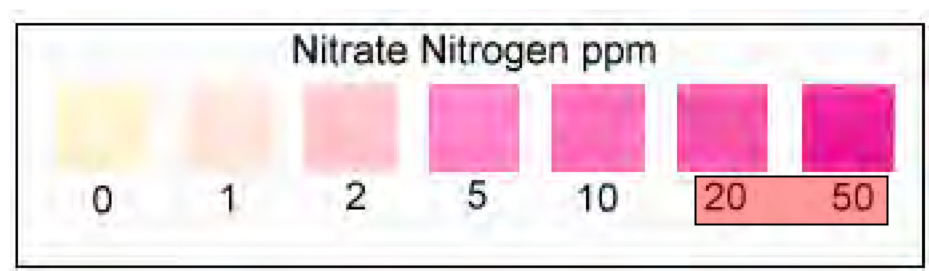
Iowa's drinking water quality standard – 10 mg/L

Nitrite/Nitrate Nitrogen

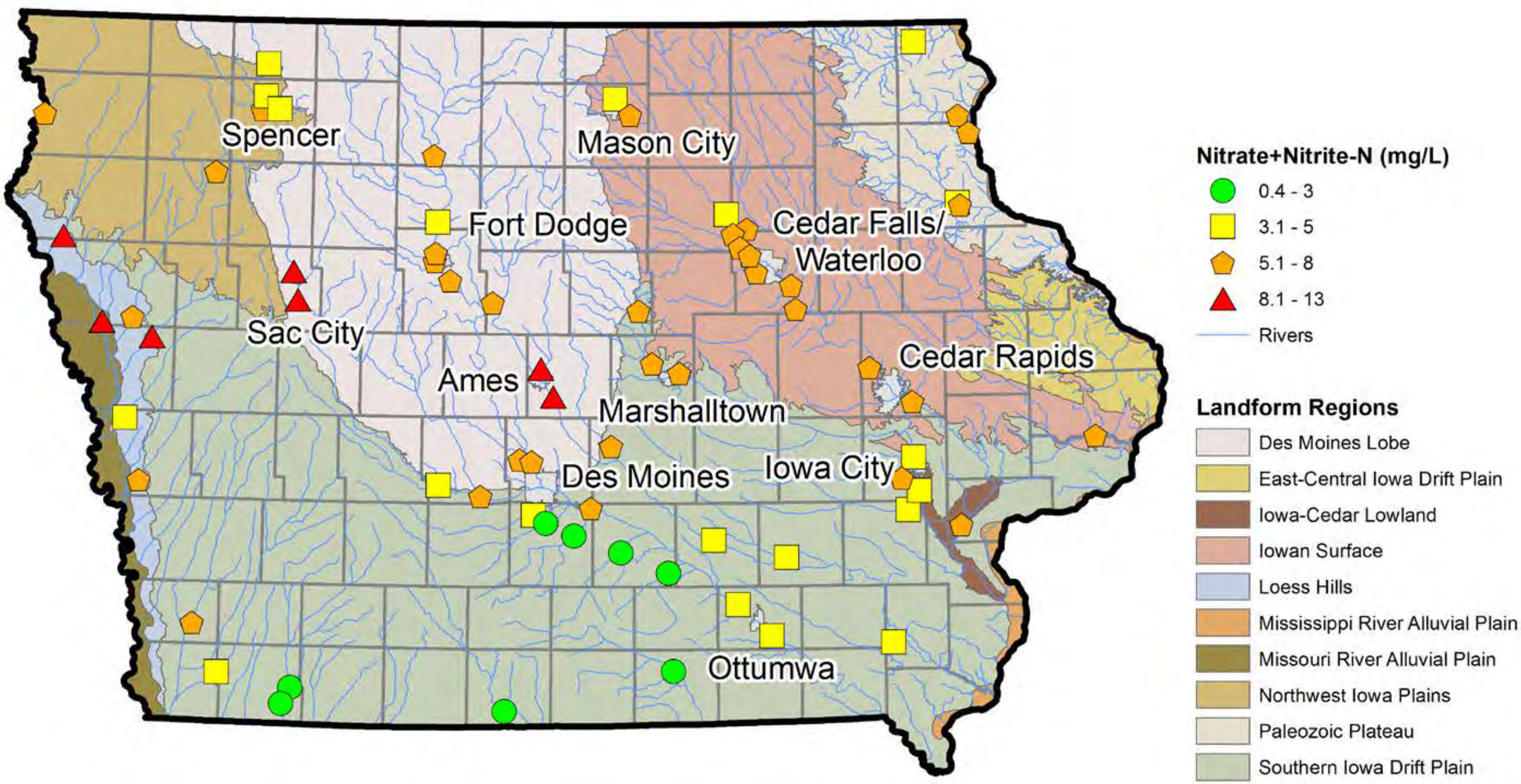
- Pads must be read at specified times
- Colors should be estimated to nearest color standard



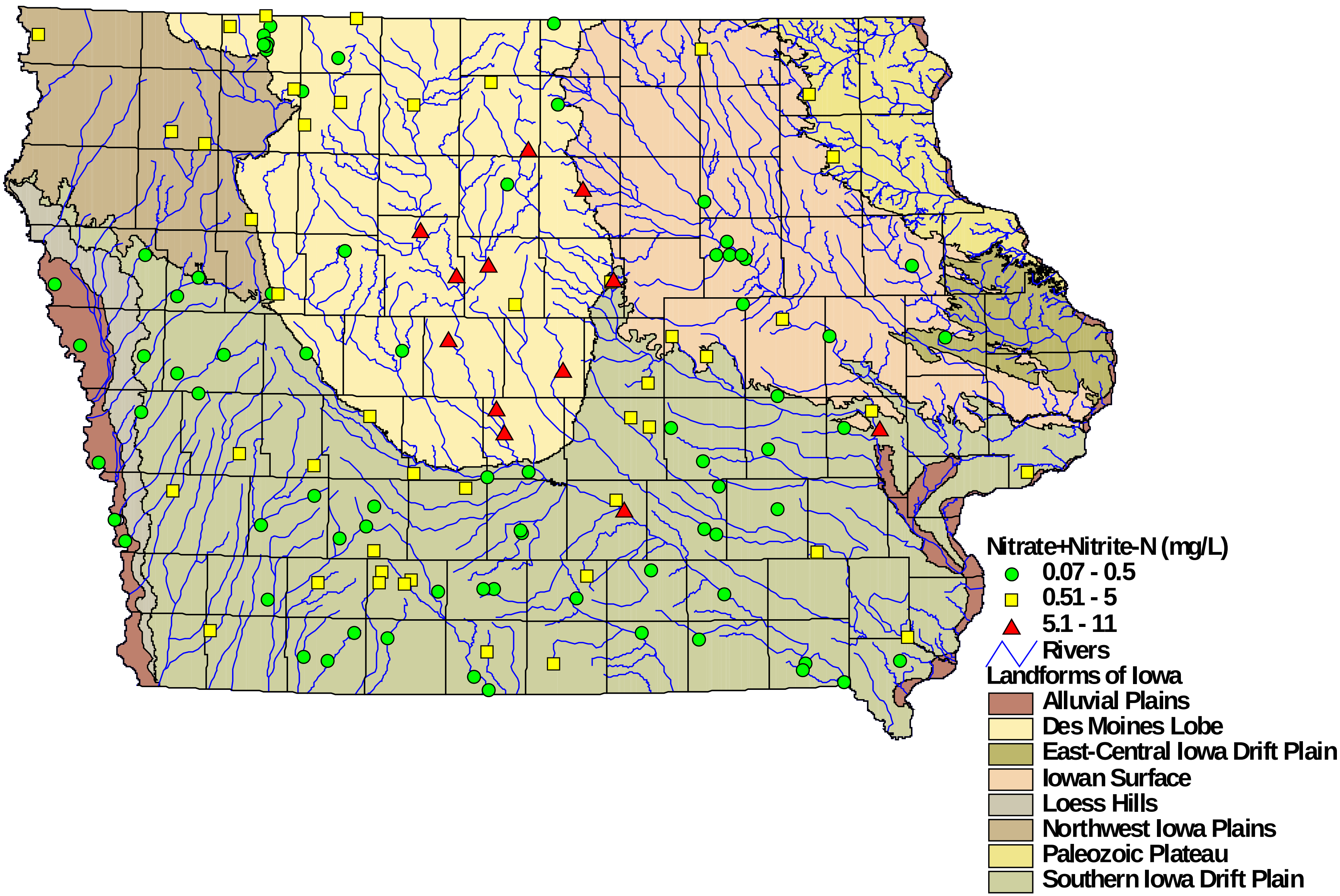
Levels of concern
- Nitrite – 0.3 and greater
- Nitrate – 20 & 50 mg/L



Ambient Monthly Stream Monitoring Sites 2000-2014 (Median)



Ambient Monthly Lake Monitoring Sites 2000 - 2008 (Average)

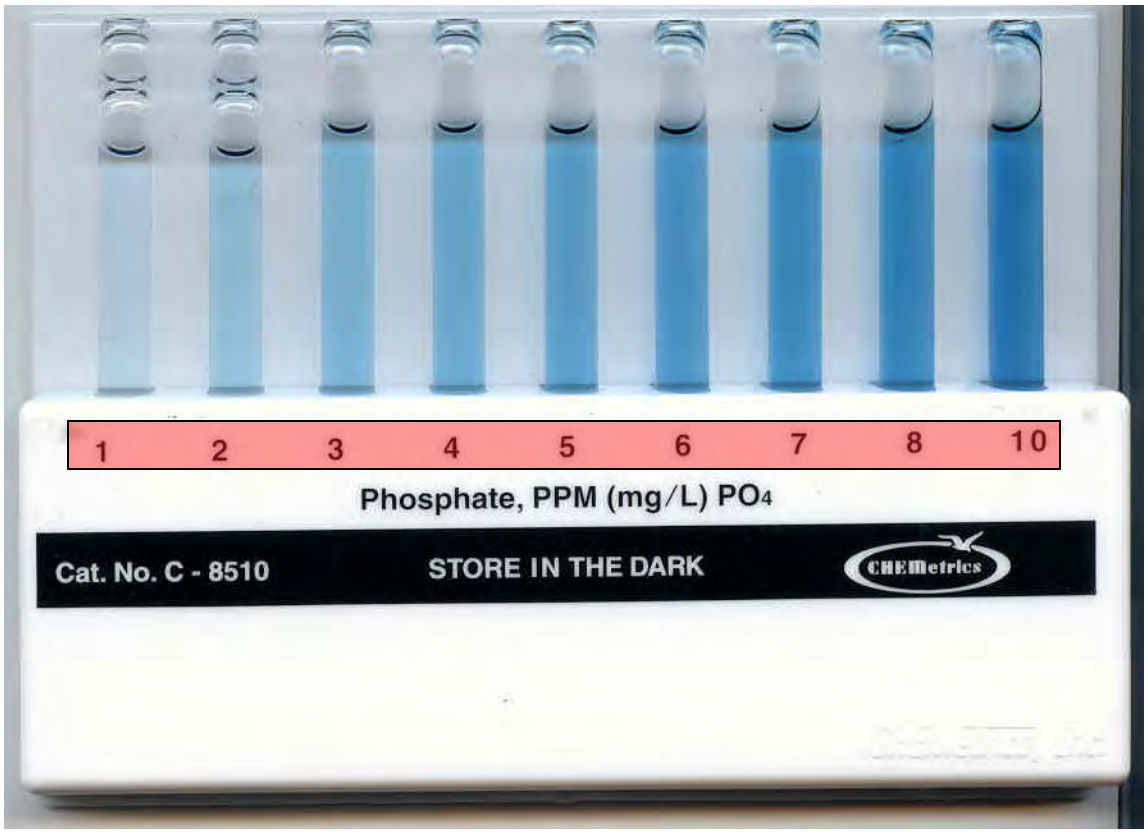


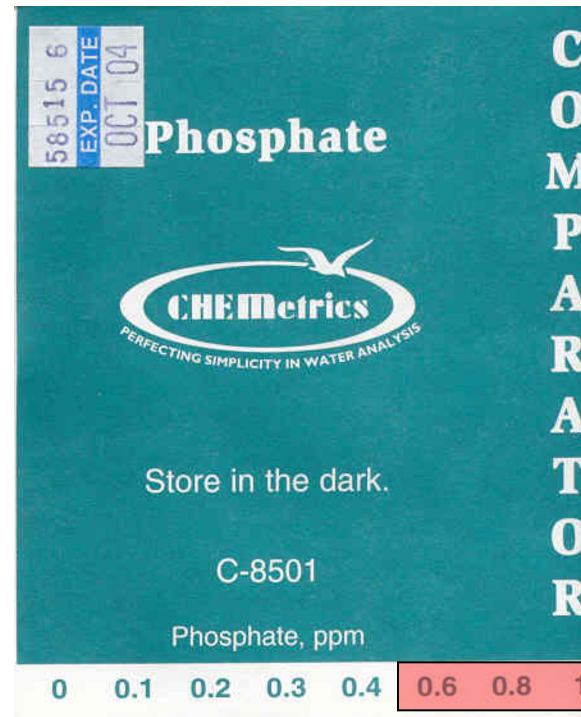
Phosphorus

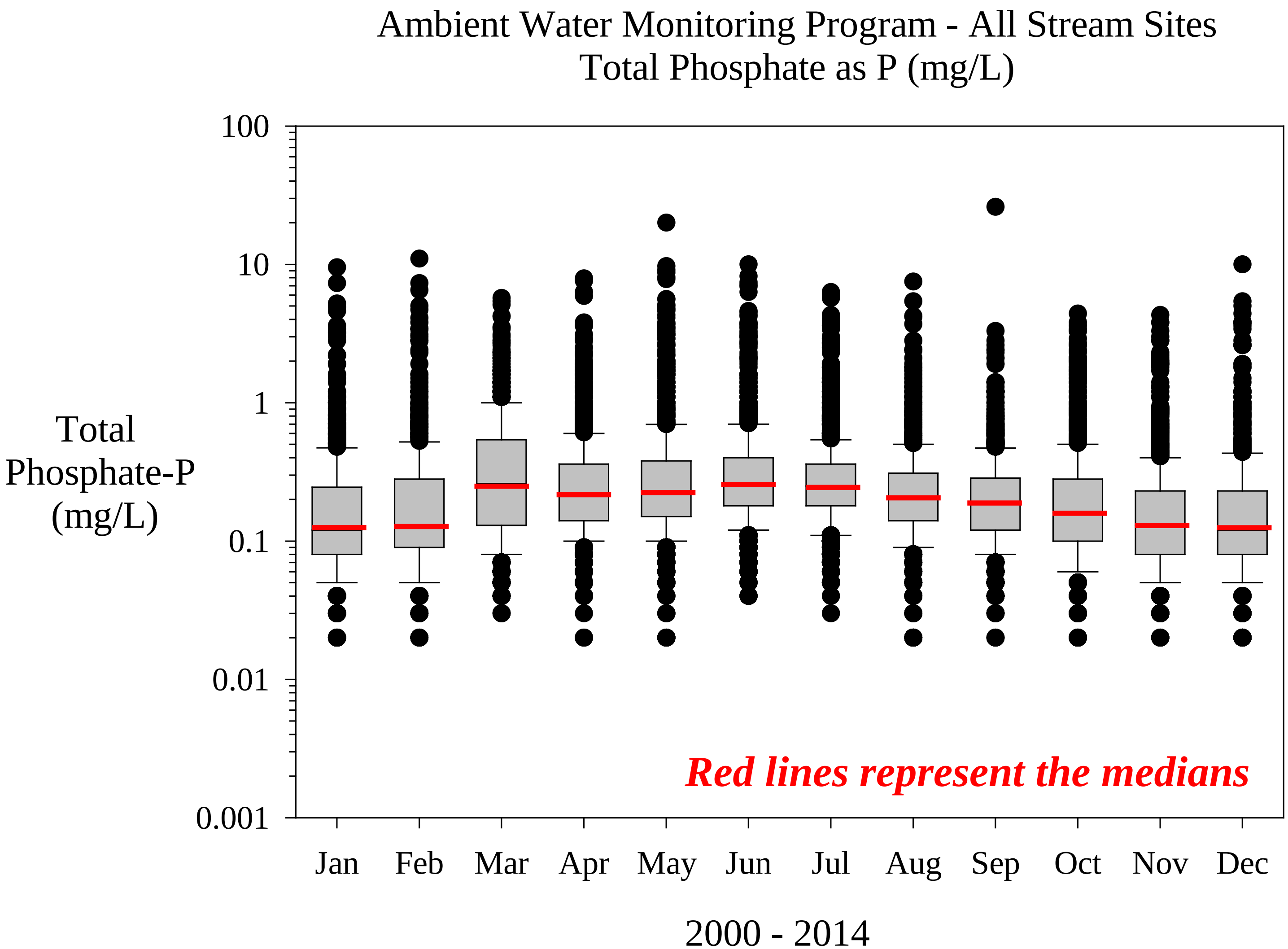
- An essential nutrient for plants and animals
- Sources include:
  - Human, animal, or industrial wastes
  - Certain soils and rocks
- Excess phosphorus in water can cause excess plant growth
  - Most common is algae blooms
  - Factoid: 1 lb of phosphorus = 500 lbs of algae
  - Cyclical death of algae and other aquatic plants = decomp = deoxygenation and fish kill potential
  - Some algae harmful to human and animal health

Phosphate

- Phosphate values of 0.6 mg/L & greater are of concern



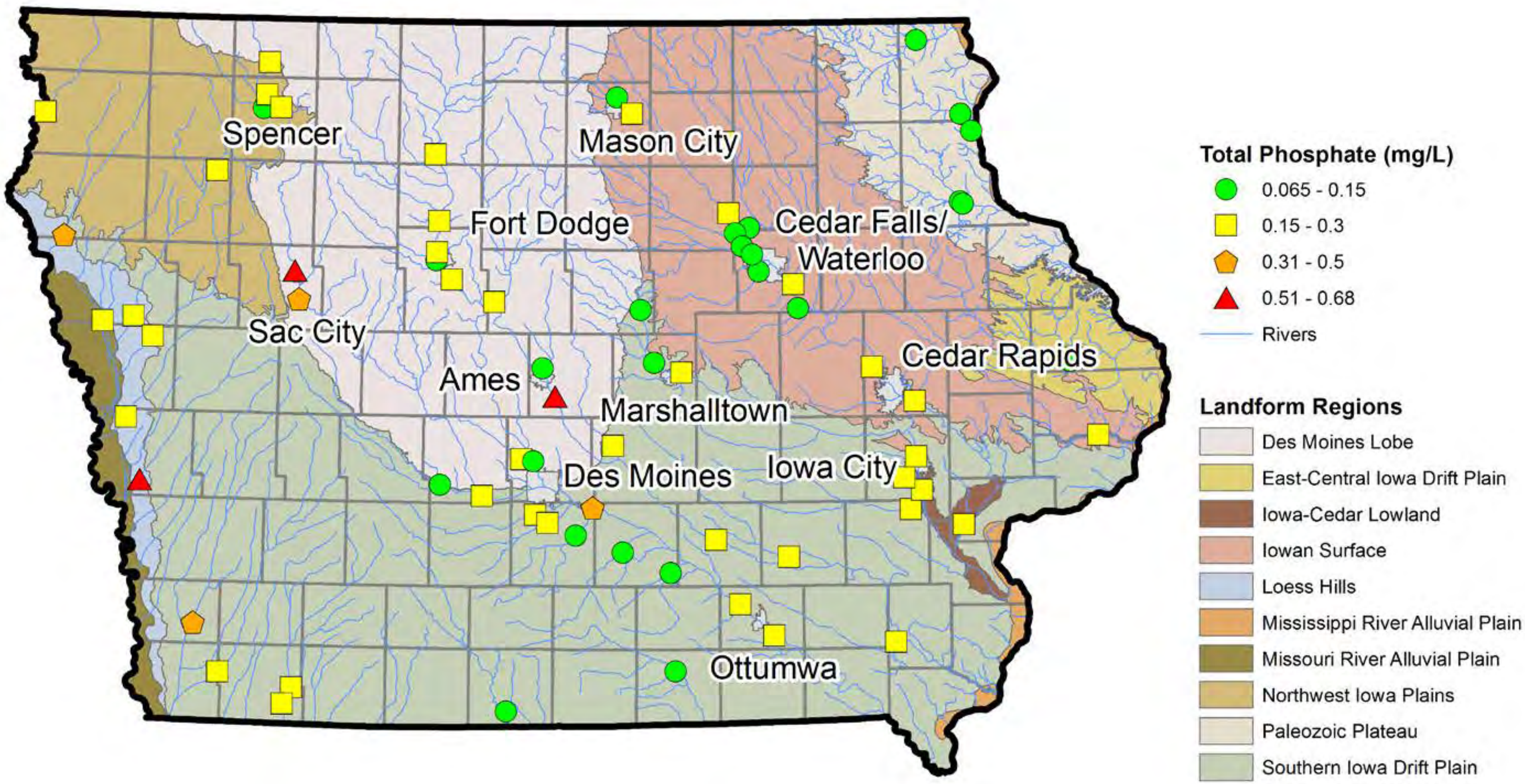




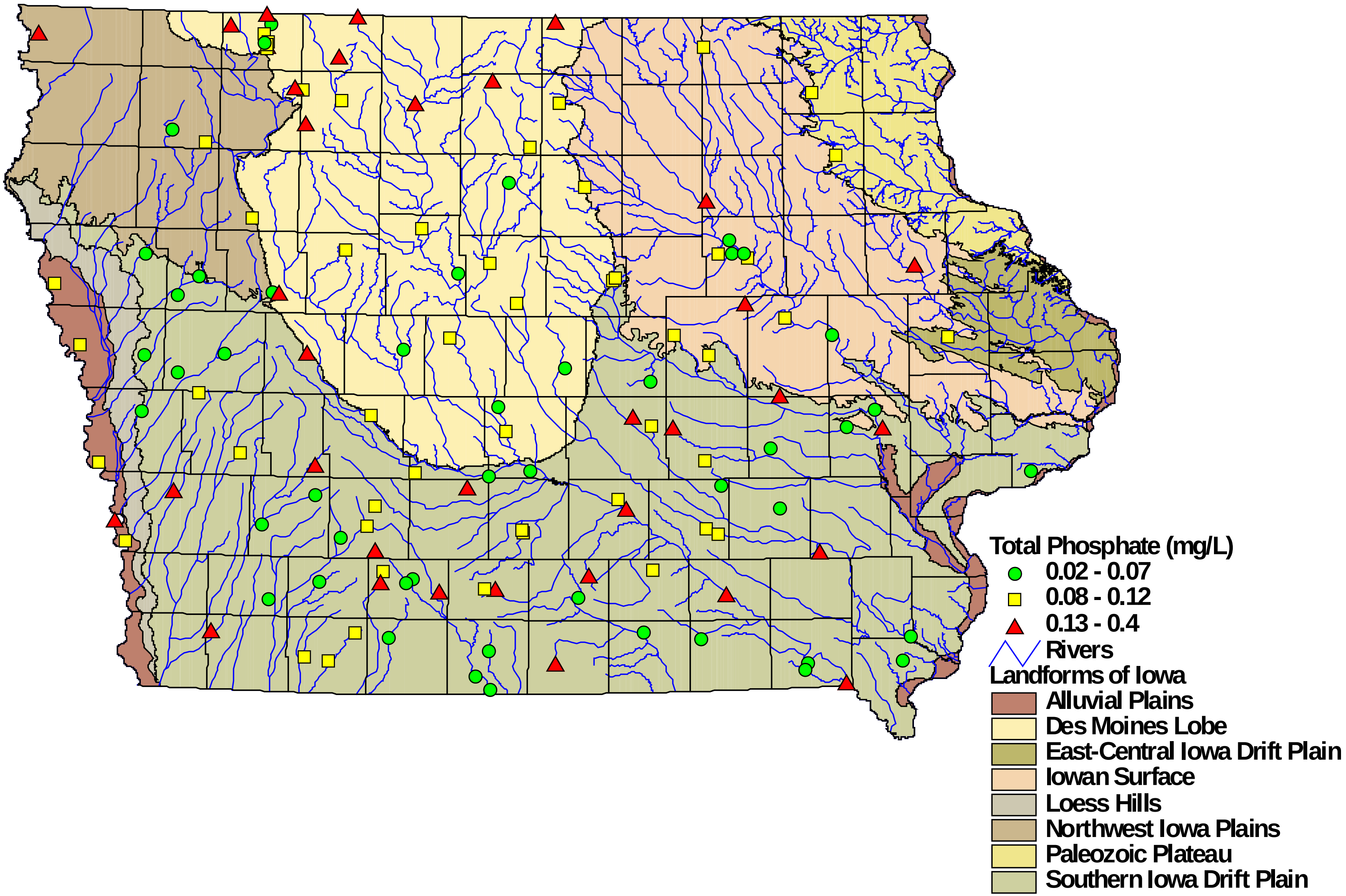
Typical range for total phosphorus = 0.11 to 0.32 mg/L (rivers); 0.05 to 0.13 mg/L (lakes)

Iowa average = 0.19 mg/L (streams); 0.08 mg/L (lakes)

Ambient Monthly Stream Monitoring Sites 2000-2014 (Median)



Ambient Monthly Lake Monitoring Sites 2000 - 2008 (Average)



Phosphorus

- Filtering can help reduce problems with off-color samples by reducing suspended solids

Chloride

- Found in salts
- Easily dissolves in water
- Sources include:
  - Human or animal wastes
  - Inputs from fertilizers
  - Road salt runoff
- Can harm aquatic invertebrates at high levels
- Standards often criticized

PHOTO: RIVERKEEPER

Quantab®

HACH®

Titrators for

Chloride

Low Range
30-600ppm Cl⁻
(0.005-0.1% as NaCl)

40 Tests
Cat. 27449-40

DIRECTIONS:

1. Remove a titrator from bottle and replace cap immediately.
2. Insert lower end of titrator into solution. Do not allow solution to reach yellow completion band at top of titrator.
3. Allow solution to completely saturate wick of titrator. Reaction is complete when yellow band turns dark.
4. Note where the tip of the white chloride peak falls on the numbered Quantab® scale. This represents the Quantab® unit value.
5. Refer to the table below to convert Quantab® units into salt concentration.

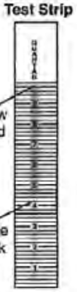
1179LB AR1204A

Lot A9099
USE BY: 01/2011

NOTE: Filtration of the sample solution may be needed to prevent obstruction of the titrator.

Quantab Units	%NaCl	ppm(mg/L) Cl^-	Quantab Units	%NaCl	ppm(mg/L) Cl^-
1.0	0.005	29	4.4	0.034	209
1.2	0.006	35	4.6	0.037	226
1.4	0.007	42	4.8	0.040	244
1.6	0.008	49	5.0	0.044	264
1.8	0.009	57	5.2	0.047	285
2.0	0.011	65	5.4	0.051	307
2.2	0.012	73	5.6	0.055	331
2.4	0.014	82	5.8	0.059	356
2.6	0.015	92	6.0	0.063	383
2.8	0.017	102	6.2	0.068	412
3.0	0.019	113	6.4	0.073	444
3.2	0.020	124	6.6	0.079	477
3.4	0.022	136	6.8	0.085	513
3.6	0.025	149	7.0	0.091	553
3.8	0.027	163	7.2	0.098	595
4.0	0.029	177	7.4	0.106	641
4.2	0.032	192			

QUANTAB® Test Strip



Important: Keep Cap on Tight Between Uses.

STORE AT TEMPERATURES NOT TO EXCEED 86°F (30°C).

USE BY DATE ON BOTTOM

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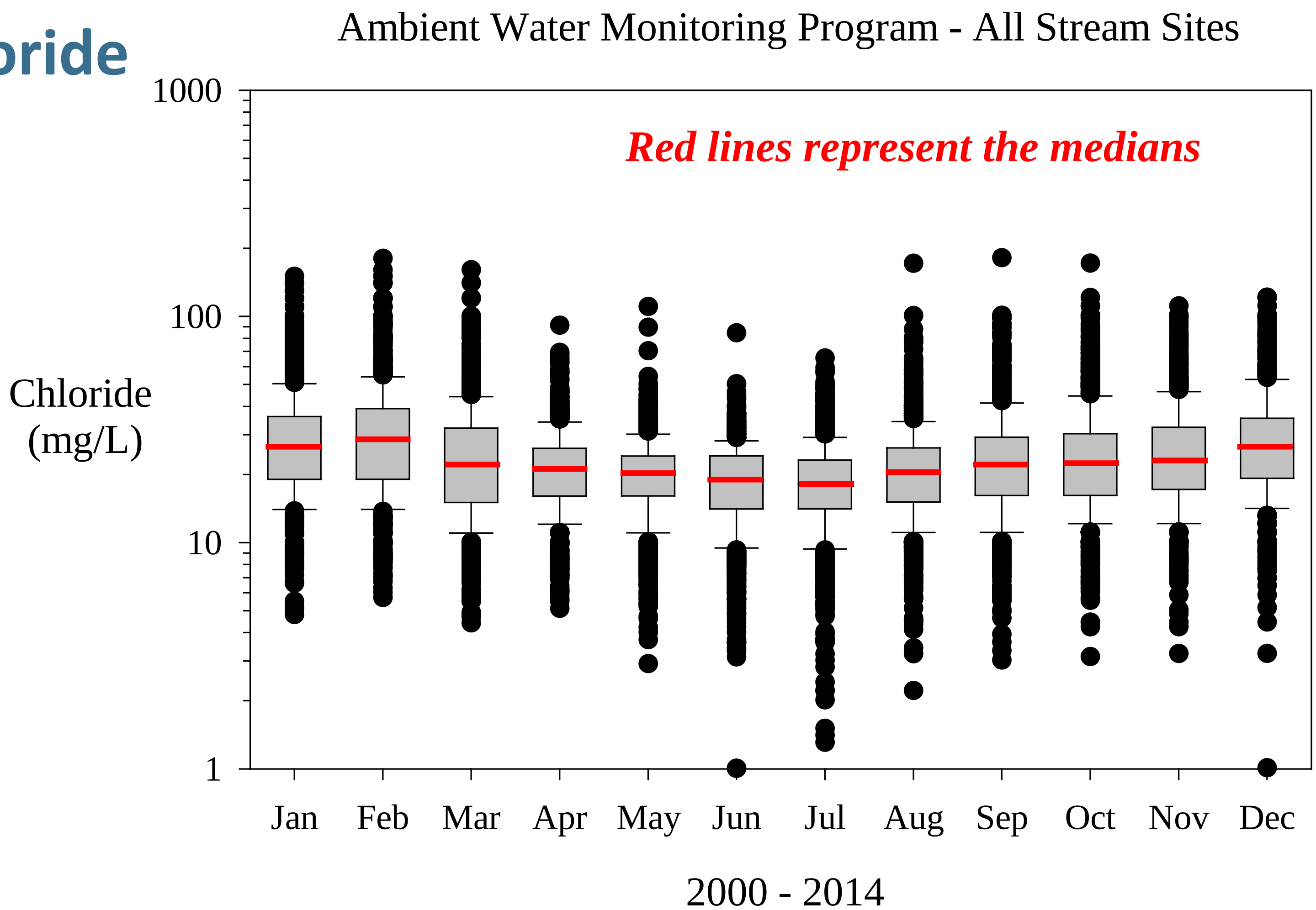
*Quantab® is manufactured by Environmental Test Systems, Elkhart, Indiana.

Chloride



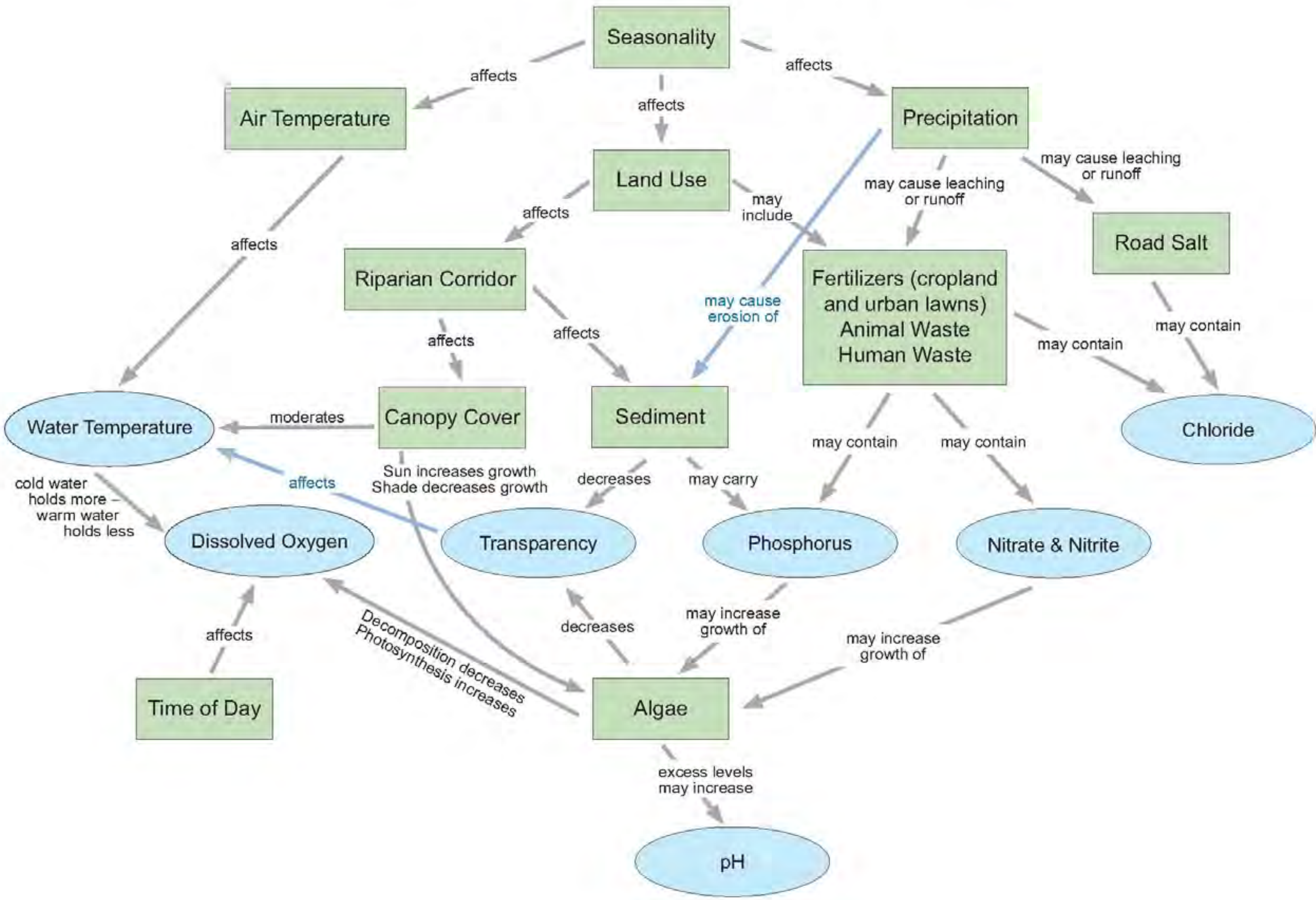
Typical range for chloride = 16 to 29 mg/L (rivers)

Iowa average = 22 mg/L (rivers)

Chloride

- Quantab values that fall below table on bottle should be recorded as <25 mg/L
- If you find your chloride strips are inadequate (chloride >600 mg/L), contact IOWATER for high range chloride strips
- Chloride values of 100 mg/L & greater are of concern

Interrelationship among Chemical and Physical Parameters



Chapter 7: Physical Assessment

Physical Assessment

- Recommended Frequency – Monthly

Weather

- Sunny
- Partly Sunny
- Cloudy
- Rain/Snow
- Windy
- Calm

Water Color

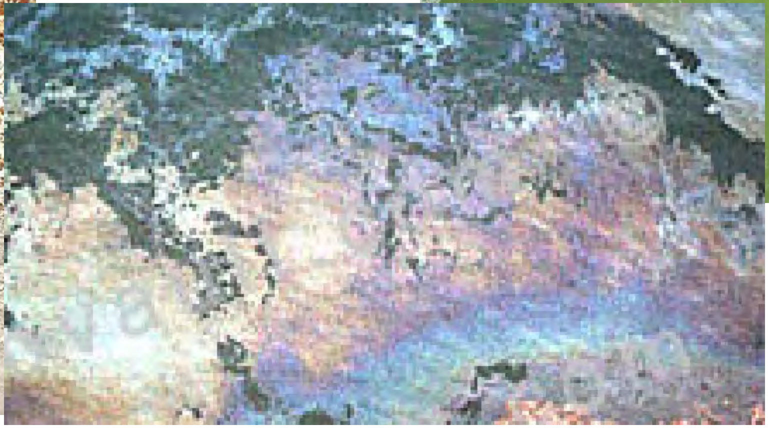
Milky

Gray

Green

Oily

Brown



Oily Sheen

If oily sheens are present, conduct a simple test to determine whether or not the sheens are natural:

Poke the sheen with a stick

- If the sheen swirls back together immediately, it's petroleum.

- If the sheen breaks apart and does not flow back together, it is from bacteria or plant or animal decomposition

Photo by Evan De Groot

Photo by Evan De Groot

Water Odor

- Manure or Sewage – urban or animal waste
- Rotten egg – low oxygen levels (decomposition)
- Petroleum – a direct pollution source
- Fishy – Stressed biological life (for lakes monitoring)

Air Temperature

- Make sure thermometer is dry
- Keep thermometer out of direct sunlight

Water Temperature

- Let thermometer stabilize (at least 2 minutes)

Precipitation

Over the past 24 hours

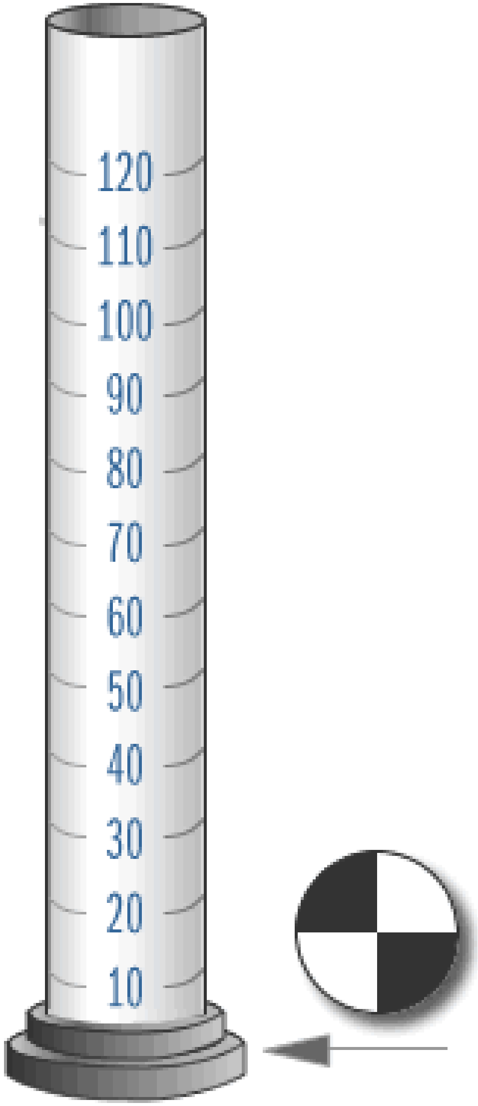
- Rain decreases point source pollution concentrations because of dilution
- Rain increases non-point pollution effects because of surface run-off

- Use your favorite weather site or:
  - http://mesonet.agron.iastate.edu/climate/

Transparency

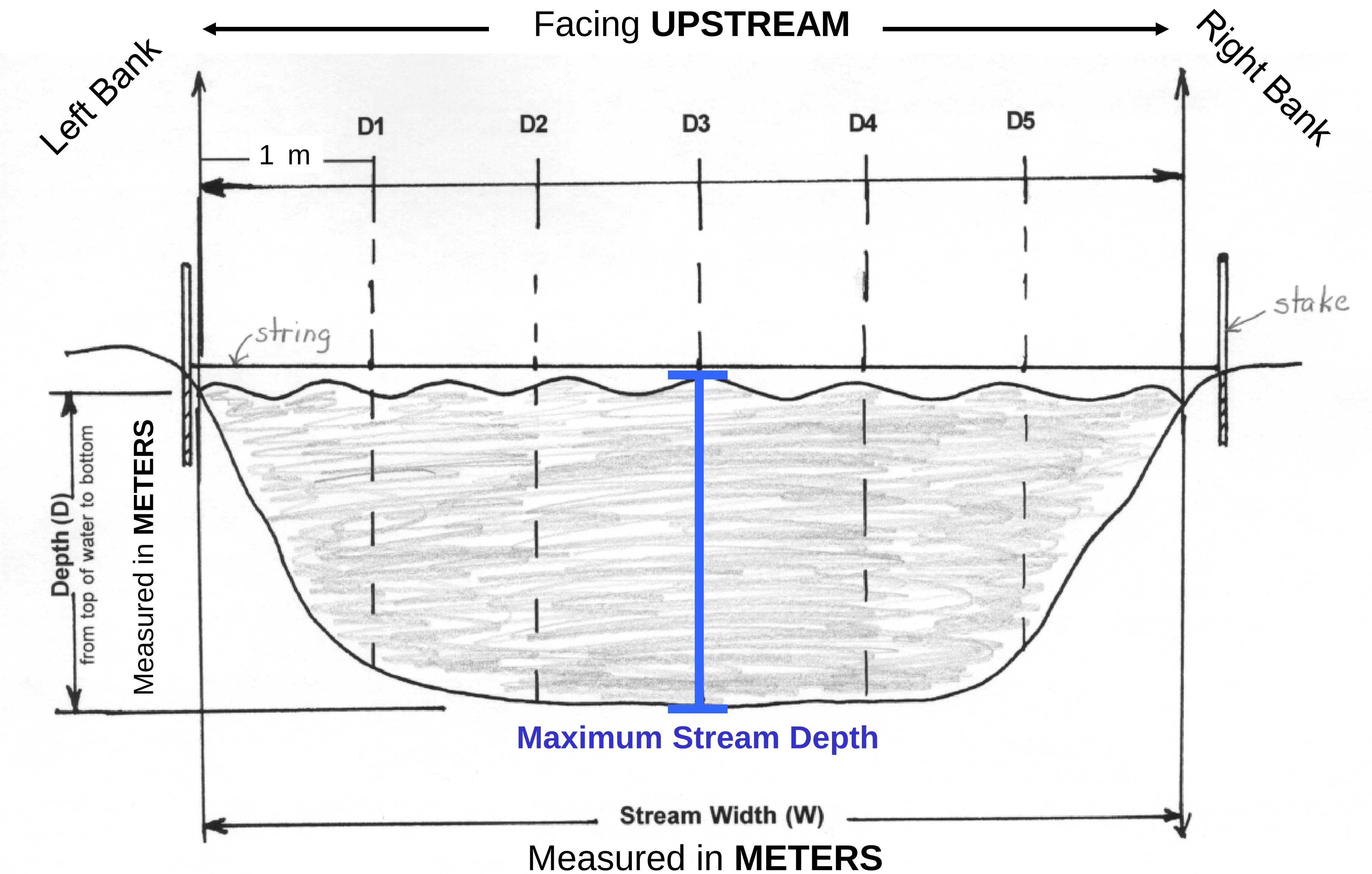
- Measured in centimeters

How far can you see through the water?



- Transparency is a measure of how *clear* the water is.
- Turbidity is a measure of how *dirty* the water is.

Stream Width & Depth



Stream Velocity

- Stream velocity is best with (expensive) equipment
- Approximations can be made with floating objects

- For many sites, see: http://rivergages.mvr.usace.army.mil/

Stream Flow (Discharge)

- **Strong** influence on water quality.
- Calculated from depth, width & velocity
- Estimated as:
  - High
  - Normal
  - Low
  - Not sure

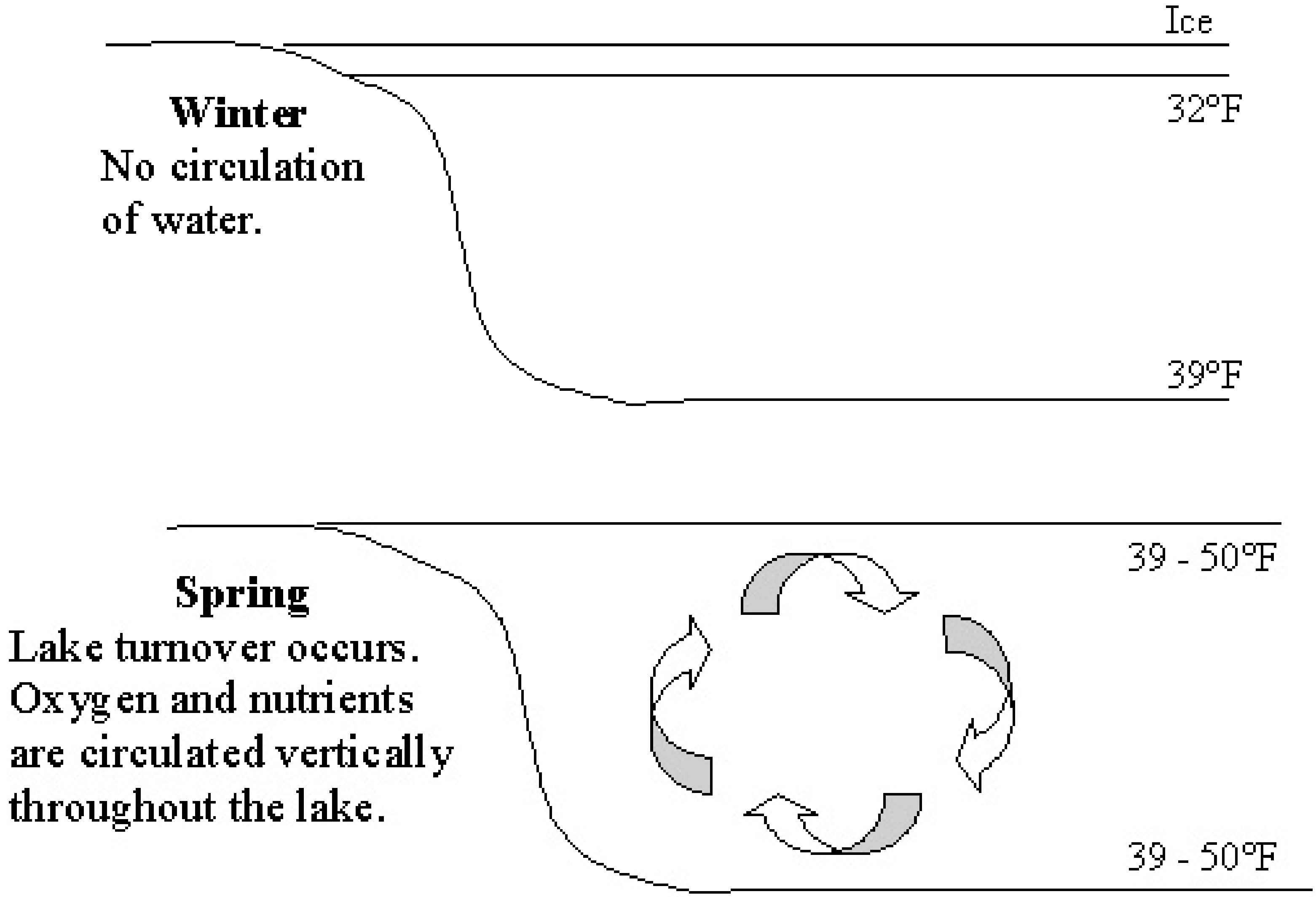
Chapter 8: Standing Waters Assessment

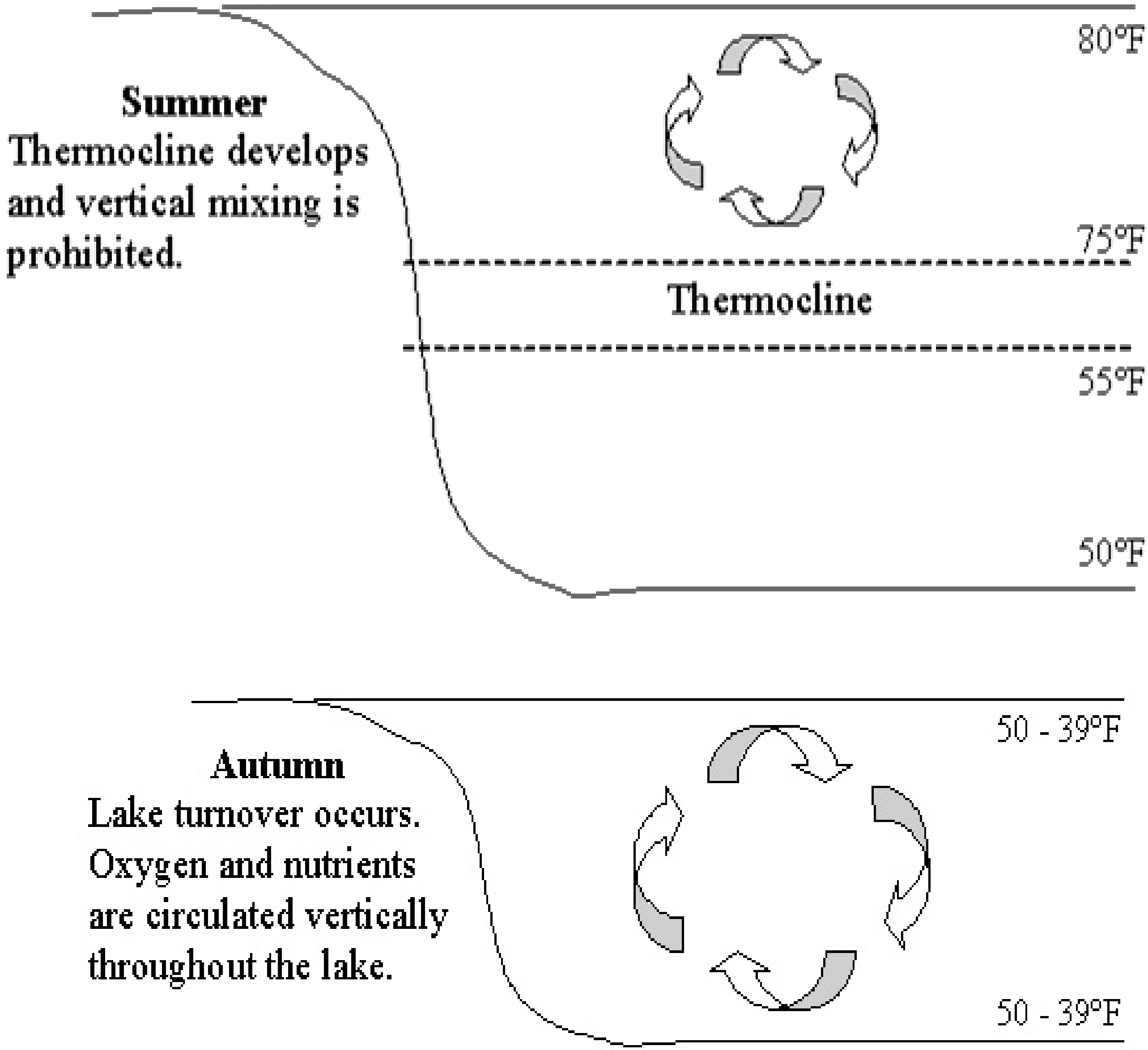
Standing Water Assessment

Introduction to Lakes

- The Iowa DNR has cataloged 5,432 "standing waters" in Iowa
  - Lakes and ponds
    - 115 Significant publicly owned lakes 67 "meandered" lakes
  - Reservoirs and Impoundments
    - 4 Flood control reservoirs
  - Wetlands
- Total acres: 161,366

Seasonal Turnover



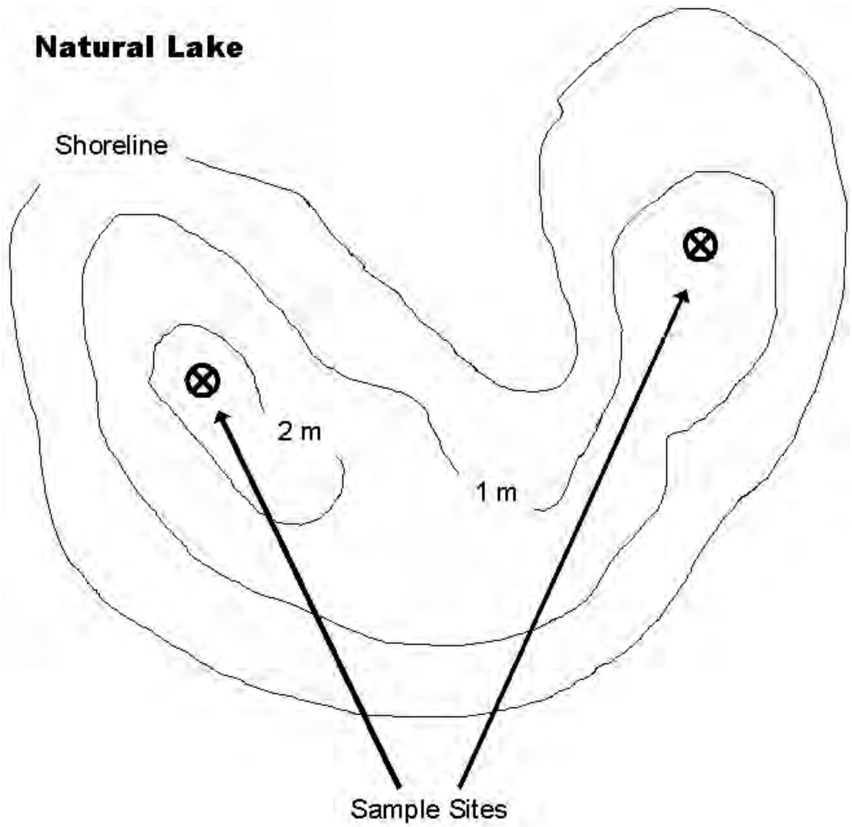

80°F
Summer
Thermocline develops and vertical mixing is prohibited.
75°F
Thermocline
55°F
50°F
50 - 39°F
Autumn
Lake turnover occurs. Oxygen and nutrients are circulated vertically throughout the lake.
50 - 39°F

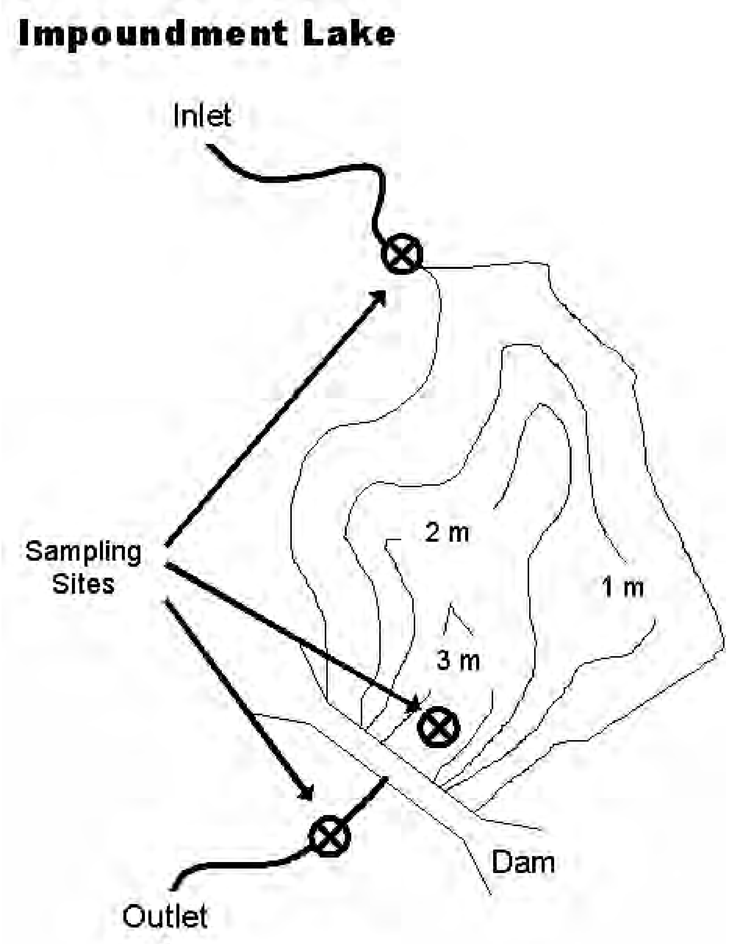
Site selection

- Most representative location
  - Deepest point
    - In circular natural lakes – the center
    - In man-made reservoirs – near the dam

- If I don't have a boat what do I do?
  - Docks, bridges, jetties, shoreline
  - May be more applicable to your project needs and areas of concern (beach?)

Site selection

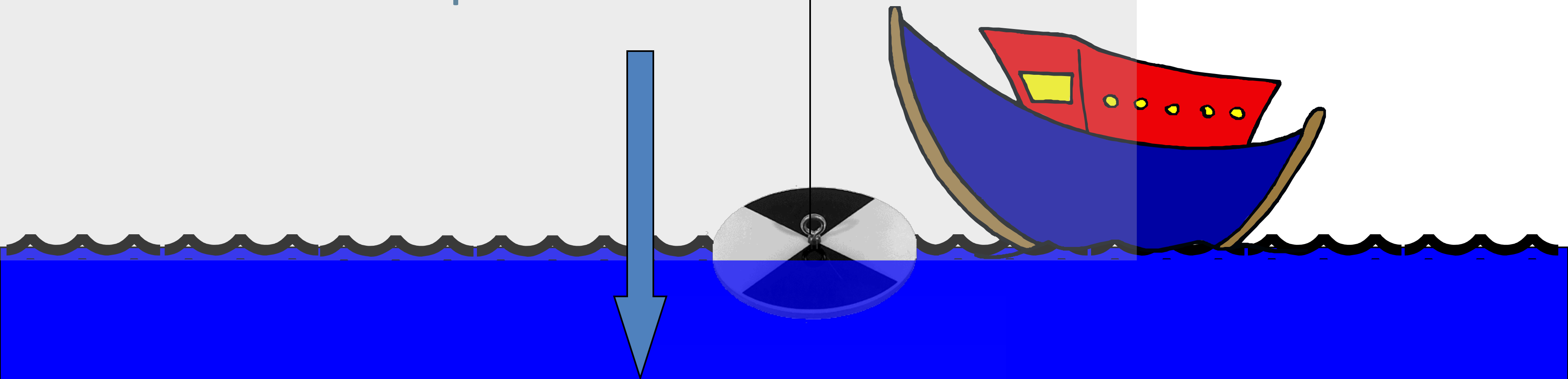




Point Sampling and Sampling Frequency

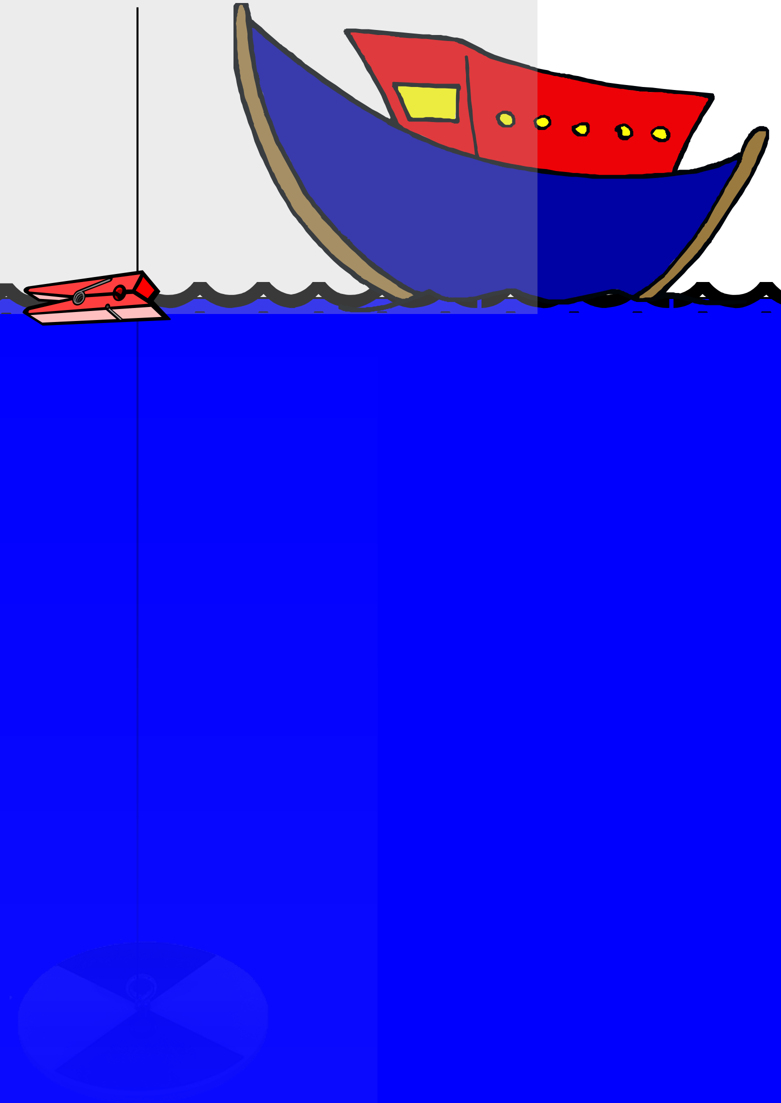
- Sampling from a specific depth
  - Elbow depth (Approx. ½ meter)
- Monthly sampling is recommended
  - From ice-out to freeze-over, between 10 AM and 3 PM
  - Be consistent – If you can only sample every other month or quarterly then stick with it

Secchi Disk Depth



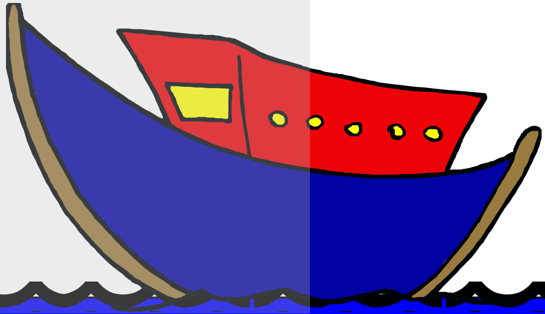
Lower the disc into the water on shaded the side until you can just make out the black & white Secchi pattern.

Secchi Disk Depth



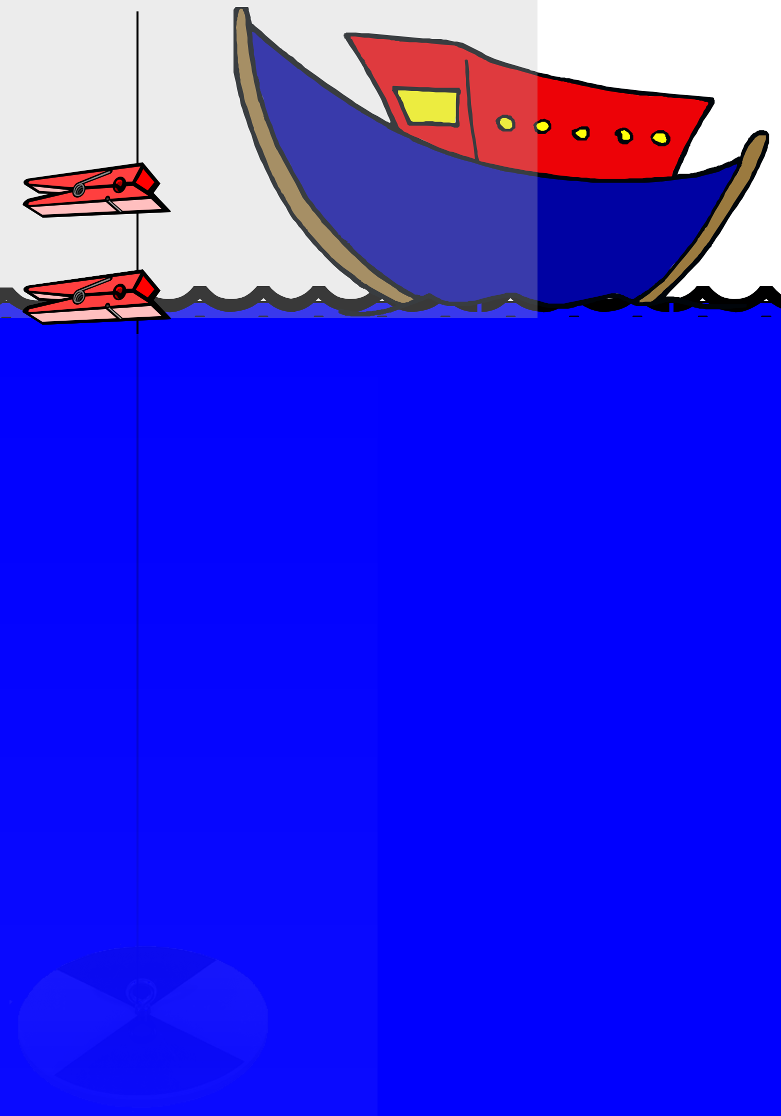
Mark that depth with a clothes pin.

Secchi Disk Depth



Lower the disc further until you can no longer see it.

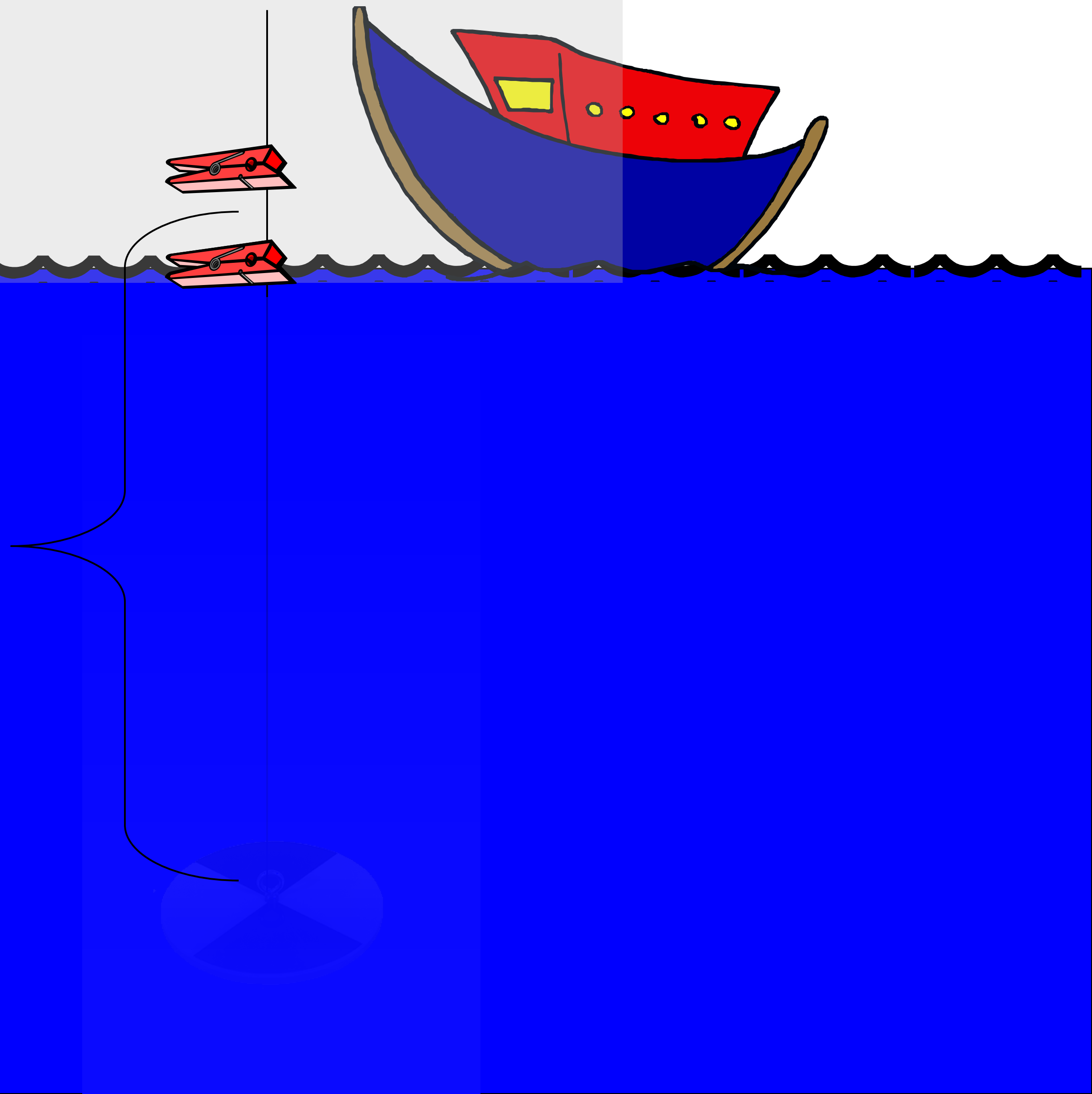
Secchi Disk Depth



Bring the disc up slowly until you can again just make out the black & white Secchi pattern.

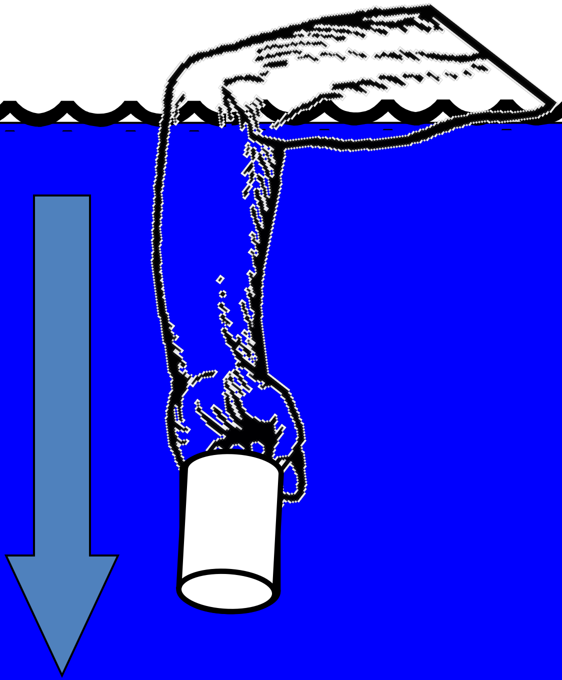
Mark this depth with a second clothes pin.

Secchi Disk Depth



The distance between the top of the disc and the average of the two pins is your Secchi depth.

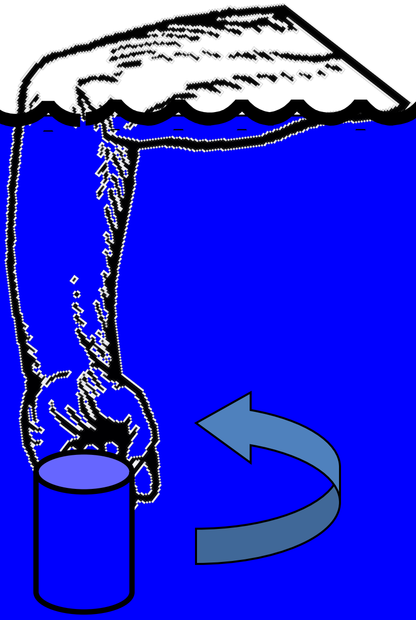
Point Sampling



Lower your sampling cup into the water to elbow depth.

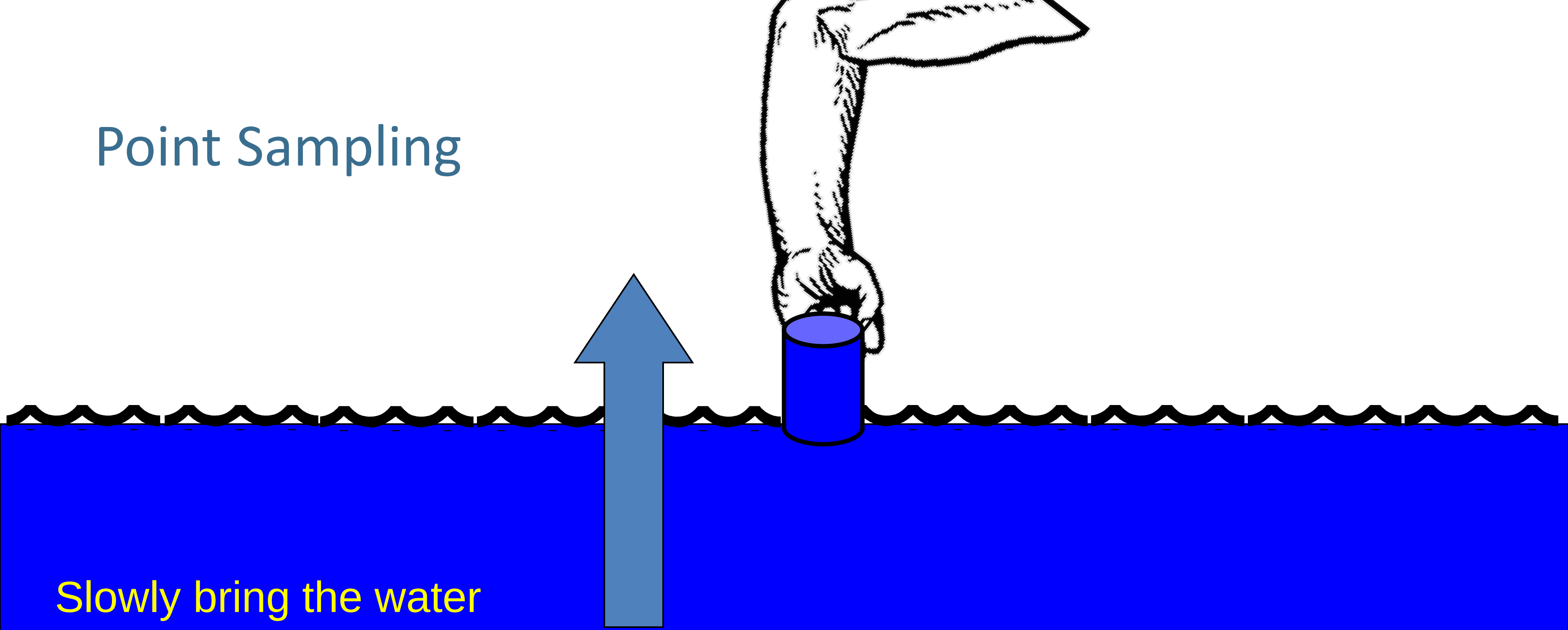
Hold the cup upside down.

Point Sampling



Slowly turn the cup upright to fill it.

Point Sampling



Slowly bring the water sample up to run your tests.

Remember to rinse your sampling cups three times when moving from site to site.

If moving between water bodies, allow all equipment to thoroughly dry to help prevent the movement and spread of aquatic invasive species.

Chapter 9: Data Interpretation

What is normal?

It is hard to know what is "normal" until:

- You can compare to a historical dataset
- You spend additional time monitoring the waterbody

Other things to consider:

Does your sampling take into account varying:

- Hydrology?
- Seasons?
- Weather?
- Other changes?

What is normal?

Level or results of concern

- <u>Chemical/Physical Assessments:</u>

  Nitrite values of 0.3 or greater (0.3, 1.0, 1.5 & 3.0 mg/L)

  Nitrate values of 20 or greater (20 or 50 mg/L)

  Phosphate values of 0.6 or greater (0.6, 0.8, 1.0-8.0, 10 mg/L)

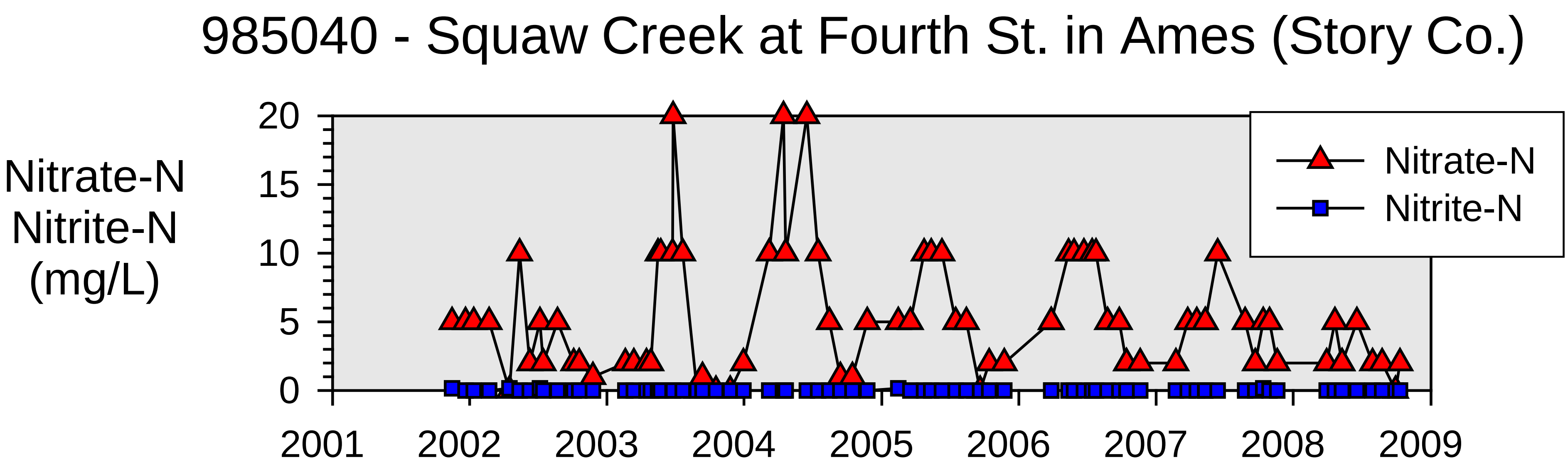
  Dissolved Oxygen values of 5 or less (1-5 mg/L)

  pH values of 6 or less (4, 5, 6)

  Chloride values of 100 or greater (100 - >600 mg/L)

How often should you collect data?

- Will depend on your monitoring plan and goals
- Monthly sampling is typical



Factors that Affect Water Quality - Land Use

- Regional Differences

  <u>Northeast</u> – rugged topography, spring-fed streams, higher transparency, lower nutrients.

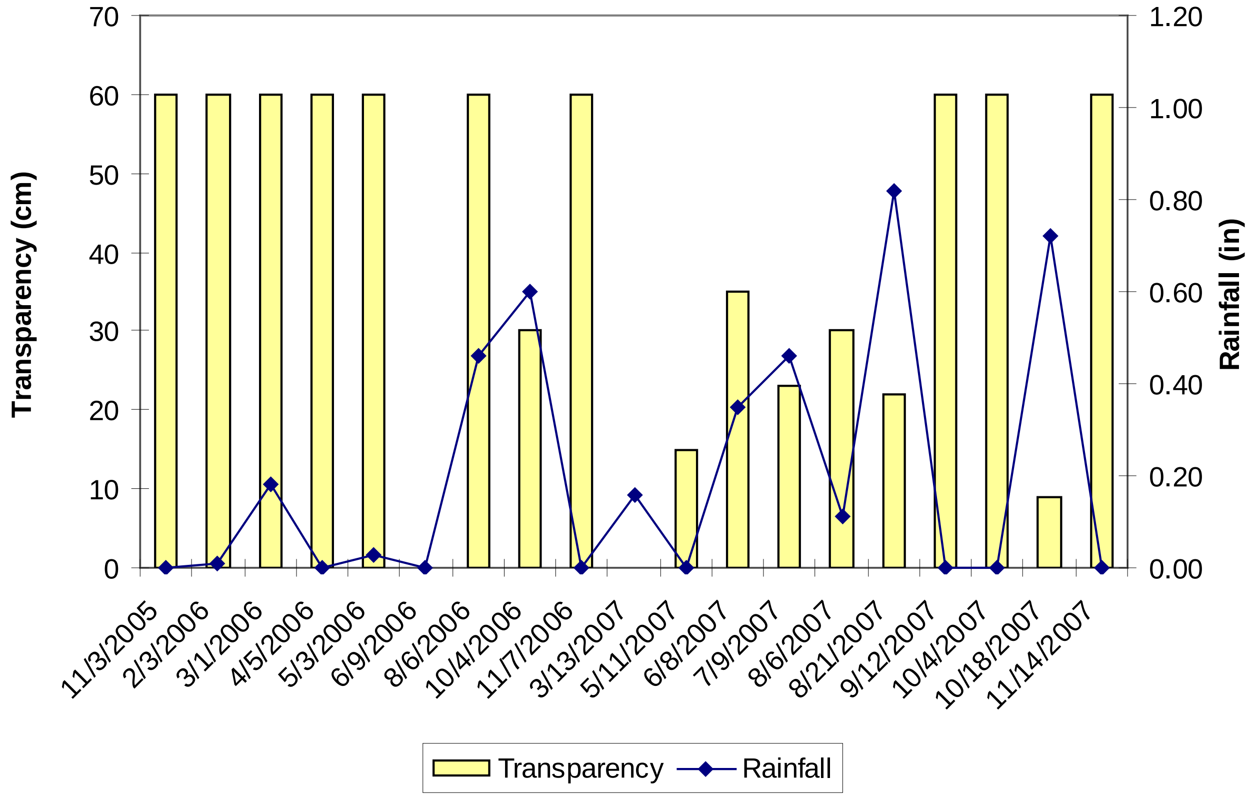
  <u>North Central</u> – flat topography, mainly row crops, tile drainage, higher transparencies, higher nutrients

  <u>West</u> – loess hills, rolling plains, forest, grassland, and row crops, low transparency

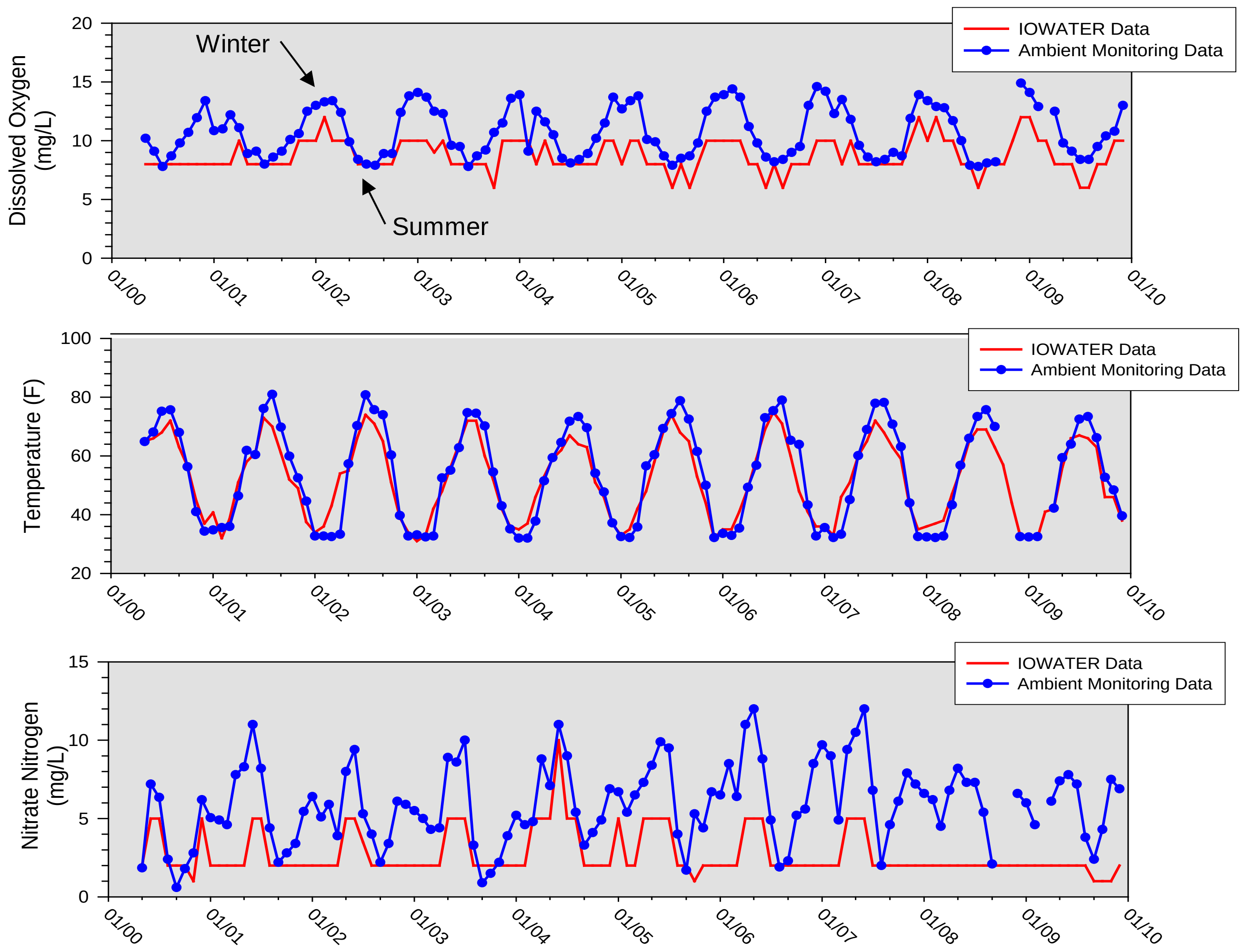
  <u>South</u> – irregular plains, low hills, forest, pasture, row crops, lower nitrogen, variable water quality

Factors that Affect Water Quality - Precipitation

- Precipitation tends to increase non-point source pollution.
- Precipitation tends to decrease point source pollution.

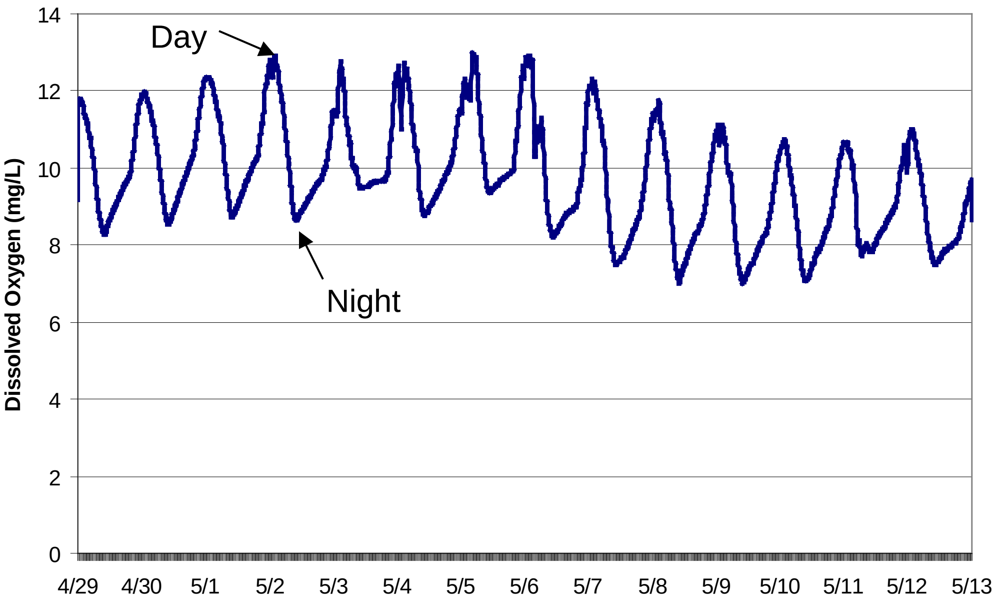


Factors that Affect Water Quality -Season



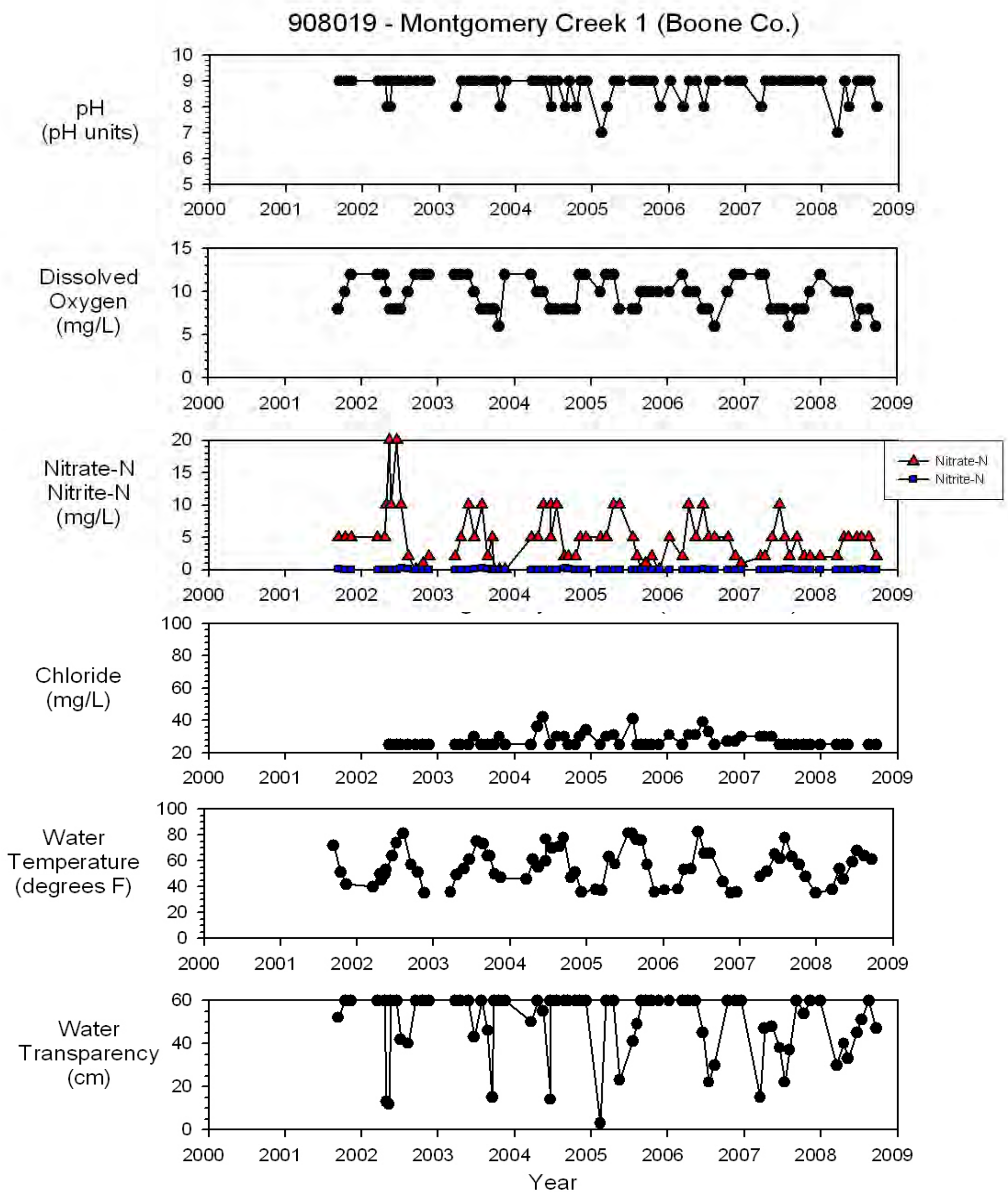
Factors that Affect Water Quality - Time of Day

- Temperature and Dissolved Oxygen vary depending on the time of day.



Factors that Affect Water Quality - Physical Influences

- Canopy Cover
- Shading
- Macrohabitats

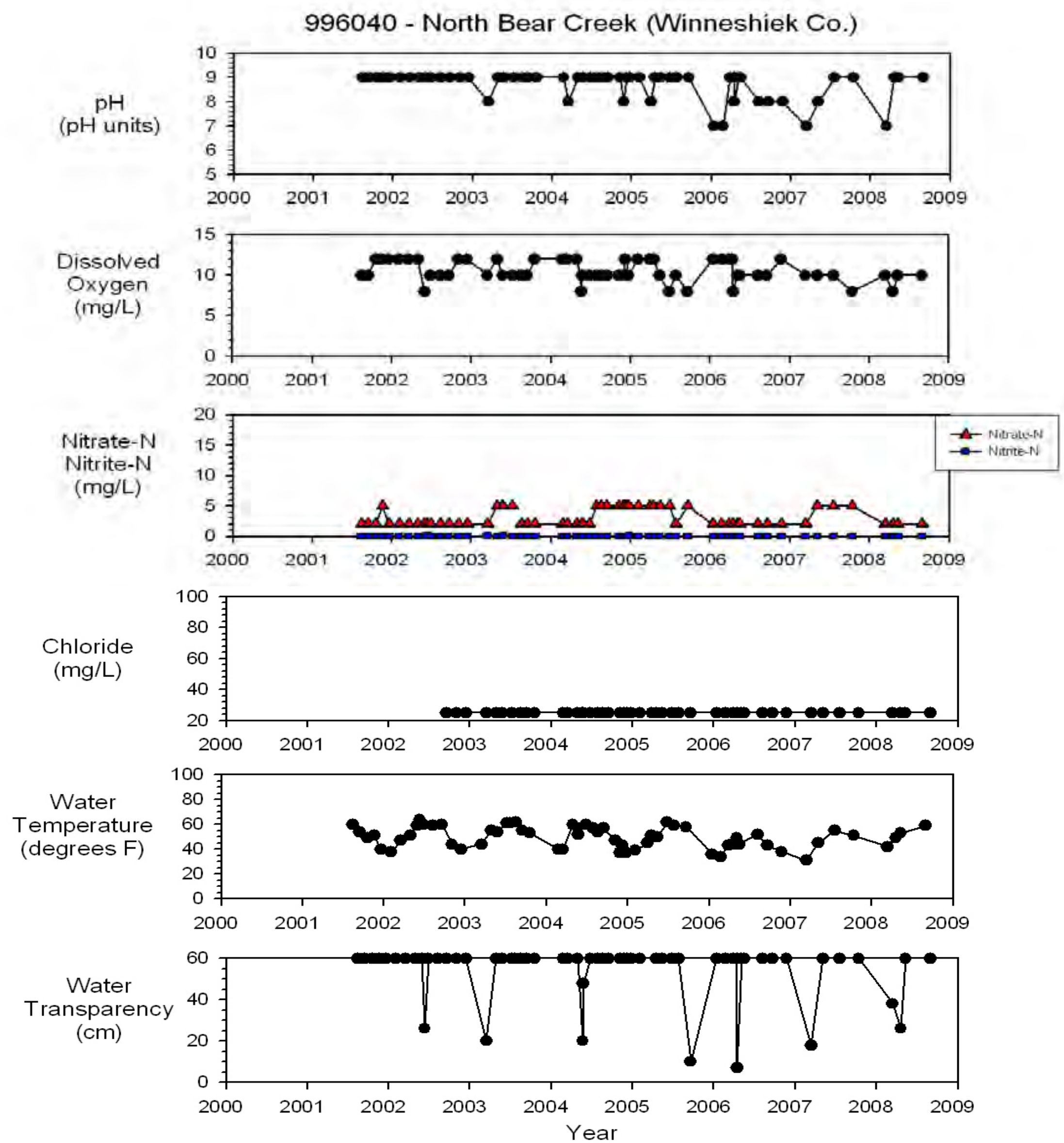


Long-term data sets are extremely valuable in determining what is normal for a site and how water quality at a site varies throughout the year.

Montgomery Creek is a warm water stream. Dissolved oxygen results meet the 5 mg/L standard. Data show a seasonal trend.

Nitrate-N shows a seasonal pattern, with higher values during the late spring/early summer months.

Chloride has been detected, but at low concentrations.



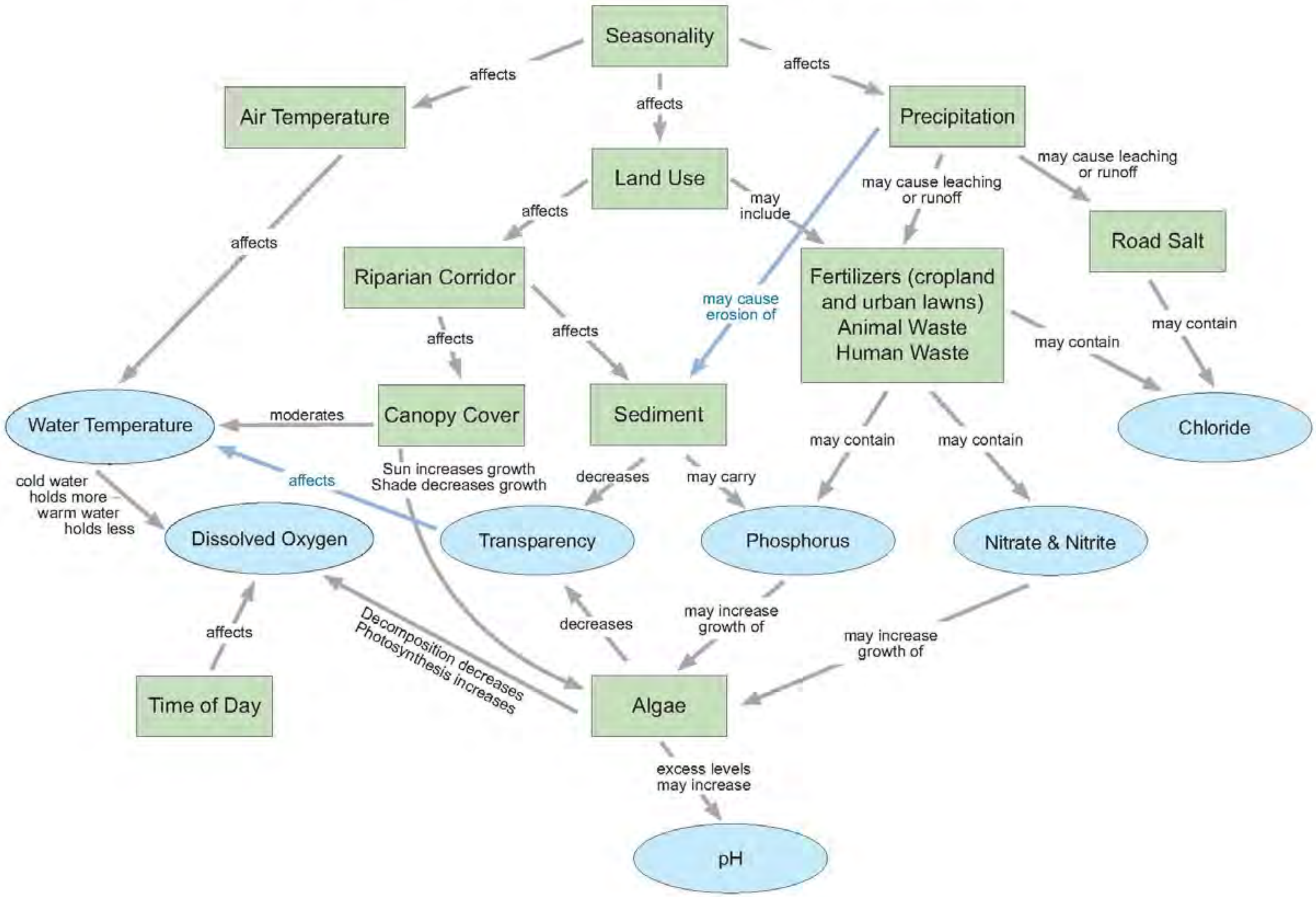
North Bear Creek is a coldwater stream which means a dissolved oxygen standard of 7 mg/L applies.

No occurrence of nitrite-N. Nitrate-N tends to be relatively low at 2 to 5 mg/L.

No obvious problem with chloride.

A closer look at temperature may be required for coldwater systems, as sustained temperatures outside of "normal" can damage the ecosystems.

Interrelationship among Chemical and Physical Parameters



Abnormal Sampling Results

How to differentiate between "normal" and "abnormal"

If you think your results are abnormal

- **RETEST** – double check results
  - And check expiration dates
- Ask someone else to double check results
- Document as thoroughly as possible
  - Data
  - Pictures
  - Observations
- Contact your local volunteer monitoring leader