2026 Envirothon Aquatics Training

Special Topic: Nonpoint Source Pollution

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Main Topics

- Nonpoint Source Pollution
  - What is it?
  - Best Management Practices
    - Wetlands
  - Ag vs. Urban
- Aquatic Life
  - Tolerant vs. Intolerant Species
  - Invasive vs. Native Species
  - Species Identification
- Monitoring
  - Tools & Parameters
  - Impairments
- Policy
  - Nebraska Government/Legislation
  - Current Issues in Nebraska
  - Nebraska Geography/Land Use
  - Nebraska Environmental History/Historical Figures

What is Aquatics?

Aquatic Ecology Learning Objectives for the NCF-Envirothon

"From vast oceans and tiny streams to irrigation systems and kitchen sinks, water touches every aspect of our lives. This essential compound makes life on Earth possible, and to continue to sustain this life, we must protect our water resources. Aquatic ecosystems are diverse, as are the creatures that inhabit them. All water on Earth, whether it is flowing in a river or deep underground in an aquifer, is connected through the water cycle. As a result, human impacts on our water resources can have far reaching effects, and careful consideration must be taken when making management decisions.

Just like the ecosystems we study, human society and culture are incredibly diverse. In the same way that biodiversity makes ecosystems more resilient, these differences in human perspective and experience make us stronger as a global community. Every person's story and relationship with the environment is important, and we must work together to ensure that everyone's stories are heard, including the historically marginalized and economically disadvantaged. We invite you to seek out stories from your own communities – to discover the unsung conservation heroes, to learn the histories that aren't typically taught in classrooms, to highlight local environmental issues, and to explore what types of natural resource conservation are occurring in your local community, state/province, and nation."

Students should be able to…

Provide an informed opinion about current issues in water quality and water resources.

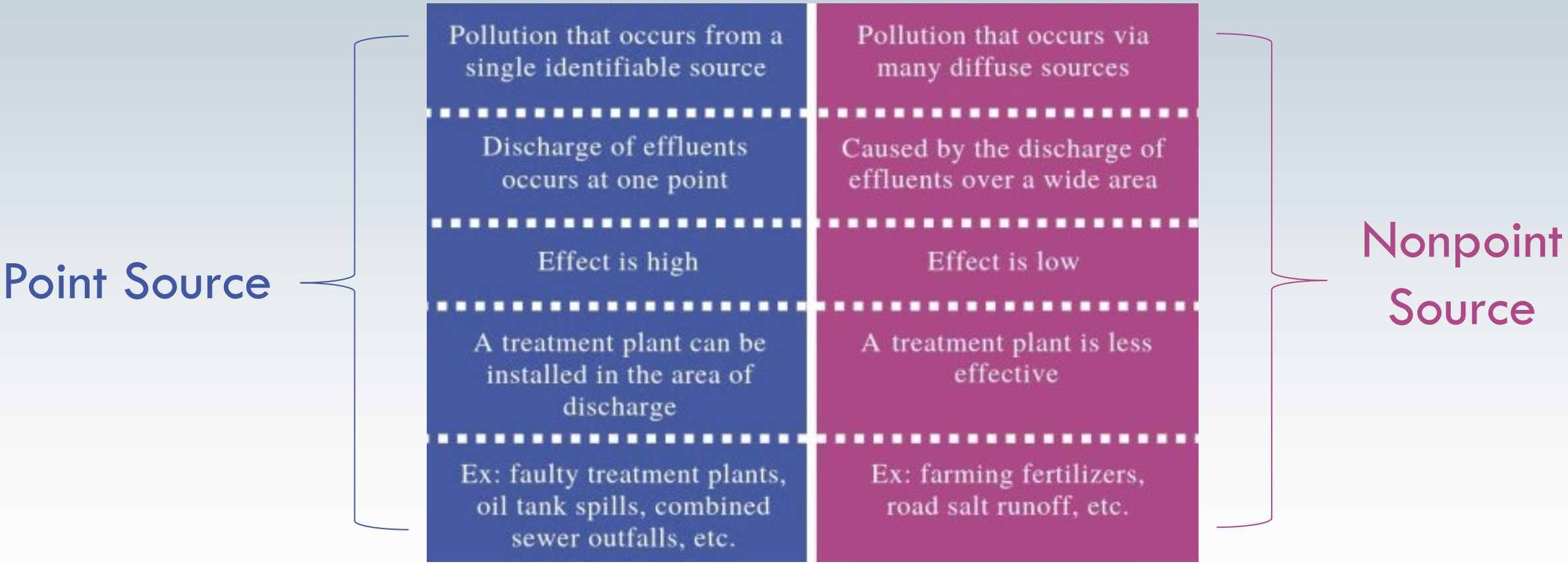
Think critically about solutions to current water quality and water resource issues.

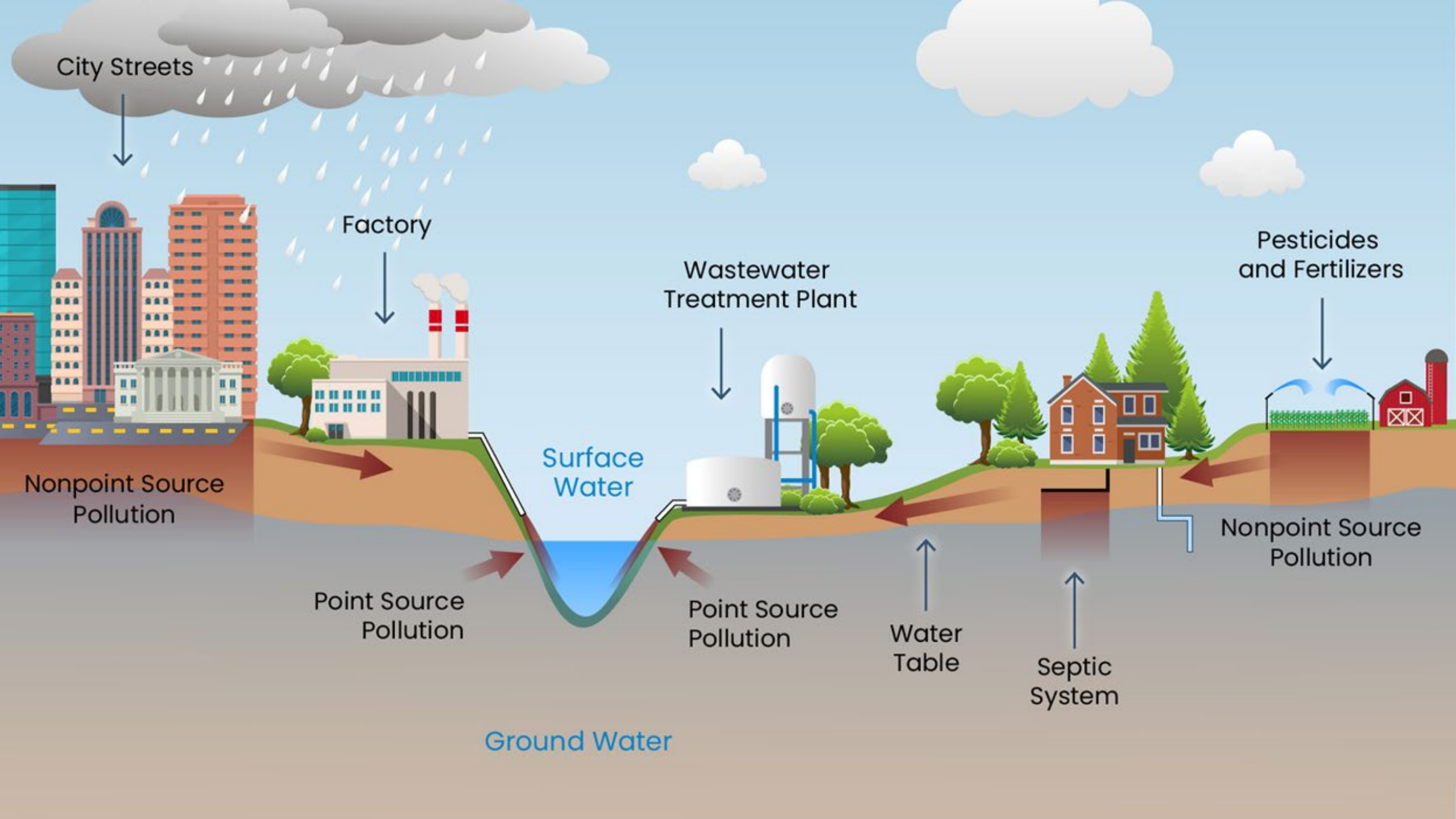
Work collaboratively in a team to synthesize and apply knowledge.

Make connections between the concepts in Aquatic Ecology and the subjects of Soils and Land Use, Forestry, Wildlife, and the Current Issue.

Nonpoint Source Pollution

What is it?




City Streets
Factory
Wastewater Treatment Plant
Pesticides and Fertilizers
Nonpoint Source Pollution
Surface Water
Point Source Pollution
Point Source Pollution
Water Table
Septic System
Nonpoint Source Pollution
Ground Water

Nonpoint Source Pollution

Best Management Practices (BMPs)

While research, monitoring, and assessment look at the larger environmental effects of nonpoint source pollution, taking measures to stop pollution before it begins is also essential for controlling the problem. If populations continue to grow, the chances for more nonpoint source pollutants such as nutrients, sediments, pesticides, and other toxic chemicals to enter waterbodies via runoff increases.

Even though the exact locations of nonpoint source pollution cannot be identified, scientists know that certain environments and operations produce a high volume of pollution. Experts have developed systems to reduce and even eliminate pollution from these places. These are known as **Best Management Practices (BMPs)**. They are area-dependent, as different forms of nonpoint source pollution need to be handled differently (Ag vs. Urban).

BEST MANAGEMENT PRACTICES in the SHELL CREEK WATERSHED

SEPTIC SYTEM UPGRADES

Provides for upgrading inadequate septic systems installed prior to January 1, 2000 to current design standards. Homeowners must apply for participation in the program.

EXCLUSION FENCING

Restricting cattle access to natural water sources to reduce E.coli contamination, sedimentation, erosion, etc. Often paired with the construction of an alternative water source.

TERRACES

A controlling practice that consist of an earthen embankment, channel, or a combined ridge and channel built across the slope of the field to intercept and store surface runoff, trapping sediments and pollutants.

GRASSED WATERWAYS

Vegetated channels through fields that provide a means for concentrated flows to drain from a field without causing erosion.

STREAMBANK STABILIZATION

Designed to prevent the loss of land or damage to land uses or facilities adjacent to the banks, maintain the flow capacity of the stream, reduce offsite or downstram effects of sedimentation resulting from bank erosion, and improve or enhance the stream corridor for fish and wildlife habitat, aesthetics, and/or recreation.

BUFFER STRIPS

Grass filter strips, or vegetated buffers, are planted between fields and surface waters to reduce sediment, organics, nutrients, pesticides, pathogens, and other contaminants in runoff water.

IRRIGATION MANAGEMENT

The process for determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner.

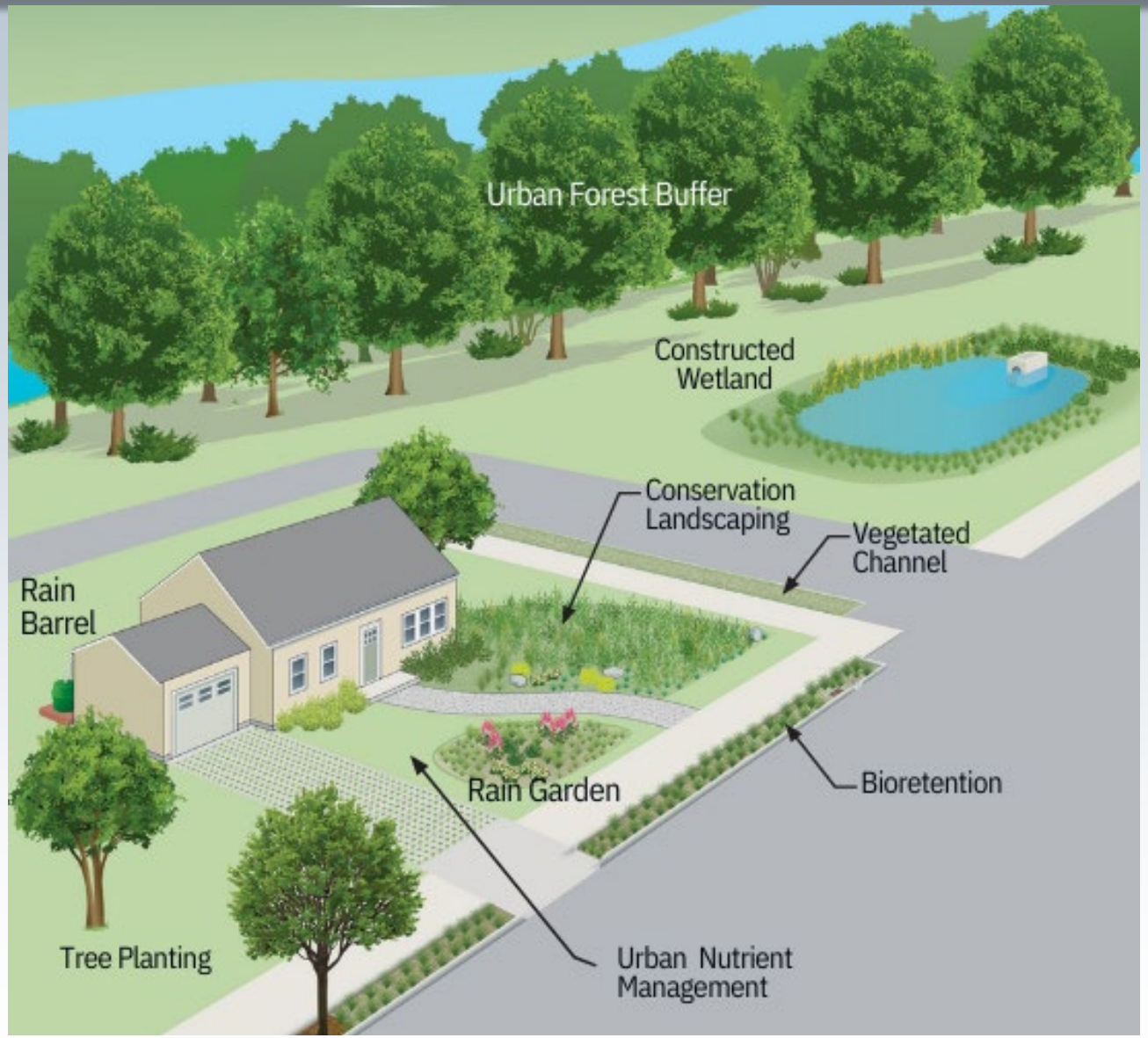
NO-TILL

The practice of planting a crop directly into the soil without tillage to prevent dislodging and mobilization of soil particles and attached agrichemicals in runoff water and reduce soil compaction, resulting in greater water infiltration and reduced runoff of water and pollutants.

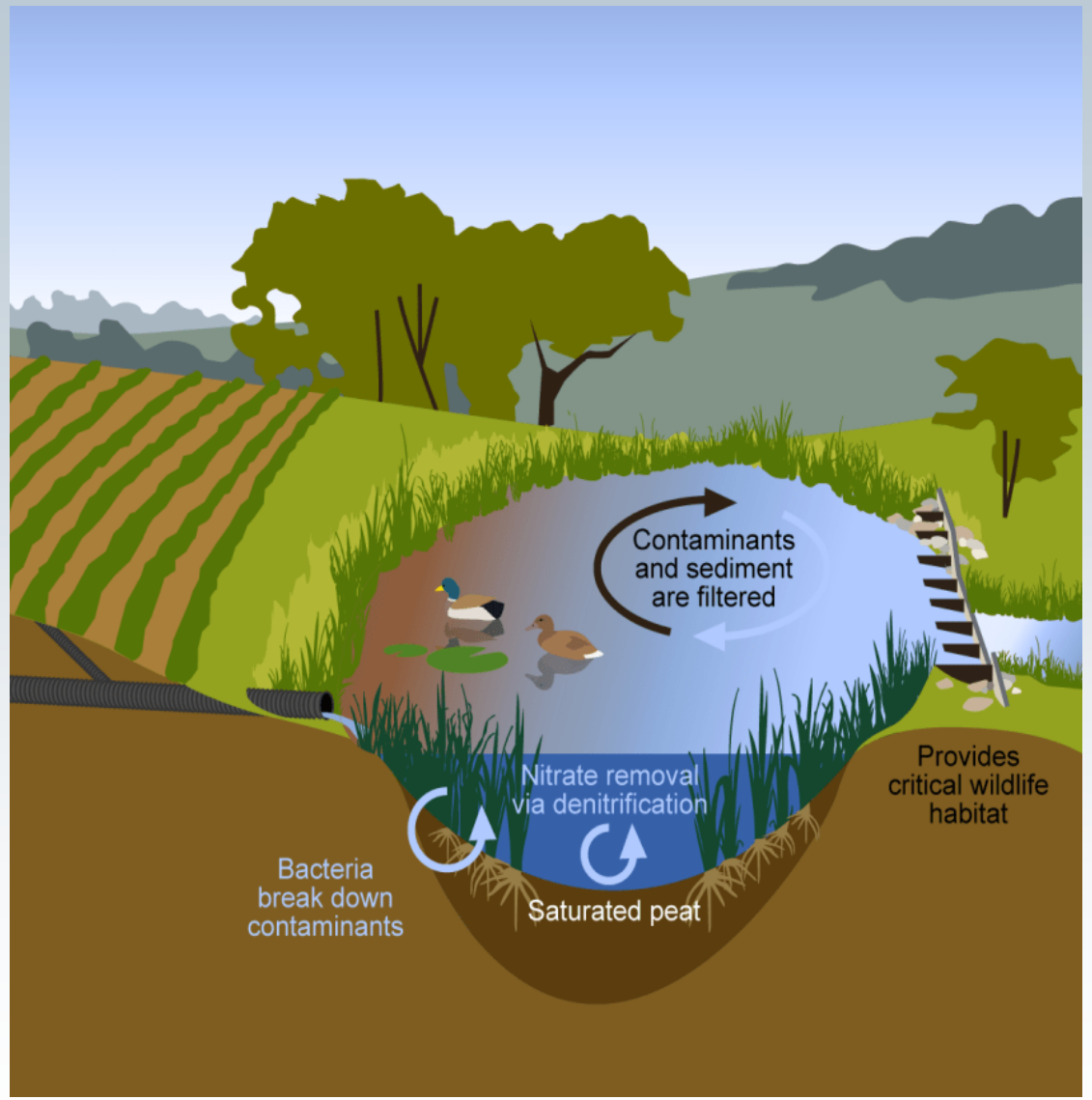
COVER CROPS

Designed to naturally absorb excess nutrients after crop harvest and to prevent erosion when the field would otherwise be fallow.

LOWER PLATTE NORTH Natural Resources District
NEBRASKA DEPT. OF ENVIRONMENT AND ENERGY


Urban Forest Buffer
Constructed Wetland
Conservation Landscaping
Vegetated Channel
Rain Barrel
Rain Garden
Bioretention
Tree Planting
Urban Nutrient Management

WETLANDS!!!



How Wetlands Filter Water

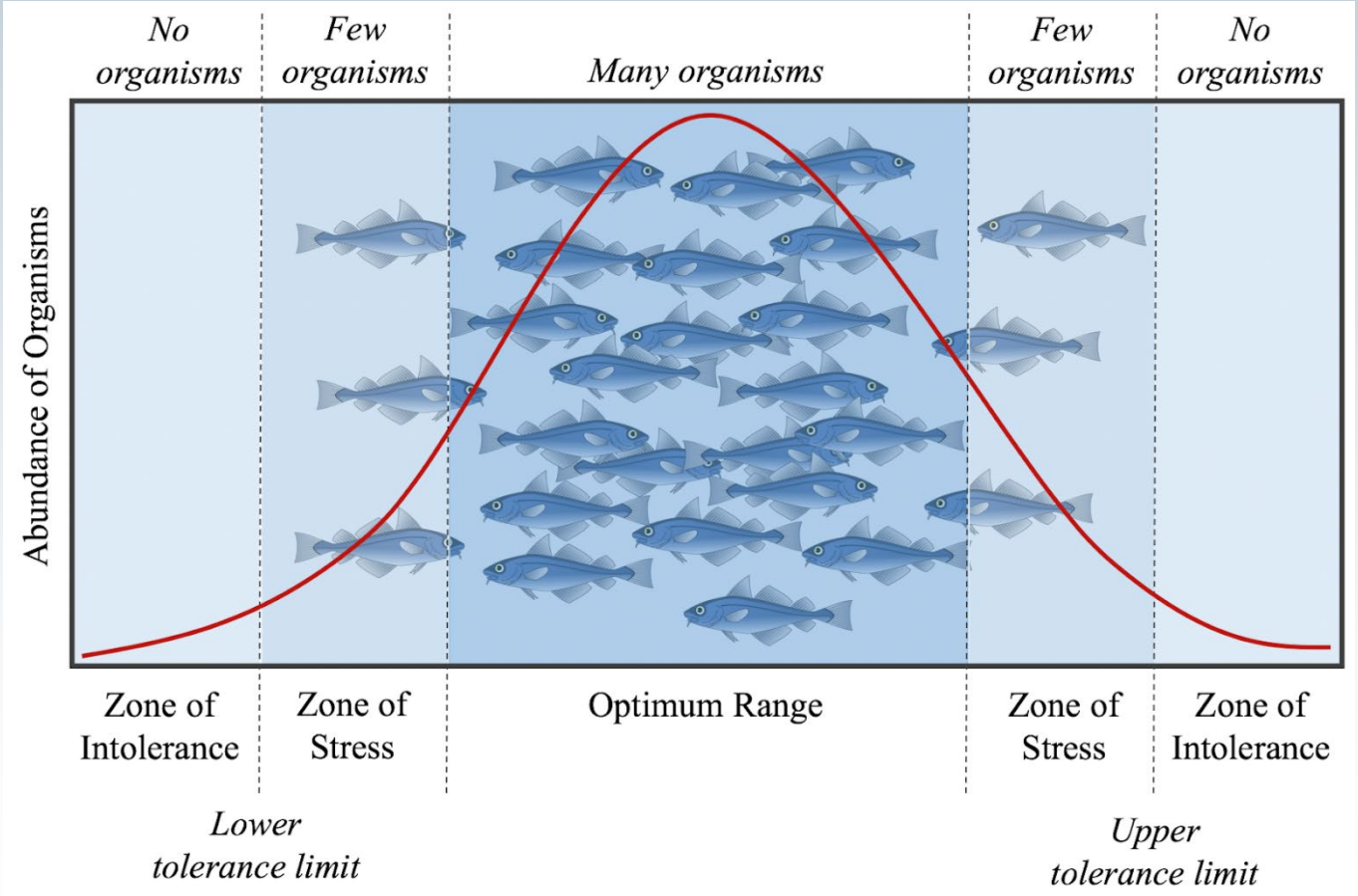
- **Slowing Water Flow:** As surface water or runoff enters a wetland, the water spreads out and slows down due to dense vegetation, allowing heavier particles to settle out.
- **Sediment Trapping:** The settled sediment, often carrying attached pollutants like heavy metals, gets physically trapped in the soil and roots, preventing it from moving downstream.
- **Nutrient Absorption:** Wetland plants absorb excess nutrients, such as nitrogen and phosphorus from fertilizers, using them as food, which prevents these nutrients from fueling algal growth.
- **Chemical Detoxification:** Wetland soils and microbes break down or bind other pollutants, including pesticides, oil, and grease, effectively removing them from the water.

Benefits of Wetland Filtration

- **Improved Water Quality:** Delivers cleaner water to downstream ecosystems and drinking water sources.
- **Flood Control:** Holds excess water and releases it slowly, reducing downstream flooding.
- **Groundwater Recharge:** Allows water to naturally infiltrate and replenish aquifers.
- **Cost Savings:** Offers a natural, cost-effective alternative to expensive water treatment facilities.

Aquatic Life

Tolerant vs. Intolerant Species



Group 1: Pollution Intolerant Species


Mayfly


Riffle Beetle

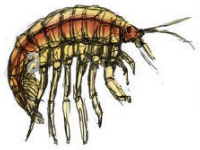

Caddisfly Larva

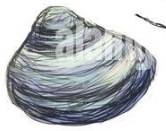

Stonefly


Right-Handed Snail

Group 2: Moderately Pollution Intolerant Species


Sowbug


Scud


Clam


Crayfish


Damselfly Larva

Group 3: Pollution Tolerant Species


Aquatic Worm


Midge Larva


Leech

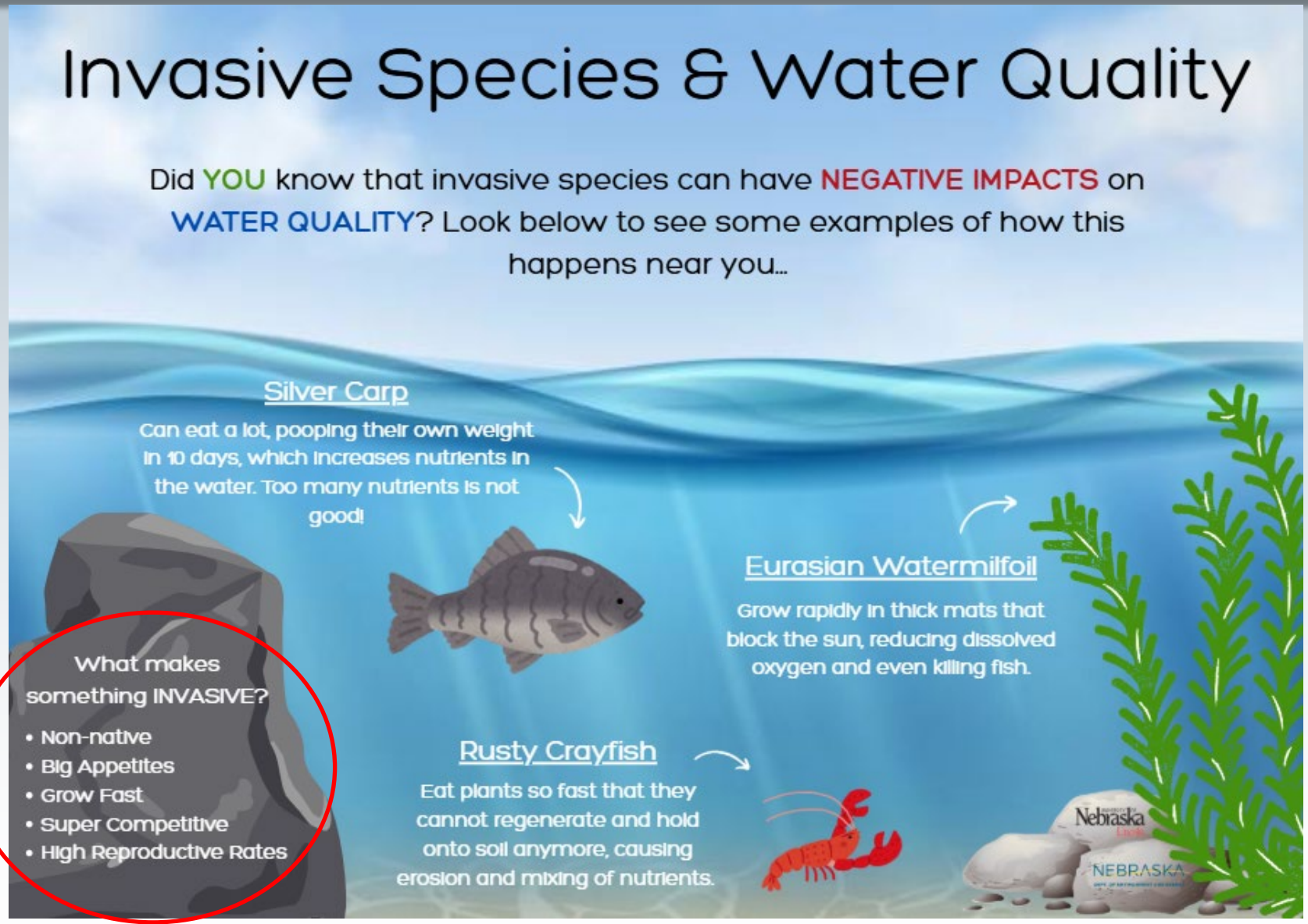

Black Fly Larva


Left-Handed Snail

Biotic Index	Water Quality	Pollution Level
> 10	**Good** Clean stream	Organic pollution unlikely
3 – 9	**Average** Some pollution	Moderate organic pollution likely
0 – 2	**Poor** Gross pollution	Substantial organic pollution

Aquatic Life

Invasive vs. Native Species



Aquatic Life

Species Identification

ID KEY
START HERE

Insect Orders

Does it have a portable case?
- YES → TRICHOPTERA (Other Caddisfly)
- NO → Does it have wings/wing pads?
  - YES → Does it have tail filaments?
    - YES → Does it have dorsal or lateral abdominal gills?
      - YES → EPHEMEROPTERA (Mayflies)
      - NO → How many tails are there?
        - 2 TAILS → PLECOPTERA (Stoneflies)
        - 3 TAILS → ODONATA (Damselflies)
    - NO → Does it have wing pads or wings?
      - WING PADS → Does it have piercing or needle-like mouthparts?
        - YES → HEMIPTERA (True Bugs)
        - NO → ODONATA (Dragonflies)
      - WINGS → Are the wings hard or leathery?
        - HARD → COLEOPTERA (Adult Beetles)
        - LEATHERY → HEMIPTERA (True Bugs)
  - NO → Are there observable tails or hooks at the end of the body?
    - YES, 2 TAILS → PLECOPTERA (Stoneflies)
    - YES, 1 TAIL OR SET OF HOOKS → Does it have lateral filaments?
      - YES → MEGALOPTERA (Dobsonflies/Fishflies)
      - NO → Does it have branched gills?
        - YES → TRICHOPTERA (Net-Spinning Caddisfly)
        - NO → Does it have lateral filaments?
          - NO → COLEOPTERA (Adult or Larval Beetles)
          - YES → On the underside, are there prolegs with tiny hooks?
            - YES → LEPIDOPTERA (Aquatic Caterpillars & Snout Moths)
            - NO → MEGALOPTERA (Alderflies)

Are there jointed legs?
- YES, 6 LEGS → Does it have a portable case? (see above)
- YES, 8 LEGS → CLASS ARACHNIDA (Water Mite)
- YES, 10 LEGS → CLASS MALACOSTRACA
  - ISOPODA (Sow Bug)
  - AMPHIPODA (Scud)
  - DECAPODA (Crayfish)
- NO → Does it have a shell?
  - YES → CLASS BIVALVIA or CLASS GASTROPODA
    - VENEROIDA (Clam)
    - BASOMMATOPHORA (Snail)
    - UNIONOIDA (Mussel)
    - NEOTAENIOGLOSSA (Sea Snail)
  - NO → Does it have a head or fleshy protrusions?
    - YES → DIPTERA (True Flies)
    - NO → How many segments are there?
      - 11-12 BODY SEGMENTS → DIPTERA (True Flies)
      - 0 OR MORE THAN 12 BODY SEGMENTS → CLASS PLATYHELMINTHES, HIRUDINEA, or OLIGOCHAETA
        - RHYNCHOBDELLIDA (Leech)

Non-Insect Orders & Classes

Water Quality Monitoring

Tools & Parameters

Name: Densiometer

Use: To measure forest overstory density, which is an indicator of plant life health around a waterbody. This is an important indicator of a waterbodies ability to support wildlife/provide sufficient habitat.

Water Quality Monitoring

Tools & Parameters

Name: Multiparameter Digital Water Quality Meter

Use: Collects data on five different water quality parameters…

- ***Turbidity*** = a measurement of how much sediment there is moving in the water colum. This increases during and after storm/flooding events.
- ***Dissolved Oxygen*** = must be present to support healthy aquatic life.
- ***Temperature*** = can inhibit aquatic life if it leans to one or more extreme.
- ***Conductivity*** = a measurement of how much salt is in the water and how easily electricity can run through it.
- ***Ph*** = shows acidity of a waterbody.

Water Quality Monitoring

Tools & Parameters

Name: Wading Rod

Use: measures the deepest part of a wadable (walkable) waterbody, known as a *thalweg*. This is an indicator of sedimentation and channelization.

Water Quality Monitoring

Tools & Parameters

Water Quality Monitoring

Impairments

Waterbody ID	Waterbody Name	Recreation	Aquatic Life	Water Supply			Aesthetics	Overall	2022 IR	Impairments (Causes)	Comments/Actions
				Public Drinking	Agricultural	Industrial					
BB1-11900	Cub Creek		I		S		S	I	5	Aquatic Life (May-June Atrazine)	Aquatic Community Assessment completed
BB1-12000	Soap Creek		I		S		S	S	5	Aquatic Life - Impaired Aquatic Community (Unknown), (May-June Atrazine)	Aquatic Community Assessment completed
BB1-20000	Big Blue River	I	S		S		S	I	4a	Recreation (*E. coli*)	Atrazine and E. coli TMDL approved 12/13, Fish Consumption Assessment completed
BB1-20100	Clatonia Creek		S		S		NA	S	2		
BB2-10000	Turkey Creek	I	I		S		S	I	5	Recreation (*E. coli*), Aquatic Life - Impaired Aquatic Community (Unknown), (May-June Atrazine)	Atrazine and E. coli TMDL approved 12/13, Aquatic Community Assessment completed, Fish Consumption Assessment completed
BB2-10100	Swan Creek		I		S		S	S	5	Aquatic Life - Impaired Aquatic Community (Unknown)	Aquatic Community Assessment completed
BB2-10110	South Fork Swan Creek		S		NA		S	S	2		Aquatic Community Assessment completed
BB2-10120	North Fork Swan Creek		NA		NA		NA	NA	3		
BB2-20000	Turkey Creek	I	I		S		S	I	4a	Recreation (*E. coli*), Aquatic Life (May-June Atrazine)	Atrazine and E. coli TMDL approved 12/13, Aquatic Community Assessment completed
BB2-20100	Spring Creek		I		S		NA	I	5	Aquatic Life (May-June Atrazine)	
BB2-30000	Turkey Creek		S		NA		S	S	2		Aquatic Community Assessment completed
BB2-40000	Turkey Creek		S		NA		S	S	2		Aquatic Community Assessment completed
BB3-10000	West Fork Big Blue River	I	I		S		S	I	5	Recreation (E. coli), Aquatic Life - Impaired Aquatic Community (Unknown), (May-June Atrazine)	Atrazine and E. coli TMDL approved 12/13, Aquatic Community Assessment completed, Fish Consumption Assessment completed

A waterbody becomes impaired when any monitoring parameter (biological & chemical) does not meet the value is needs to be in order to support proper functions.

Example: If a waterbody is impaired for E.coli, that means that the E.coli levels are higher than they should be. This can cause excess growth of toxic algae and invasive species, effectively impairing the proper functions of the waterbody.

All impairments are listed in the Integrated Report put out by DWEE every 2 years.

Understand the role that local, state and federal agencies have in:

- Implementing and creating Policy on:
  - Understand and development of conservation practices
  - Research
  - Collection and storage of natural resources data
  - Providing education and technical support
  - Developing and enforcing regulations

What U.S. Government agency collects and evaluates surface water, groundwater and groundwater quality data in order to aid in defining hydrologic systems?

A. The U.S. Geological Survey
B. The U.S. Army Corps of Engineers
C. The Environmental Protection Agency
D. The Bureau of Reclamation

Describe Nebraska geography and land use

- Policies on land ownership and water rights
  - Crop types and irrigation use
- Agrichemical use
  - Its effects on crop production and the environment
- Environmental problems and opportunities in Nebraska
- Place and names of major rivers, lakes, geographic regions
  - Describe the function of specific rivers and lakes
  - Along with their historical significance
- Know the history of natural resources use in Nebraska

Nebraska Sandhill streams are fed by the High Plains Aquifer and baseflow from water infiltrating the sandy soil. These streams are most noted for:

A. High levels of erosion
B. Intensive crop development throughout the basin
C. The high levels of overland runoff contributing to the system
D. Its relatively steady level of flow

Show up-to-date knowledge on the following:

- Current land and water use laws and their effects
- Historical significance of natural resources law
  - May include current bills
- Historical figures in conservation and natural resources
- Plants and animals protected by The Endangered Species Act
- Current policies in regulation and regulatory issues
  - Water rights issues
  - Protection of wetlands
  - Issues related to multi-state compacts

Which of the following factors is generally not used in defining a wetland?

A. Wildlife
B. Soils
C. Vegetation
D. Hydrology

Useful Study Exercises

- Contact a representative from your local NRD:
  - Discuss policies and their effects
    - On natural resources management and usage
    - Discuss local environmental problems
    - Policies used to control and/or correct these problems
  - Check out each of the Natural Resources District webpages
    - National Association of Resource Districts
      - http://www.nrdnet.org
- Discuss the role of the local, state, and federal government
  - Regarding protecting natural resources
  - How their rolls may differ

More Useful Study Exercises

- Read newspaper and magazine articles
  - On land use and policy issues
    - Magazines such as:
      - Nebraska Farmer
      - Nebraskaland
- Also check out websites/newsletters/reports published by:
  - Various government agencies
    - Describing their programs
    - Land use issues
    - Current projects
    - Policies
    - Natural resource legislation

Federal Agencies

- Bureau of Land Management (BLM)
  - http://www.blm.gov
  - BLM Facts page
    - http://www.blm.gov/nhp/facts/index.htm
- Bureau of Reclamation (BOR)
  - http://www.usbr.gov
  - BOR Projects & Facilities page
    - https://www.usbr.gov/projects/facilities.php?state=Nebraska
- Environmental Protection Agency (EPA)
  - http://www.epa.gov
- Nebraska Natural Resources Conservation Service (NRCS)
  - http://www.ne.nrcs.usda.gov
- United States Army Corps of Engineers (COE)
  - http://www.usace.army.mil
- United States Geological Survey (USGS)
  - http://www.usgs.gov

State Agencies

- Nebraska Department of Agriculture
  - http://www.agr.state.ne.us
- Nebraska Department of Water, Energy, and Environment (DWEE)
  - https://dwee.nebraska.gov/
- Nebraska Game and Parks Commission (NGPC)
  - http://outdoornebraska.gov/
- NE Natural Resources Commission/Water Task Force
  - https://nrc.nebraska.gov/water-sustainability-fund-0
- University of Nebraska:
  - Conservation & Survey Division (CSD)
    - http://snr.unl.edu/csd
- Nebraska Water Center
  - https://watercenter.unl.edu

Thank you!

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