Minnesota River

A Water Quality Investigation

Lesson 1

The Minnesota River Watershed

Guiding Question

How can we describe the movement of water into the Minnesota River?

Learning Goal

Describe the ways that water and pollution moves through the Minnesota River Watershed.

Agenda

1. Unit Overview-Problem Introduction
2. Modeling a Watershed
3. Watershed Definition
4. Finding Minnesota River's watersheds

Do you go to the a lake or river with your family or friends?

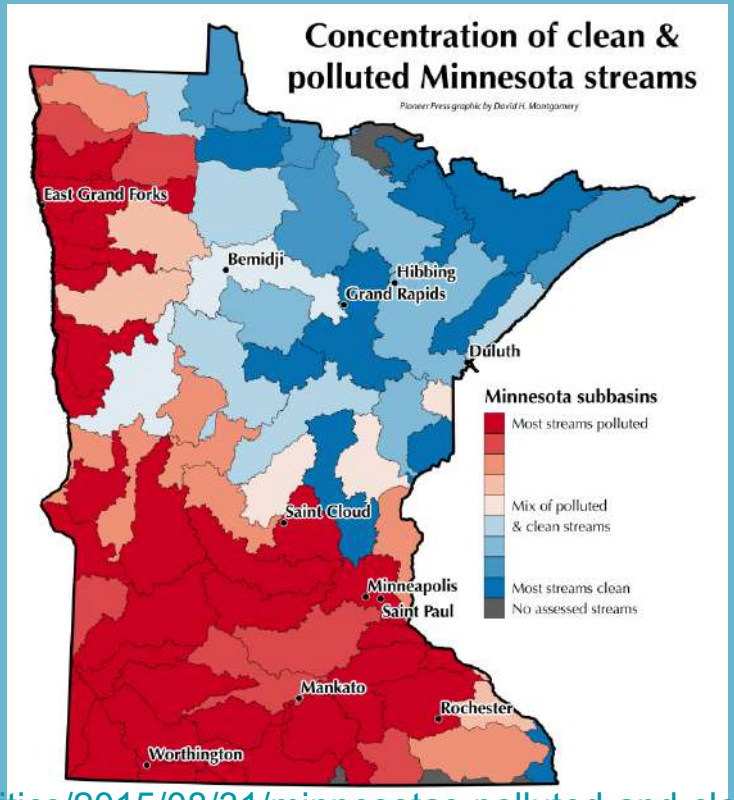
What do you do at the lake or river?

Riverside Chat #1

Native Americans, First to use the River

Taken from : https://mrbdc.mnsu.edu/mnbasin/interviews/interviews.html on June 16th, 2018

Is it safe to swim, boat, and fish in Minnesota's Lakes and Rivers?



Taken from http://blogs.twincities.com/politics/2015/08/31/minnesotas-polluted-and-clean-waters-mapped/

How do we know if the Minnesota River is polluted and what can we do if it is?

Where do you think the water in our lakes and rivers comes from?

How does water get in the lakes, rivers, and streams?

How do our rivers get polluted?

Modeling The Flow of Water

Source of water for lakes and streams

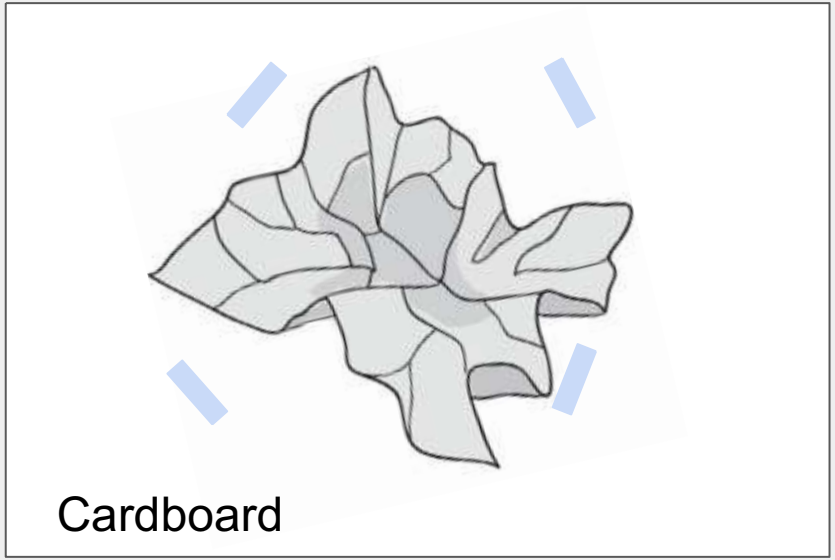
Group Supplies

-1 large piece of paper
-1 large piece of cardboard
-4 felt tip markers (2 are blue)
-Transparent tape
-Spray bottle with water

Constructing your Model

In your group….

1. Crumple up your large piece of paper. The looser the better.
2. Smooth it back out, leave some wrinkles in the paper. This is your landscape.
3. Use the transparent tape to tape down corners of the paper on the cardboard.
4. Using your non-blue marker color the ridges (High area) of your land.



Taken from
https://omsi.edu/sites/all/FTP/files/expeditionnw/4.E.1.Crumple.pdf

Modeling The Flow of Water

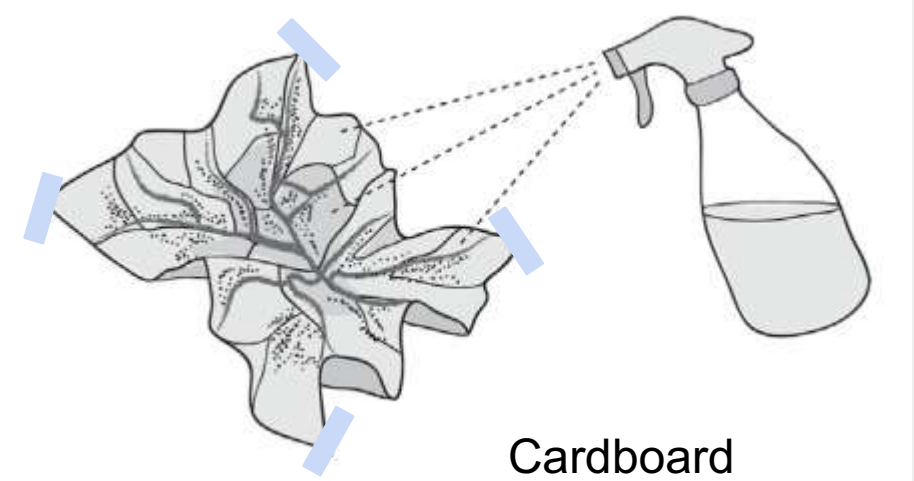
Predictions

You are going to rain on your paper landscape with the spray bottle. Before it rains make some predictions and record them in your science notebook.

1. Using the BLUE marker draw on your landscape where you think the water will flow.
2. In your notebook draw your landscape showing where your ridges are.
3. In your Notebook answer these questions
    a. Where do you think the water flow when you spray the bottle?
    b. Are there any places in your model where you think the water will not flow?

Test Your Prediction

1. Get a spray bottle of water.
2. Lightly spray water on top of the paper.
3. Watch as the water slides down the sides of your ridges.
4. Set off to the side to dry.



Taken from
https://omsi.edu/sites/all/FTP/files/expeditionnw/4.E.1.Crumple.pdf

Modeling The Flow of Water

Results

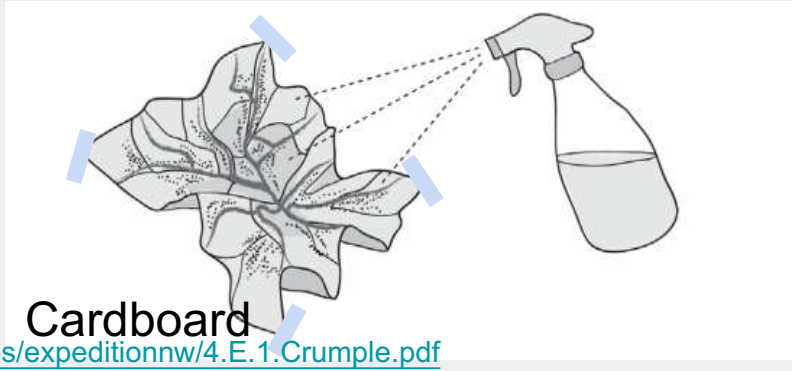
1. Record your observations of your model.
2. What direction does water flow in your model, what is your evidence?
3. Look at the predictions you made, where your predictions correct? Why/Why Not?
4. How can we use this model to show how how pollutants may get into Minnesota's Rivers and Lakes?

Modeling The Flow of Water

Parts of the Model

Draw a picture your model, including the spray bottle. Label the following

1. Rain
2. Direction of water flow as an arrow
3. Ridge/Height of Land
4. Rivers
5. Lakes



Taken from https://omsi.edu/sites/all/FTP/files/expeditionnw/4.E.1.Crumple.pdf

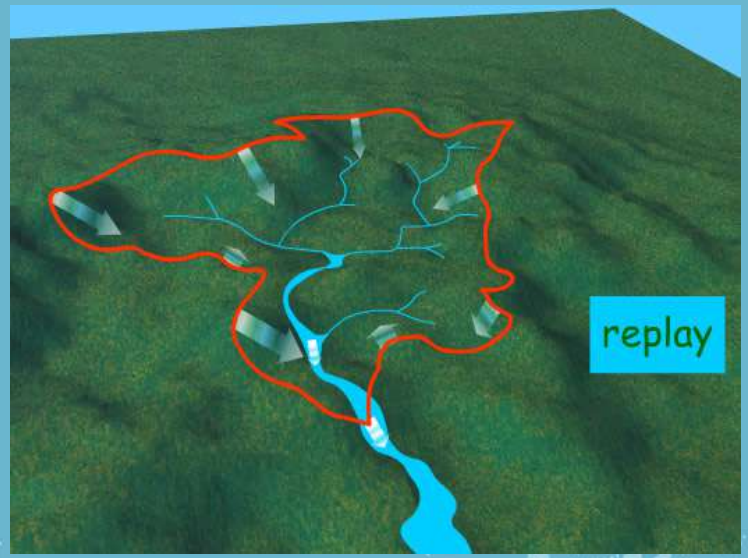
What is a Watershed?

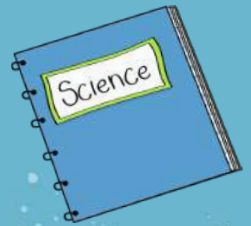
Watershed

Vocabulary

A ridge of high land dividing two areas that are drained by different river systems. On one side of a watershed, rivers and streams flow in one direction; on the other side they flow in another direction. Also, the area drained by a water system.

-Dictionary.com



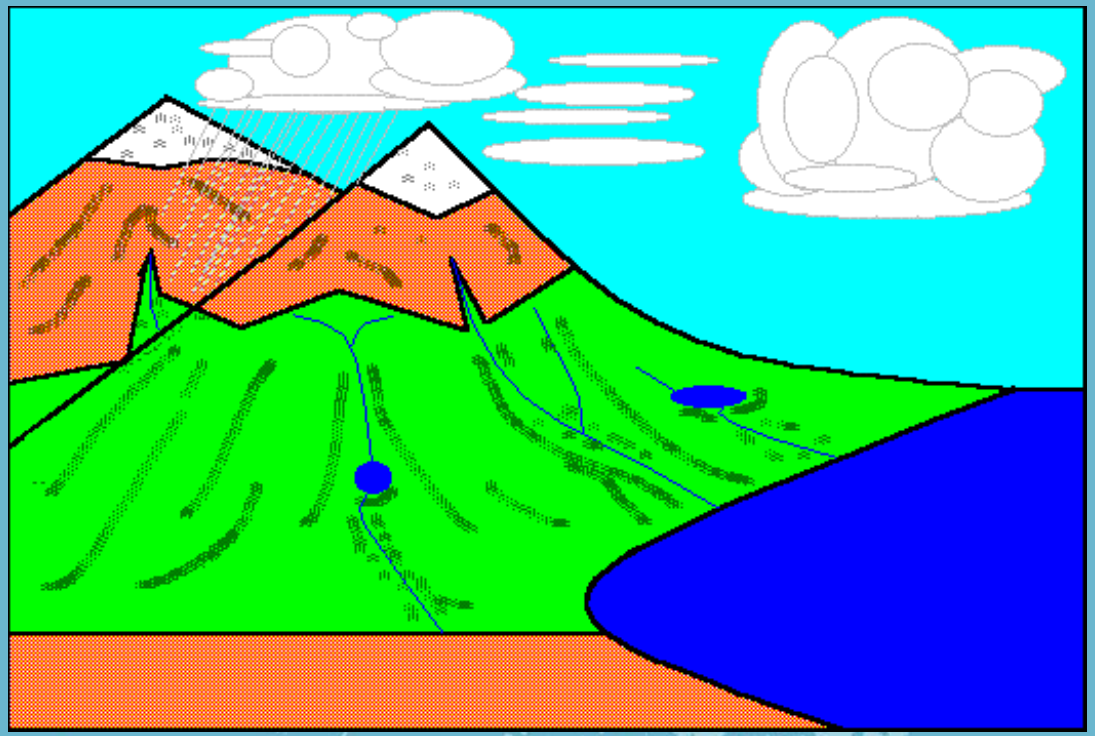


Taken from: Taken from: http://techalive.mtu.edu/meec/module01/Watershed.html on June 8, 2018

Runoff

Vocabulary

Water the moves across the surface of the Earth. Water does not evaporate or infiltrate.



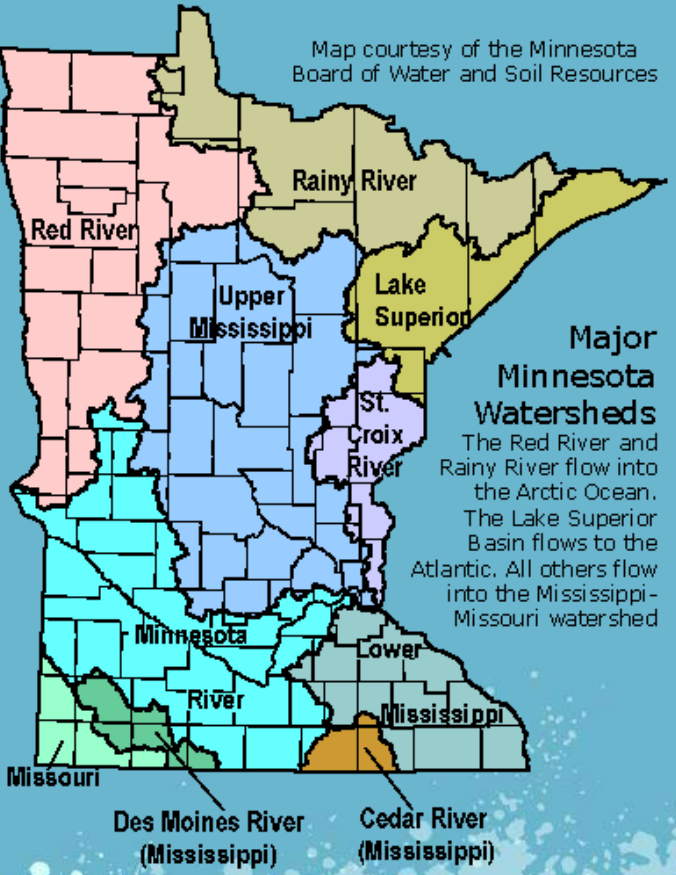
Animation by: Bramer

Focus Question

How can we describe the movement of water into the Minnesota River?

Taken from: http://blogs.twincities.com/politics/files/2015/06/river-alone.jpg on June 8, 2018

Watershed of Minnesota



mage taken from: https://www.maswcd.org/Youth_Education/StudyGuides/WatersStudyGuide.htm on June 16, 2018

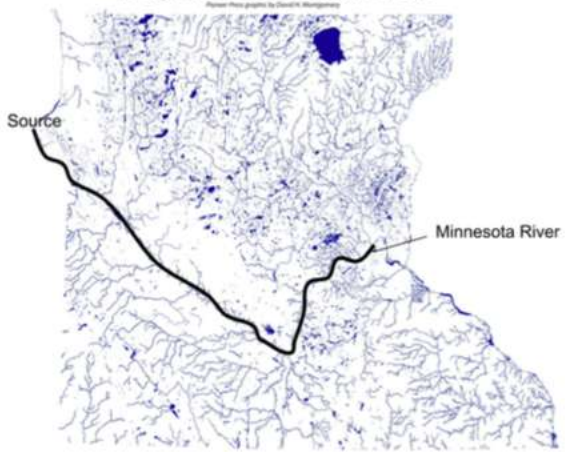
Identifying Watersheds

Minnesota River Watersheds

The map below shows all the rivers and lakes in Minnesota. Use the map to find the watersheds that flow into the Minnesota river basin. The Minnesota river is show as the darkest line running.

1. Draw the watersheds on the Every lake & river in Minnesota map.
   a. Find the Minnesota river (the dark thick line on the map)
   b. Find a river that flows into the Minnesota River and trace it the source of all the water for that river. Circle all the sources.
   c. Repeat for every river flowing into the Minnesota river.
   d. Color each circled watershed a different color.
   e. Add arrows to show what direction the water is flowing.

Every lake & river in Minnesota



2. What did you look at (patterns, shapes, lines) on the map to help you draw the watersheds?

3. Are there any areas where you were not sure where to draw the line? What more information do you wish you had?

Reflection and Analysis

Directions: Use the official map of Minnesota River's watershed and the watershed map you made to answer the questions below.

Official Watersheds of the Minnesota River

4. How well does the watersheds you made match the Official watershed of the Minnesota River?

5. It what ways are the watershed your drew the same as the official watersheds?

6. It what ways are the watershed you drew different from the official watersheds

7. Why do you think the watershed you made are different from the the Official Watersheds?

8. Do you agree with the the official watersheds map? Why or Why Not?

Minnesota River Watersheds

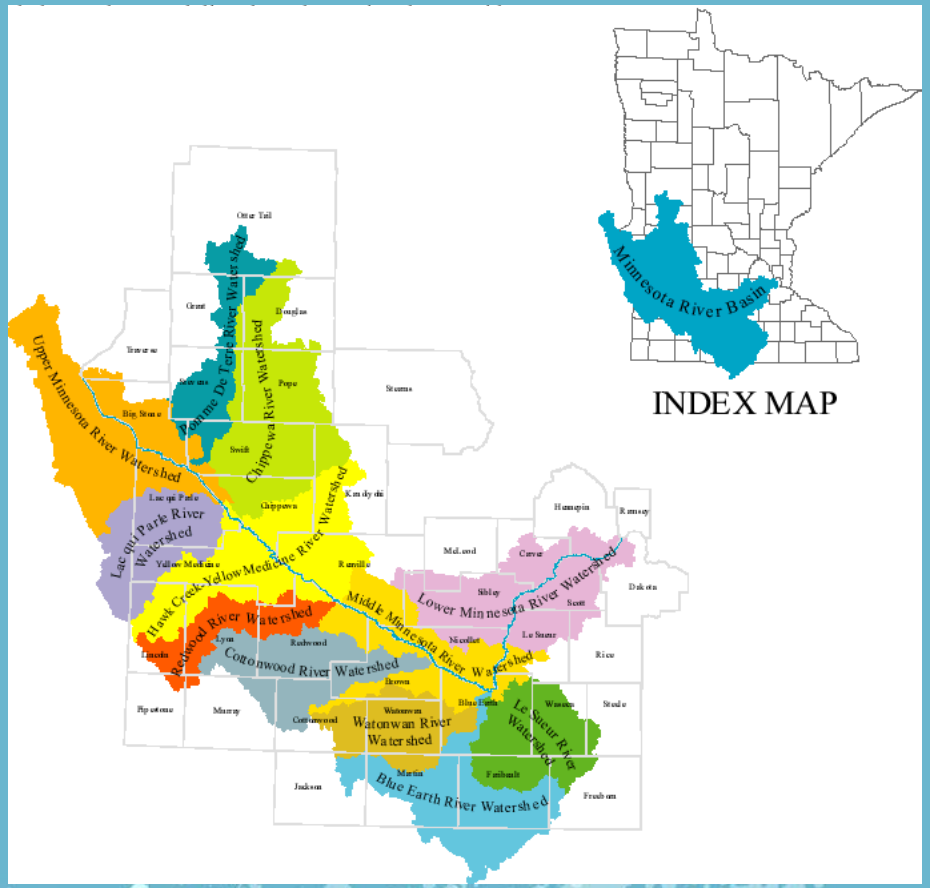
The map below shows all the rivers and lakes in Southern Minnesota. Use the map to find the watersheds that flow into the Minnesota river basin. The Minnesota river is show as the darkest line.

1. Draw the watersheds on the Every lake & river in Minnesota map.
   b. Find the Minnesota river (the dark thick line on the map)
   c. Find a river that flows into the Minnesota River and trace it the source of all the water for that river. Circle all the sources.
   d. Repeat for every river flowing into the Minnesota river.
   e. Color each circled watershed a different color.
   f. Add arrows to show what direction the water is flowing.

Every lake & river in Minnesota

Modified from http://blogs.twincities.com/politics/files/2015/06/river-alone.jpg

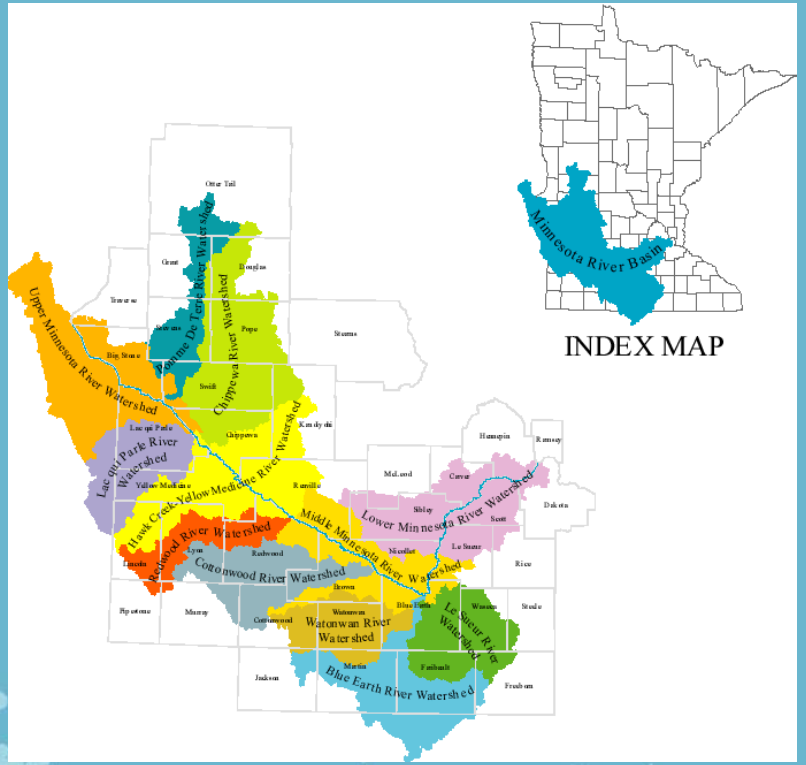
Minnesota River Watershed Map



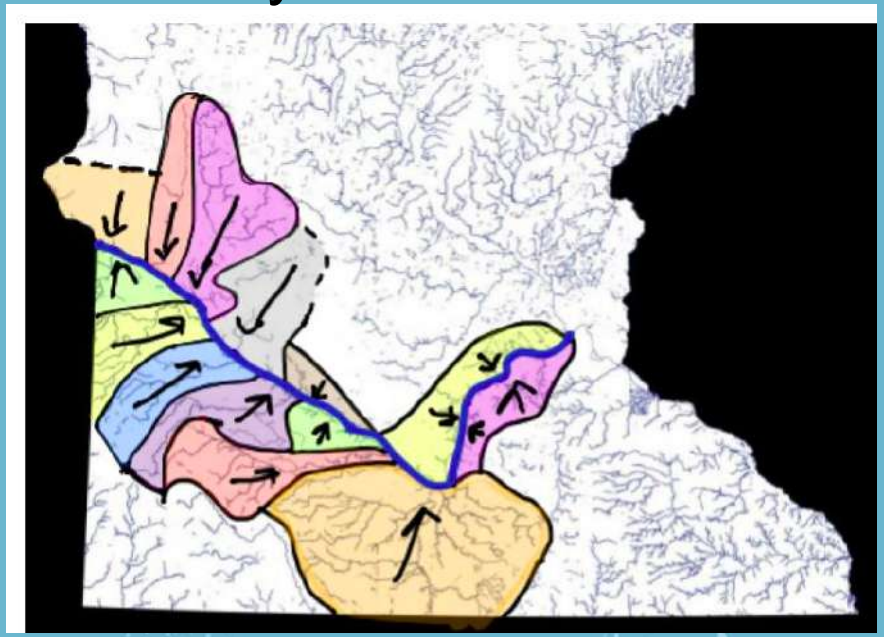
https://mrbdc.mnsu.edu/mrbdc-data-inventory

Final Reflection

Official Watersheds



My Watersheds



https://mrbdc.mnsu.edu/mrbdc-data-inventory

Riverside Chat #2

Many rivers come together

Taken from : https://mrbdc.mnsu.edu/mnbasin/interviews/interviews.html on June 16th, 2018

Guiding Question

How can we describe the movement of water into the Minnesota River?

How do we know if the Minnesota River is polluted and what can we do if it is?

Lesson 2

Monitoring the Watershed

Guiding Question

How can we monitor the Minnesota River for pollution?

Learning Goal

Design a monitoring program for the Minnesota River Watershed

Agenda

1. Water pollutants in the Minnesota River
2. How to measure phosphate and nitrates in water
3. Design a monitoring procedure for the Minnesota river

How do we know if the Minnesota River is polluted and what can we do if it is?

Nutrient Pollution

What is it?

Nutrient Pollution Test Lab

Nutrient Pollution Testing Lab

Why: Nutrient Pollution is a major concern in the Minnesota River Basin. You will learn the procedure used to monitor water quality in the Minnesota River Watersheds. You will use what you learned in this lab to develop a plan to monitor the water quality for the Minnesota River and its Watersheds for nutrient pollution.

Investigation Question: Which water type has the highest levels of nutrient pollution?

Safety

- Where gloves when handling all water samples and test tablets
- Where safety goggles
- Wash your hands in hot, soapy water at end of lab.
- Inform your teacher of any spills

Supplies

1. 4 different water samples: Tap water, clear stream water, lake/pond water, water with fertilizer in beakers
2. Color Matching Card from LaMotte
3. Directions for Phosphate and Nitrate Tests
4. 4 Test tubes
5. 4 Nitrate tablets
6. 4 Phosphate tablets
7. Bottle of deionized water

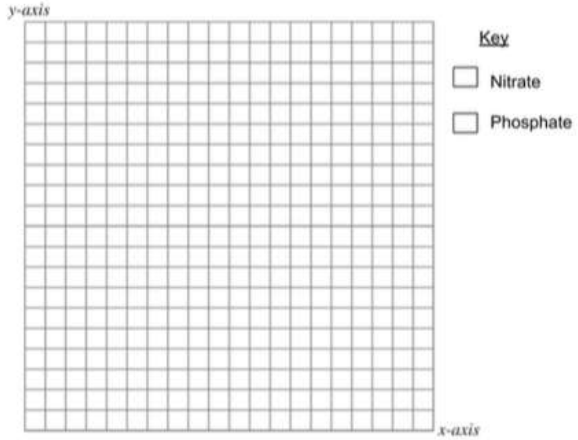
Procedure

1. Your group will have 30 minutes to complete 2 tests for each of the 4 water samples. This is 8 tests in all and each test takes 5-10 minutes. Divide the data table up so that each test can be done in the 30 minutes you have to complete the lab.
2. SAFETY: Put on Gloves and Safety goggles
3. Make observations of your water sample
4. Complete your assigned test using the instruction cards found at your table
5. Rinse the test tubes between tests with the deionized water.
6. Clean up the table, dispose of your gloves, and wash your hands
7. Share your data with the group to complete the data table

Data

Water Sample	Observations	Nitrate (ppm)	Phosphate (ppm)
Tap			
Pond/Lake			
Stream			
Fertilizer			

Graph Your Data



Explanation

Claim (Using your data table, answer the investigation question)

Evidence (Provide numbers with units as well as observations from your data table or graph that support your claim)

Reasoning (Why did you get the results you did? Use the key words: fertilizer, nutrients, phosphate, runoff, nitrate)

Nutrient Pollution Test Lab

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Investigation Question: Which water type has the highest levels of nutrient pollution?

Testing for Nitrates

Water quality Sampling

Directions

1) Put on Gloves
2) Fill up a container with water from the testing site
3) Fill up a test tube to the 5 ml mark with your testing water
4) Get the NITRATE test tablet and put into tube, cap the tube
5) turn the tube upside down and back up until the table dissolves.
6) Set a 5 min Timer
7) Match the color of the test tube to the card.

Testing for Phosphates

Water quality Sampling

Directions

1) Put on Gloves
2) Fill up a container with water from the testing site
3) Fill up a test tube to the 10 ml mark with your testing water
4) Get the PHOSPHATE test tablet and put into tube, cap the tube
5) Turn the tube upside down and back up until the table dissolves.
6) Set a 5 min Timer
7) Match the color of the test tube to the card.

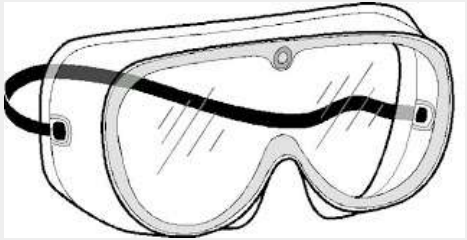
What is ppm?

Units for water quality tests

Nutrient Pollution Test Lab

Safety

- Where gloves when handling all water samples and test tablets
- Where safety goggles
- Wash your hands in hot, soapy water at end of lab.
- Inform your teacher of any spills



Nutrient Pollution Test Lab

Supplies

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6. 4 Phosphate tablets
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Nutrient Pollution Test Lab

Make a Plan

Your group will have 30 minutes to complete 2 tests for each of the 4 water samples. This is 8 tests in all and each test takes 5-10 minutes. Divide the data table up so that each test can be done in the 30 minutes you have to complete the lab.

Data

Water Sample	Observations	Nitrate (ppm)	Phosphate (ppm)
Tap			
Pond/Lake			
Stream			
Fertilizer			

Nutrient Pollution Test Lab

Collect Your Data

You have 30-Min

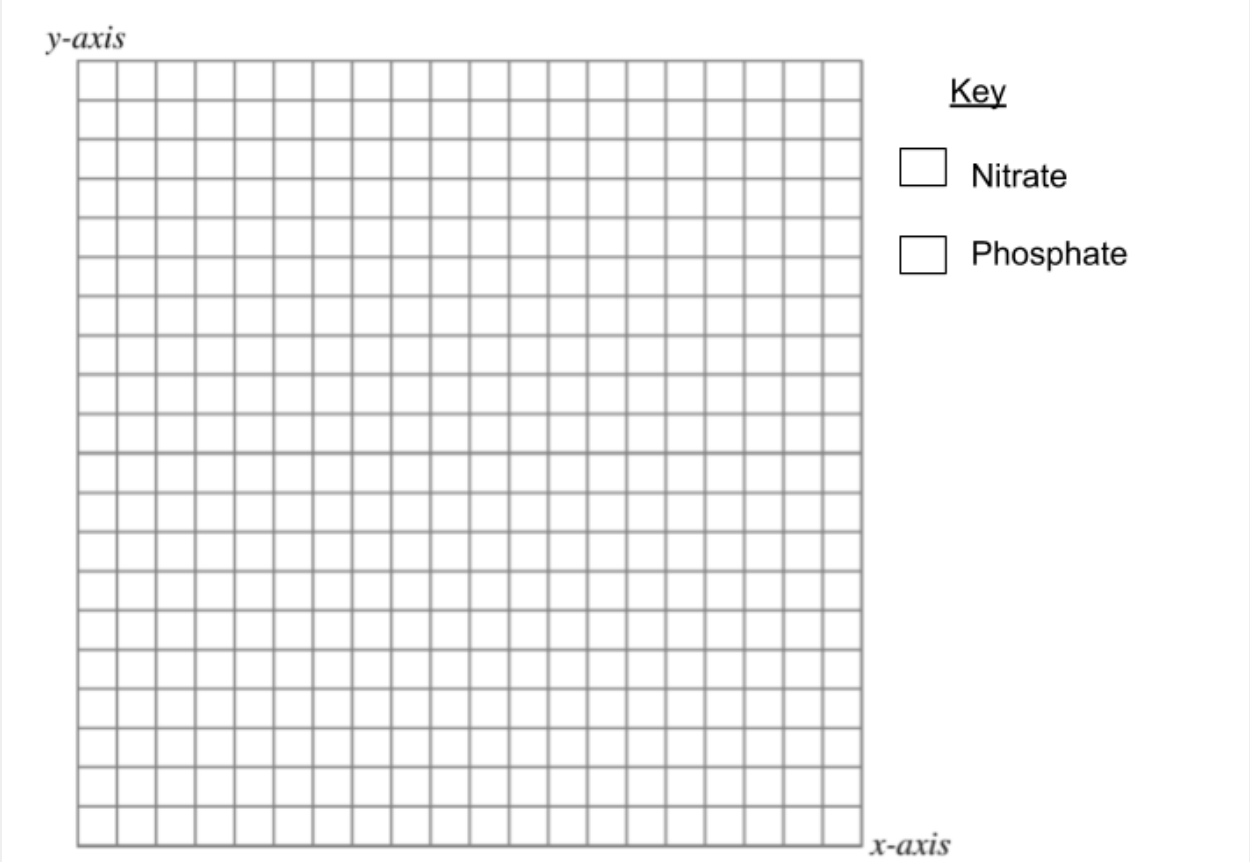
Nutrient Pollution Test Lab

Clean-up

1. Rinse out your test tubes with deionized water
2. Get a rag and wipe down your lab table
3. Put all lab supplies back where you got them
4. Throw away your gloves
5. Wash your hands

Nutrient Pollution Test Lab

Graph Your Data



Nutrient Pollution Test Lab

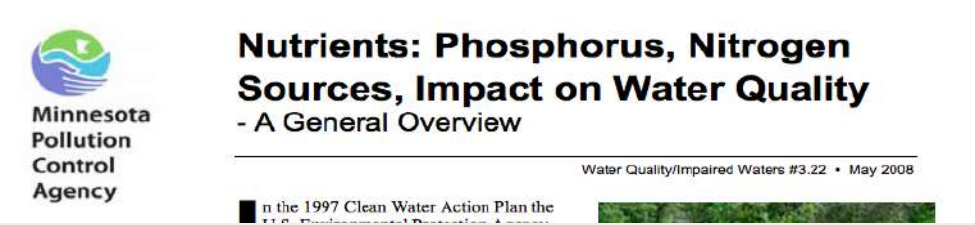
Explanation

Claim (Using your data table, answer the investigation question)

Evidence (Provide numbers with units as well as observations from your data table or graph that support your claim)

Reasoning (Why did you get the results you did? Use the key words: fertilizer, nutrients, phosphate, runoff, nitrate)

Read "Nutrients: Phosphorus, Nitrogen Sources, Impact on Water Quality" for scientific knowledge to your reasoning.



How do we know if the Minnesota River is polluted and what can we do if it is?

Focus Question

How can we monitor the Minnesota River for pollution?

Riverside Chat #3

Water Quality Monitoring

Taken from : https://mrbdc.mnsu.edu/mnbasin/interviews/interviews.html on June 16th, 2018

Ask an expert

Technology in water monitoring

Make a plan for monitoring

Criteria Chart

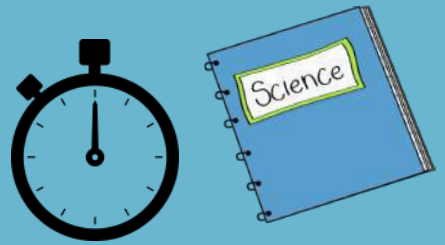
You will be making a plan to monitor the water quality for the Minnesota River, what should be in the plan?

Design your monitoring plan

With your group, develop a plan to monitor the water quality of Minnesota River's Watershed.

Include everything you came up on your class's criteria chart.

You will have 20 minutes to come up with your plan

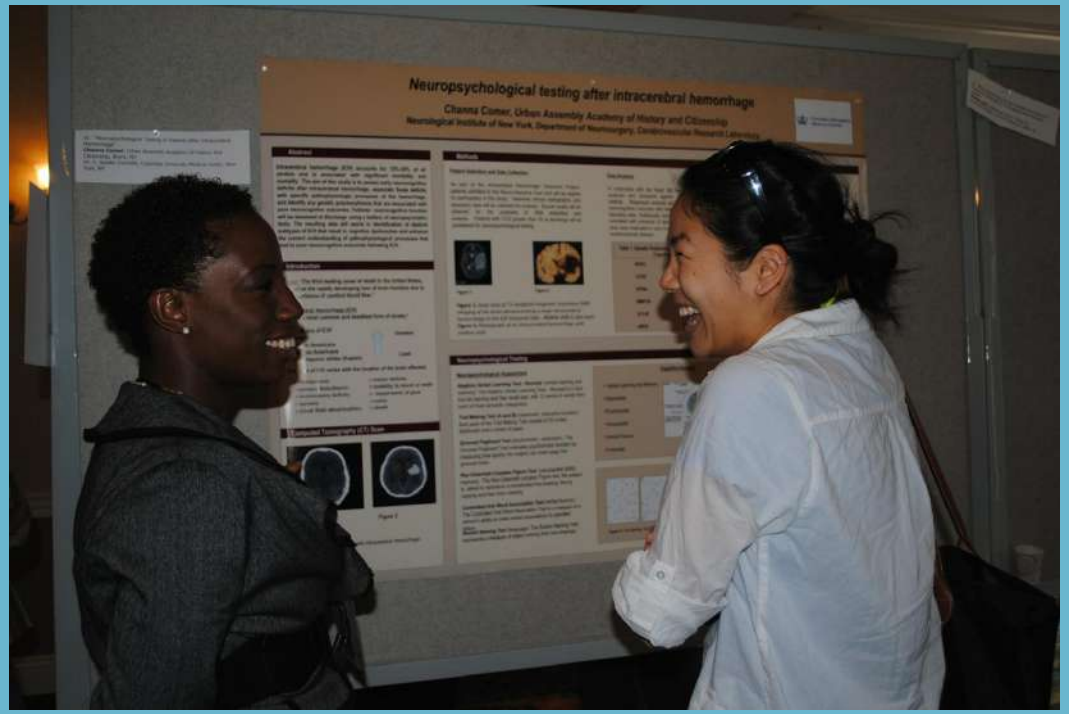


Evaluating the Plans

Mini Poster Session

1. Pick one person at your table that will present your group's plan in our poster session.

1. Everybody else will visit 3 different groups to learn about their plan and ask questions



http://www.scienceteacherprogram.org/PIS2011/Posters/index.html

Evaluating the Plans

Mini Poster Session

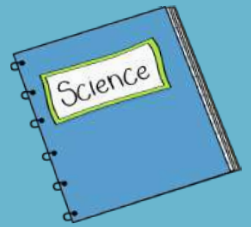
1. Your group will stay together and rotate through 3 different groups. You will have 5 min at each group.
2. At each station each person in the group will ask 1 question about the plan.
3. Each person will have 3 stickers to put on the BEST part of the plan presented for each group.

Revise the Plan

Use the feedback you got from the other groups AND what you saw from your presentations and answer these questions.

1. What was the best part of the plan that your group created?

1. What do you want to add or change in your plan using what you learned from other groups?



Lesson 3

Results of Monitoring

Focus Question

How healthy is the Minnesota River?

Learning Goal

Make claims and provide evidence for pollution levels in the Minnesota River

Agenda

1. Collect Data
2. Graphical representation of data
3. Claims and Evidence

How do we know if the Minnesota River is polluted and what can we do if it is?

Monitoring Plan

Review plans made last lesson

INSERT PLANS CREATED BY STUDENTS LAST TIME HERE

Constraint

Vocabulary

Limit you must consider when designing a plan or solving a problem.

Examples: Cost, Maintenance, availability of technology,

Nutrient Pollution in the Minnesota River Basin

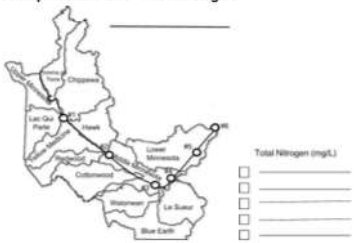
Nutrient Pollution in Minnesota River Basin

The results of your Minnesota River Watersheds monitoring are in. The Minnesota Pollution Control agency has collected phosphorus and nitrogen concentrations starting as far back as 2006, for some areas that is over 10 years of data. Your task to complete the data table below and complete your own graphical representation.

1. Go to Watershed Pollutant Load Monitoring Network (WPLMN) Data Viewer
2. Set the following settings
   a. Average Values
   b. Check: Watersheds and Subwatersheds
   c. Check Total Kjeldahl Nitrogen
   d. Get your pan tool for the map
3. Hover over the watersheds of the Minnesota River Basin, write down the testing site name, and record Both the Total Kjeldahl Nitrogen and the Total Phosphorus for the site.

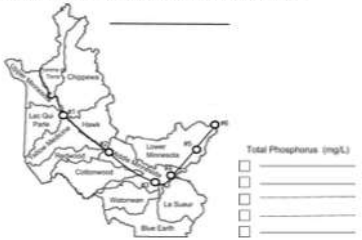
Watershed	Testing Site	Average Values of Total Kjeldahl Nitrogen (mg/L)	Average values of Total Phosphorus (mg/L)
Upper Minnesota	Yellow Bank River CSAH40		
Pomme de Terre			
Lac Qui Parle			
Chippewa			
Yellow Medicine			
Hawk			
Redwood			
Cottonwood			
Middle Minnesota	Seven Mile Creek nr St. Peter		
Watonwan			
Blue Earth			
Le Sueur			
Lower Minnesota	High Island Creek CSAH6		
Minnesota River #1	Nr Lac Qui Parle, MN		
Minnesota River #2	At Morton, Mn		
Minnesota River #3	At Judson		
Minnesota River #4	At St. Peter		
Minnesota River #5	At Jordan		
Minnesota River #6	At Fort Snelling State Park		

Graphical representation of Total Nitrogen



Claims	Evidence

Graphical representation for Total Phosphorus

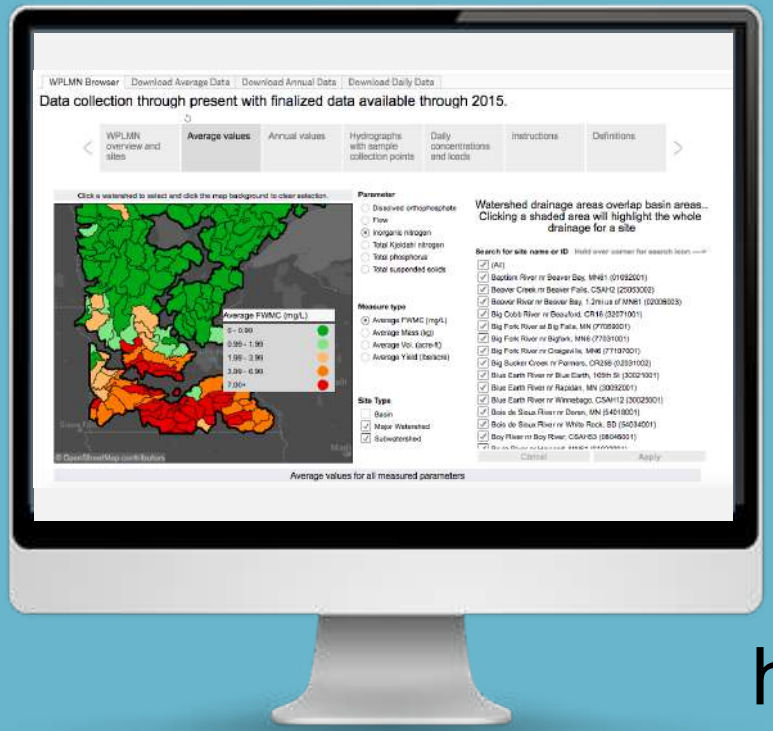


Claims	Evidence

Caption (written on next notebook page

Nutrient Pollution in the Minnesota River Basin

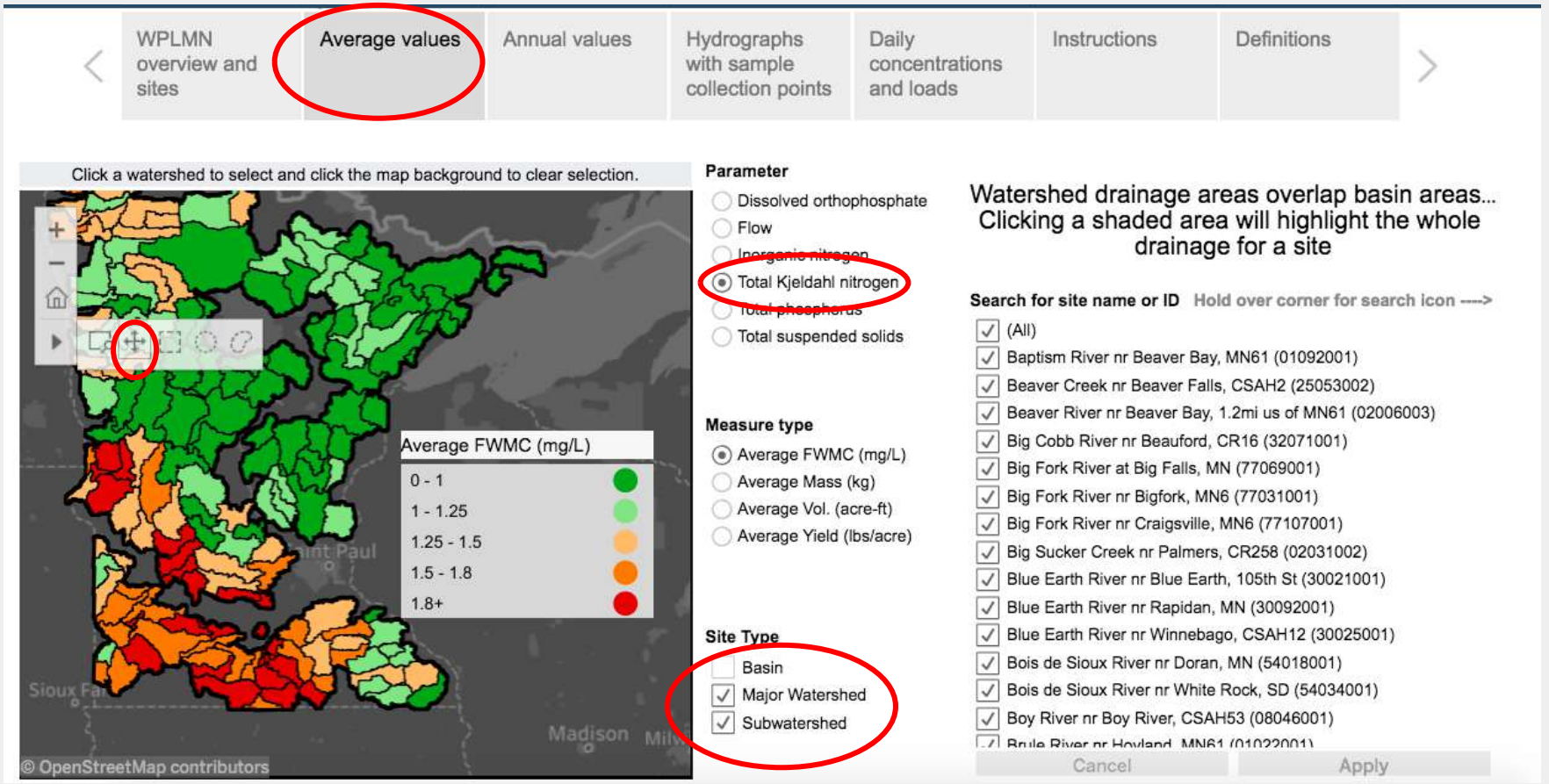
Minnesota Pollution Control Agency (MPCA) Data



Go to the [Watershed Pollutant Load Monitoring Network (WPLMN) Data Viewer]

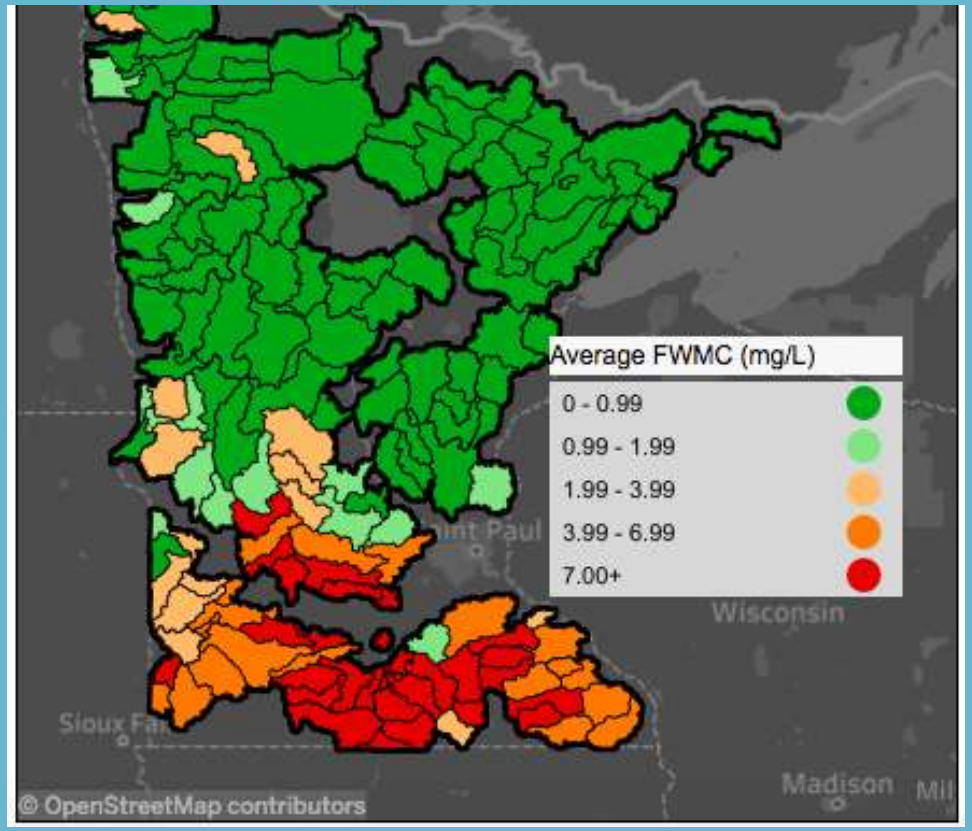
https://goo.gl/kJUprm

Nutrient Pollution in the Minnesota River Basin



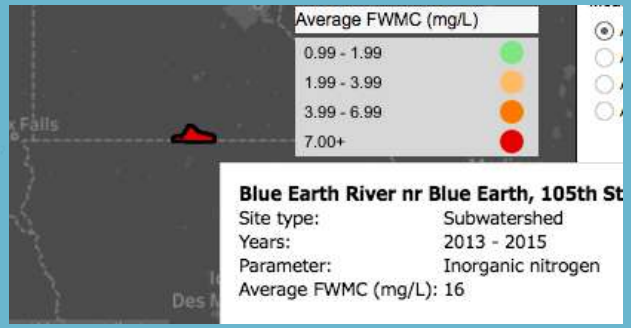
Where should we record our data?

Some Watersheds have MANY data points

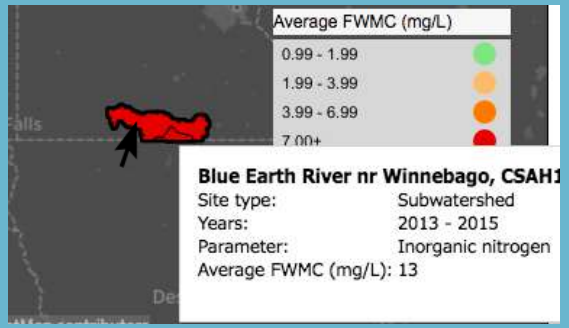


Where should we record our data?

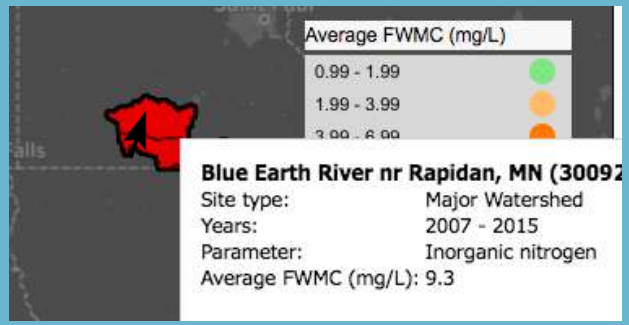
For example, Blue Earth River has MANY data points, which should we choose?



Option 1 Near Blue Earth

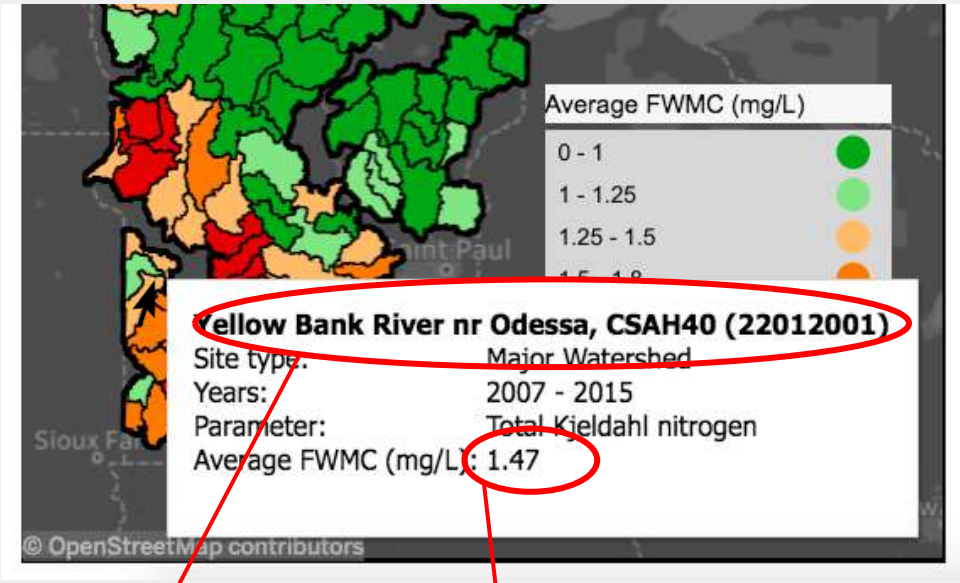


Option 2 Near Winnebago



Option 3 Near Rapiden

Nutrient Pollution in the Minnesota River Basin

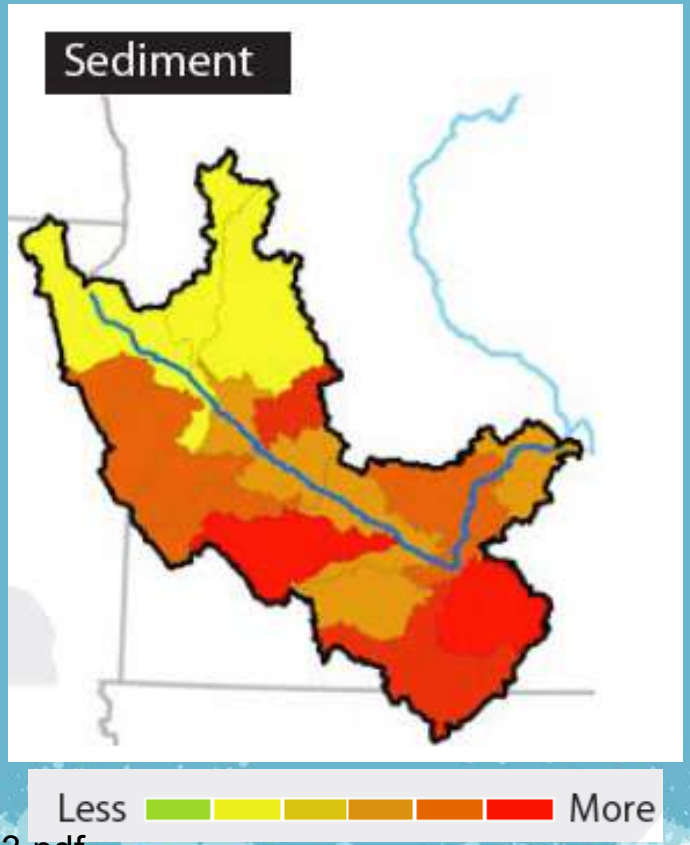


Watershed	Testing Site	Average Values of Total Kjeldahl Nitrogen (mg/L)	Average values of Total Phosphorus (mg/L)
Upper Minnesota	Yellow Bank River CSAH40		

Graphical Representation of Data

Example with Sediment

1. What do you notice about this graphical representation of data?
2. What does it tell you about sediment in the Minnesota River?
3. What are the different parts of this graphical representation?



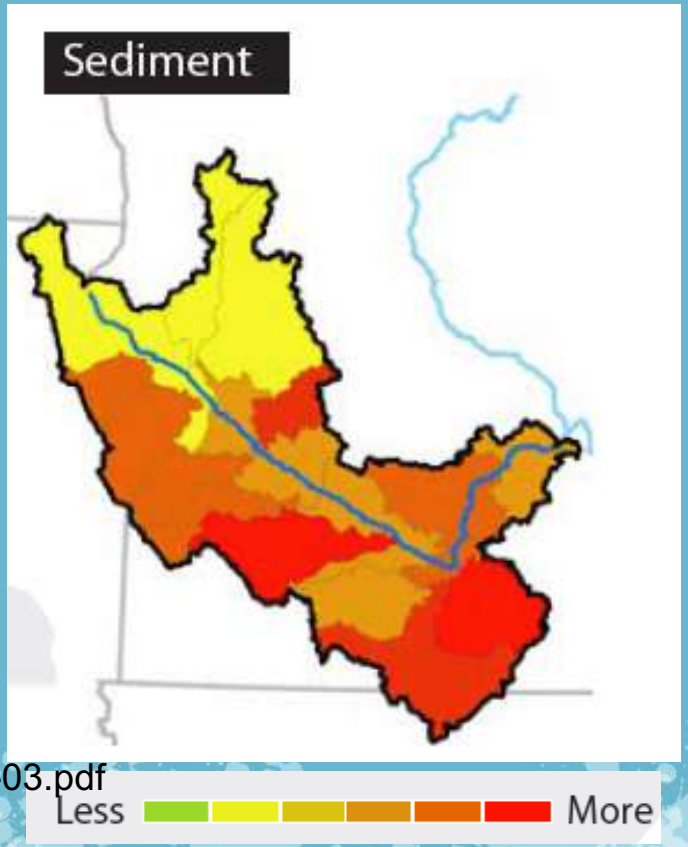
https://www.pca.state.mn.us/sites/default/files/wq-swm1-03.pdf

Graphical Representation of Data

Example with Sediment

Required Parts to your Map

- Title
- Color
- Color key with numbers and Units

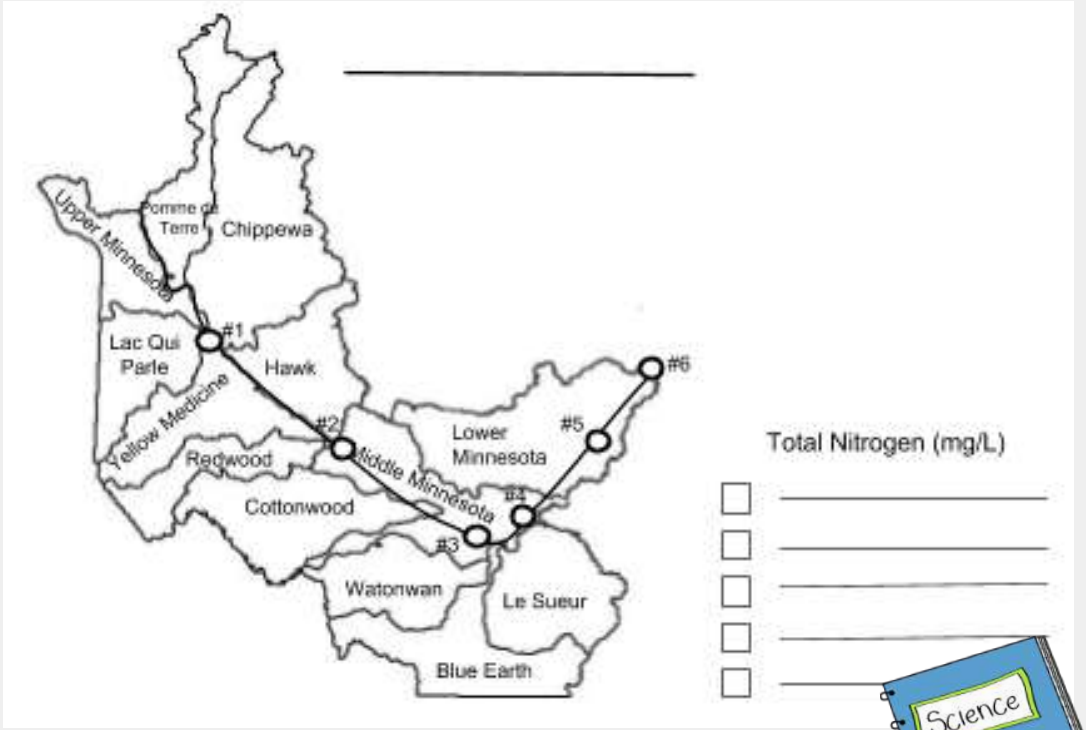


https://www.pca.state.mn.us/sites/default/files/wq-swm1-03.pdf

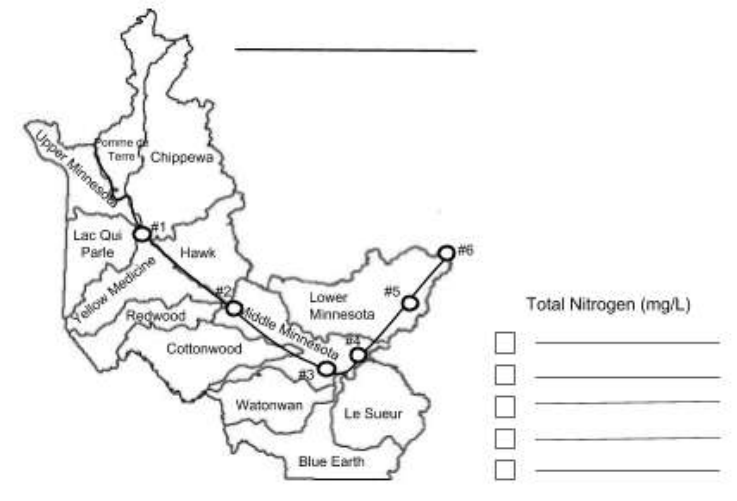
Nutrient Pollution in the Minnesota River Basin

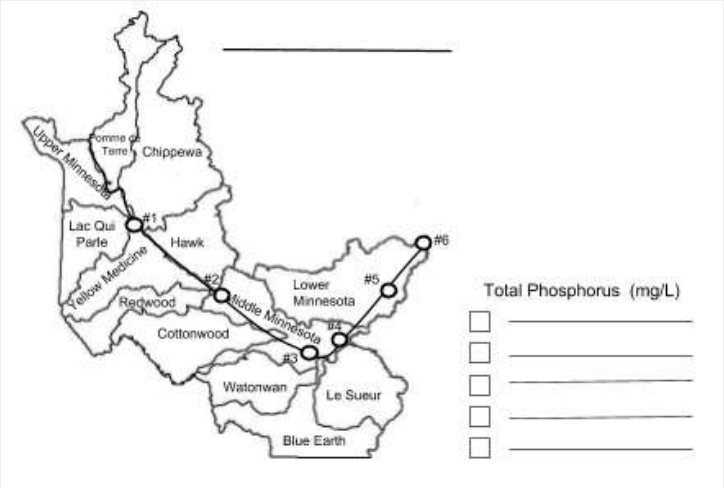
Use the data you collected to color your maps of the Minnesota River Basin. Make sure you have.

- Title
- Color
- Color key with numbers and units



Nutrient Pollution in the Minnesota River Basin





Claim

What do you notice?

Evidence

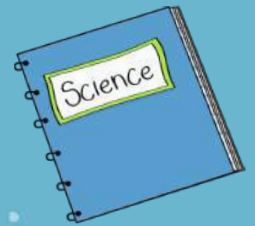
Numbers or description of patterns you find written as a sentence

Point Source Pollution

Vocabulary

Source of pollution where a single point such as a pipe or a drain from a single source.

Example: Wastewater treatment plant release treated water into the river.



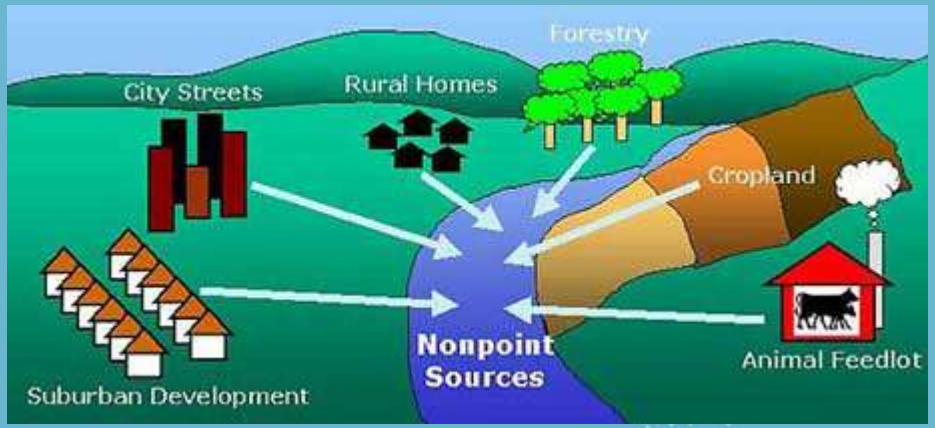
Taken from https://www.pca.state.mn.us/water/regulatory-certainty-wastewater-treatment-facilities on June 18, 2018

Non-Point Source Pollution

Vocabulary

Pollution that comes from many sources.

Example: Pollution runoffs into rivers and streams from farmland, lawns, and streets.



Taken from https://oceanservice.noaa.gov/education/kits/pollution/04nonpointsource.html

Fertilizers

Vocabulary

Nutrients of nitrogen, phosphorus, and Potassium added to farms, lawns, and gardens to help plant grow.

Taken from https://maxpull-tlu7l6lqiu.stackpathdns.com/wp-content/uploads/2014/08/fertilizer-400x600.jpg

Ask an Expert

Sources of Nitrogen

What are the major sources of nitrogen for Minnesota Rivers?

Write the answer in your notebook

Ask an Expert

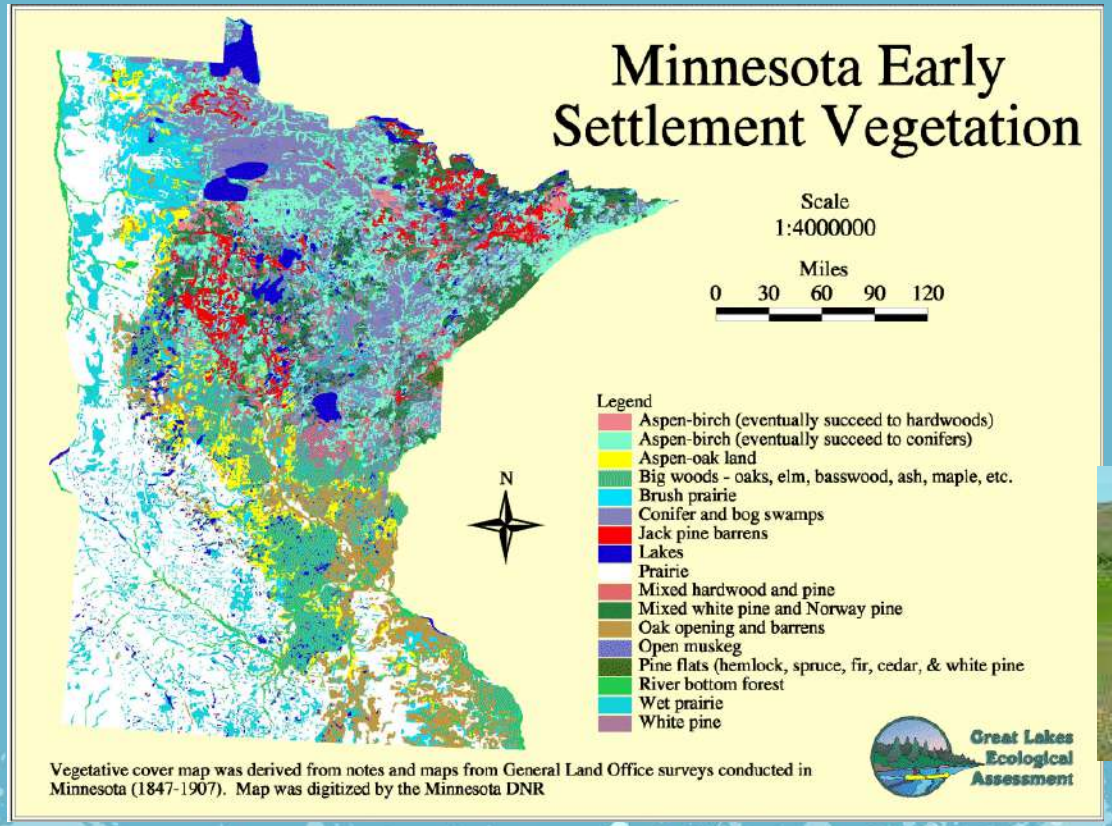
Sources Phosphorus

What are the major sources of phosphorus for Minnesota Rivers?

Write the answer in your notebook

Land Cover

1847-1907



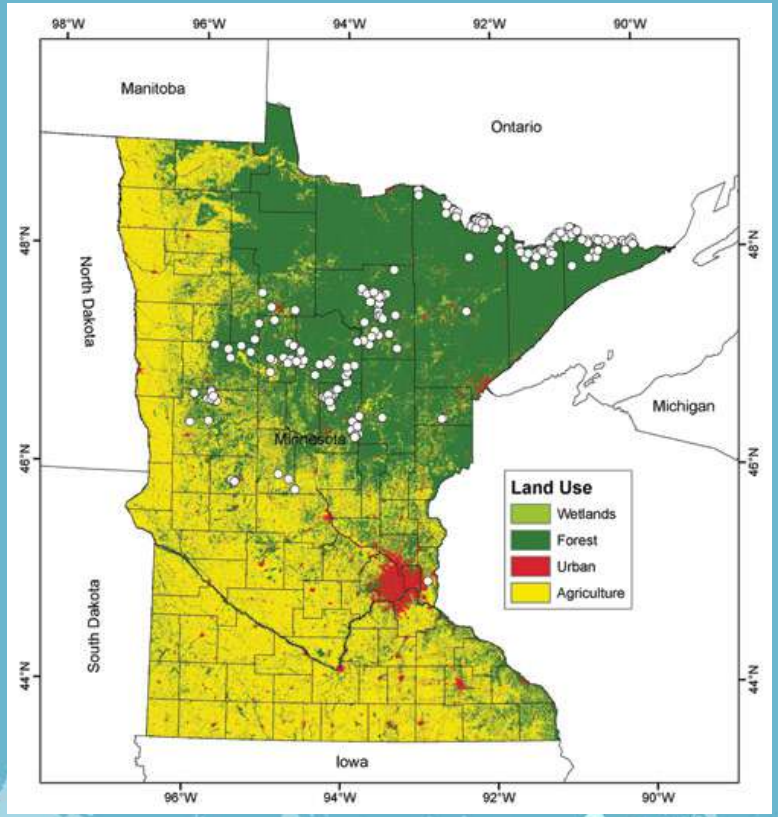
Taken from: http://www.mngeo.state.mn.us/chouse/land_use_historic.html

- **Historic land cover for Minnesota River was prairie.**
- **Minnesota's population in 1900 was 1,751,394.**
- **United States population in 1900 was 76,212, 168.**

Taken from: https://www.fws.gov/refuge/northern_tallgrass_prairie/

Land Cover

Today



Land Cover today in the Minnesota River basin is Agriculture (Farming).

Minnesota's population today is 5,525,000

United States Population is 323,400,000

Peter Jacobson, Minnesota Department of Natural Resources

http://nemwuppermiss.blogspot.com/2013/05/minnesota-agricultural-water-quality.html

Why the Change to Farmland?

- Immigrants, mainly from European countries, where able to buy cheap land from:
  - United States Government through the Homestead Act of 1862
  - Railroad Companies
- Both the US Government and the expanding Railroads wanted to settle the Prairie.

Image from: http://storage.brantfordexpositor.ca/v1/dynamic_resize/sws_path/suns-prod-images/1297775207259_ORIGINAL.jpg?quality=80&size=650x&stmp=1448242119948

Why the Change to Farmland?

- The land was not great for farming, it was too dry and was plagued by locusts (specific type of grasshopper). The soil was rich with nutrients for farmers to grow crops on
- With new technologies farmers were able to farm the land to feed their family and some were able to make a profit and sell what they grew.
- Poor farming practices in the arid climate led to the dustbowl of the 1930's.

Taken from: http://www.ghostsofnorthdakota.com/2014/03/16/the-grasshopper-plague/

Ask an Expert

Downstream Effect

Nitrogen

Phosphorus

Effects of Nutrient Pollution

Environmental

Nutrient pollution promotes the growth of harmful algal blooms:

- Reducing the ability of fish and other aquatic life to find food causing a decrease in fish population.
- Promoting the growth of thick, green muck that impacts clear water.
- Creates toxins that can kill fish and other animals.
- Blocks out sunlight and clogging fish gills.

Source: https://www.epa.gov/nutrientpollution/effects-environment

Effects of Nutrient Pollution

Environmental

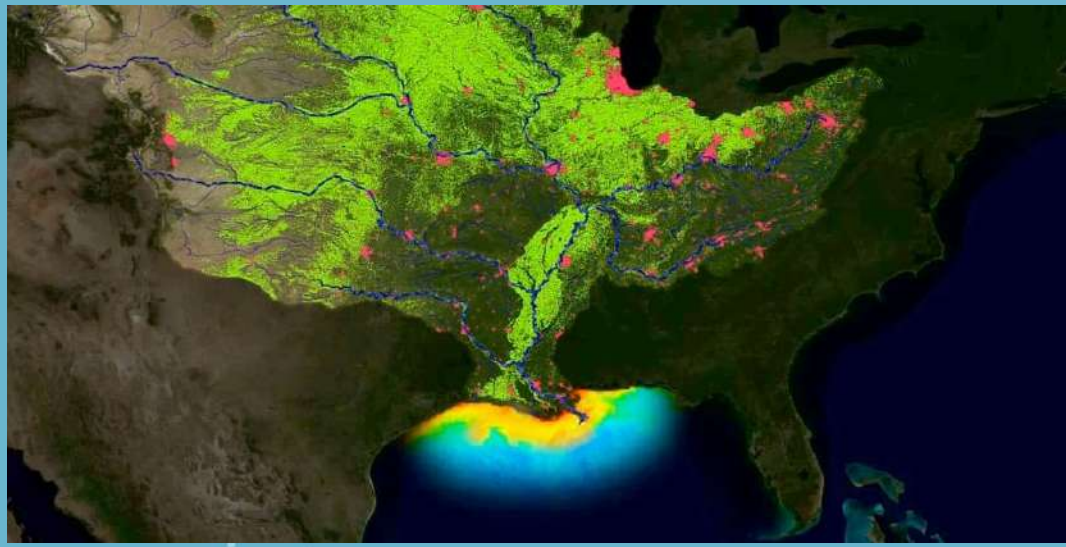
Dead zones and Hypoxia

- Dead Zones/Hypoxia: Caused by nutrient pollution, these are areas in salt water with little or no oxygen where aquatic life cannot survive.

- Created by algal blooms consuming oxygen as they die and decompose.

Gulf of Mexico Hypoxia

- Largest dead zone in the United States, measured to be 5,840 square miles in 2013.
- Occurs every summer because of nutrient pollution from the Mississippi River Basin, an area that drains 31 upstream rivers, including the Minnesota River



https://oceanservice.noaa.gov/podcast/feb18/nop13-hypoxia.html

Effects of Nutrient Pollution

Health

Drinking water with toxins from Algal Blooms can cause:

- Rashes
- Stomach or liver illness
- Respiratory problems
- Neurological effects

Nitrates from Fertilizers end up in drinking water if too high can cause infants to become seriously ill and even die, know as blue baby syndrome.

https://www.epa.gov/nutrientpollution/effects

Effects of Nutrient Pollution

Economical

- **Increase cost in Water Treatment-**in Minnesota cost rises from 5-10 cents per 1000 gallons to over $4 per 1000 gallons.
- **Loss of tourism** losses in fishing and boating activities, as a result of water bodies that have been affected harmful algal blooms.

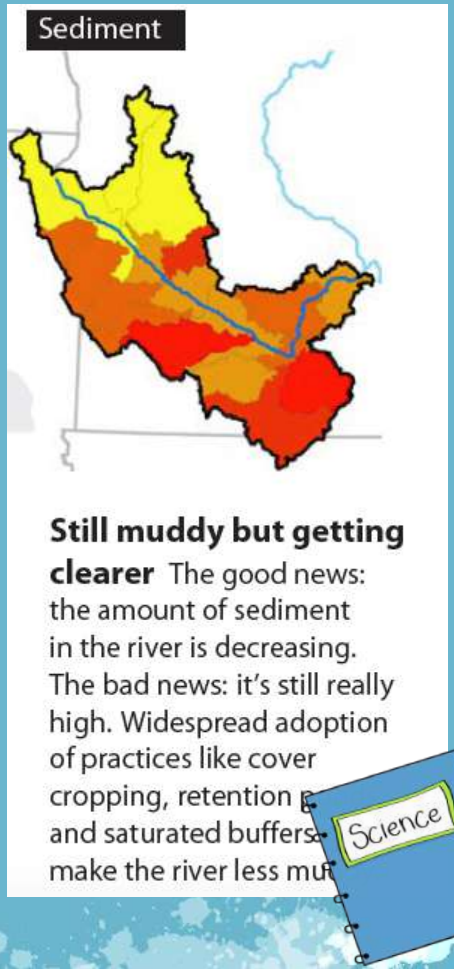
https://www.epa.gov/nutrientpollution/effects

Add a Caption

Write a caption for your maps. Include both nitrogen and phosphorus.

Your caption needs to include:

- **Summary of your claims for nitrogen and phosphorus**
- **The cause of the the pollution including changes in land use and population**
- **Effects of the pollution on the natural system.**



https://www.pca.state.mn.us/sites/default/files/wq-swm1-03.pdf

How do we know if the Minnesota River is polluted and what can we do if it is?

Lesson 4

Engineering a Solution

Guiding Question

How can we reduce the amount of Nitrogen and Phosphorus in the Minnesota River?

Learning Goal

Design and create a model to help mitigate the flow of nitrogen and phosphorus into the Minnesota river.

Agenda

1. Solution Introduction
2. Project Criteria and Constraints
3. Plan and model solutions
4. Write argument

How do we know if the Minnesota River is polluted and what can we do if it is?

Mitigation

Vocabulary

Actions taken to reduce the cause of a problem

Example: Using less fertilizer on lawns to reduce nutrients going into the river

Modeling Mitigations Project

Project Introduction

You work for the Soil and Water Conservation District as an environmental engineer for the Nicollet Country. Nicollet County in is Southern Minnesota where agriculture is the primary land use. Nicollet County includes the Northern portion of the urban area of Mankato along with the towns of St. Peter and New Ulm. Watersheds of upper and middle Minnesota river are found in Nicollet County, including Seven Mile Creek.

Your task is to create an argument to convince framers, business owners, or housing developers to use land practices that reduce pollution runoff to the Minnesota River. You can choose an urban (business owners or housing developers) or rural (farmers) audience for your project. Along with your argument you will need to make a model of the land practice you want your audience to adopt.

You will work in a group to make your model while your argument will be written by yourself.

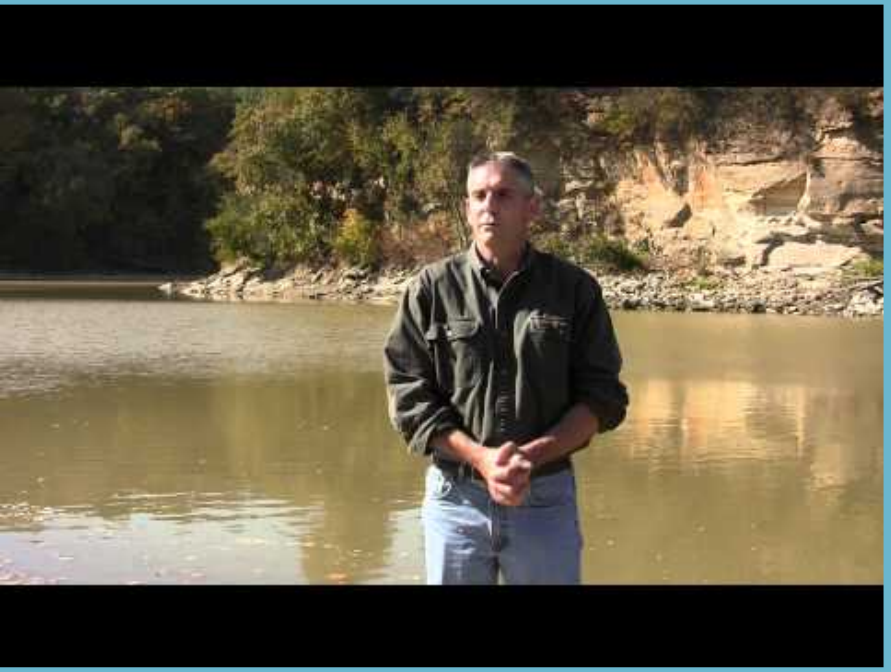
Mitigations for Minnesota River

Everybody doing their part

Urban Mitigations

Washington DC and the Potomac River

Mitigation Ideas



Criteria and Constraints

Criteria
-Reduces nutrient pollution in Minnesota River
-Mitigation address the source of nutrient pollution

Constraints
-Economically viable
-Time Limited to _____ Min to build
-Available Materials (You can add your own)

Model Project

Rubric

Model Rubric - Group

	Exceeds Proficient (4)	Proficient (3)	Partially Proficient (2)	Not Proficient (1)
Criteria and Constraints	Meets all requirements for a (3) plus: Written paragraph includes additional criteria or constraints that were not presented in class.	Written paragraph clearly describes both the criteria and constraints considered when developing a model for mitigating the impact of water pollution on the Minnesota River Basin.	Lists the criteria and constraints that were considered when developing the model.	Includes an incomplete list of criteria and/or constraints.
Model	Meets all requirements for a (3) plus: Model includes multiple approaches to mitigating pollution for the area. Model incorporates additional research beyond resources presented in class.	Model shows an effective approach to reducing the amount of pollution that enters the Minnesota River Basin. Approach meets all the criteria and constraints.	The mitigation approach that is modeled is missing some of the criteria and/or constraints.	The mitigation approach that is modeled is missing many of the criteria and/or constraints.

Model Project

Supplies

- Straw
- Moss
- Toilet paper tubes
- Paper towels tubes
- PVC pipes
- Stream table or Shoebox of soil/sand
- Other?

Present Your Model

Requirements for the presentation or video

- What the mitigation was that you modeled
- Why the mitigation will reduce nutrient pollution
- Everybody must speak in the presentation

Argument

Rubric

Argument Rubric - Individual

	Exceeds Proficient (4)	Proficient (3)	Partially Proficient (2)	Not Proficient (1)
Claim	Meets all requirements for a (3) plus: Shows depth of understanding of connections between nutrient pollution and land use.	Describes the health of the Minnesota River Basin in terms of nutrient pollution using data from maps and data tables.. Describes the relationship between nutrient pollution and both population change as well as land use.	Claim does not include claims made from both maps and data tables of the data provided.	Claim does not directly relate to the data provided.
Evidence	Meets all requirements for a (3) plus: Clear, specific connections are made linking the claim and evidence.	Claim is supported with evidence from multiple sources including: • Data tables • Graphical representations • Notes on land use and population	Evidence presented supports the claim but is only from a single source.	Evidence is limited or does not support the claim.
Reasoning	Meets all requirements for a (3) plus: Includes a description of possible effects of nutrient pollution on human health and on the economy.	Explains the cause and effect relationship between nutrient pollution and environmental impacts on both local and national scales.	Shows partial understanding of the cause and effect relationship between nutrient pollution and environmental impacts.	Shows very limited understanding of the cause and effect relationship between nutrient pollution and environmental impacts.

Writing Your Argument

Paragraph 1: Your claims and evidence

Start with your claims, SIMPLE SENTENCE AND TO THE POINT.

- Sentence about pollution for of the Minnesota River Basin in terms of nutrient pollution using data from maps and data tables.
- How changes in population and land use relate to the pollution . USE YOUR NOTES

Next write your evidence including NUMBERS

According to the data_____

- Data tables
- Maps
- Notes on land use and Population

Writing Your Argument

Paragraph 2, Reasoning

Sentence 1: Intro sentence: Summarize your claim

Sentence 2-5: Explain the effects of nutrient pollution on the Minnesota River. Effects need to include BOTH local and National effects.

> **Hint:** See your notes about the effects of nutrient pollution and the caption your wrote for your maps

BONUS: Include the health and economic effects in your reasoning

How do we know if the Minnesota River is polluted and what can we do if it is?

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