Week 1

Week 2

Grade level: 4th Grade

Driving Question for the unit: How do humans impact the water system?

Specific Lesson Question: What is water pollution?

<table>
<tr><th colspan="3">Overview</th></tr>
<tr><td colspan="3">For lesson 2, how will you contribute to answering your overarching unit question?
● Now that students understand what a water system is and how they work, now students must understand water pollution and how water pollution is a problem. This ties into our overarching unit question because students need to know why water pollution is a problem before understanding how humans are feeding into the problem.</td></tr>
<tr><td>Disciplinary Core Idea Addressed in lesson:
We will be addressing what water pollution is and how it affects the world and the animals in that ecosystem. Water pollution is when harmful substances contaminate a body of water and water system. This core idea is important to the overall arching question because it is important for students to understand what water pollution is in order to understand how it is a problem.

Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)</td><td>Science and Engineering Practices Addressed in Lesson:

No other aspects of STEM are incorporated in this lesson. (however, we are incorporating literature)</td><td>Cross-Cutting Concepts Addressed in Lesson:
Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)</td></tr>
</table>

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]
Yes
No
*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

Learning objectives (outcomes):
What do you want students to be able to explain/state in response to the specific lesson question?
Students will be able to explain/state [USE KIDS' WORDS]:

- Students will be able to explain that water pollution is when different pollutants make their way to our water systems (lakes, rivers, reservoirs, etc.) and contaminate the water. The students will be able to say, "Pollution effects animals, humans and ecosystems in lakes, rivers, and oceans. It is not good for them and the world."
- Students will be able to list multiple types of pollution, such as agricultural pollution (fertilizers, pesticides, animal waste), sewage (used water from our pipes at home), wastewater (water from factories that has toxic chemicals and metals in it) and oil (from cars and trucks after it rains and oil spills) The students will be able to say" Water gets polluted by a lot of different things, including agricultural pollution, this means fertilizers, pesticides and animal waste, sewage, wastewater and oil. This also includes plastic and other materials"
- Students will begin to see the effects of pollutants on animals through the freddie the fish activity. Students will be able to say "Freddie and other animals that live in water systems are hurt by water pollutants."

Learning Plan
(using the 5E model--Meredith will explain as needed)

In person

ENGAGE To start out our lesson, we will be showing students a series of pictures depicting water pollution and then have a discussion after the video to get their minds running.(https://docs.google.com/presentation/d/1yJ68BwTSRH2KjRqvE-cUJSV2iKSKXZlTrG1lXS3lUMc/edit?usp=sharing) We will give them a piece of paper to write down their reactions to each picture that is shown. After we are done looking at all of the pictures, we will ask for their reactions of the pictures and ask about the different types of pollutants depicted in this lesson.

EXPLORE

Adaptations for Online

(as needed by phase)

ENGAGE
We have no online students

EXPLORE

EXPLAIN

- During the explore, we will be conducting “Freddy the Fish” as an interactive read aloud and hands on activity.
    - “Freddy the Fish” is the journey of a sponge fish that moves through a water system that is being polluted by a variety of materials. The journey shows how the different pollutants have an effect on the fish.
    - We show this through a demonstration in a tub of water adding in different materials (pollutants) while reading a story.
- Our freddie the fish story is here https://docs.google.com/presentation/d/1INS0D70g-cAlwFInfrgEgfnAIjhwfFUWzfATimMjBn8/edit?usp=sharing
- After Freddie the Fish is in his contaminated tupperware, how can we remove these contaminants? Can we remove all of them? What could we have done about the other contaminants that we can’t take out with our hands or spoons etc.?

EXPLAIN

- Questions for Our Discussion
    - What are some things we saw that hurt Freddy?
    - Can someone explain what water pollution is for our class?
    - Have you seen or experienced any of these things?
    - What pollutants were the easiest to remove? Hardest? Why?
    - How can we prevent polluting the water with pollutants that are hard to get out of the water?

- Terms to Define in Discussion (connect back to student observations)
    - Water pollution
    - Pollutants
    - Contaminate

ELABORATING/EXTENDING Understanding

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- Exit slip
    - Question 1: What were some pollutants that you found hard to get out of the water or could not get out?
    - Question 2: What do you think you could do to help solve the problem of pollutants that we cannot or are hard to filter out once they are in a water system?
    - Question 3: If you had to explain to someone what water pollution is, what would you say?

Individual Student Accomodations

Required Accommodations/Modifications:

- We can slow down if students are having trouble understanding what we are teaching.
- We have a teacher per student, so they will have individualized help.
- For students who need extra time, allowing them to have the time that they need.
- We will allow for the students to work with a partner, or have a teacher there to help them

Additional Modifications for Individual Students:

- No additional modifications for individual students

Materials
REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

In person (Things highlighted is what we will provide)	**Online**
• 5 large tupperware containers without lids • 5 large sponges (that will be cut into fish) • 1 bottle Green food dye • Red solo cups,dixie cups • Syrup (1 bottle) • 1 cup of sand • Styrofoam (either cups, plates or beads) (about 2 cups worth of styrofoam)	**We don't have any online students :)**

• 5 small boxes of raisins • 10 sheets of paper for students (2 pieces each) • 5 pencils for students (one pencil each) • Markers • Box of Coffee filters • Box of Plastic forks (one per student)	

Week 3

Driving Question for the unit: How do humans impact the water system?

Specific Lesson Question: How is wastewater from our homes similar/different from water pollution?

Overview		
How does this lesson contribute to your overarching unit question? • **This lesson contributes to our overarching unit question by showing students how the water they use in their house is part of a water system. This lesson also ties to our overarching unit question because it will allow students to think more critically between anthropogenic water pollution vs. the different uses of water in their own homes. Students will learn that when they use the restroom or pour something down the drain, they aren't polluting the water.**		
Disciplinary Core Idea Addressed in lesson: **In this lesson we will be addressing the rest of the water cycle and the difference between wastewater from our homes and water pollution. We will discuss how water leaves our house, goes through the sewers, is treated and returned back to our homes for use in other ways.** **Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are**	**Science and Engineering Practices Addressed in Lesson:** No other aspects of STEM are incorporated in this lesson.	**Cross-Cutting Concepts Addressed in Lesson:** **Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) • Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3-2)

renewable over time, and others are not. (4-ESS3-1)		

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]
Yes
No
*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

Learning objectives (outcomes):
What do you want students to be able to explain/state in response to the specific lesson question?

- We will want our students to be able to explain where water goes when we use our drains. The students will be able to say, “The water from our houses goes through our local waste treatment facility.”
- We will want our students to be able to explain the difference between water pollution and the water that leaves our houses. The students will be able to say, “Pollution and the water that leaves our houses is different because pollution is not cleaned and processed the way our water is after it leaves the house. The water goes through a treatment plant, while the pollution does not.”
- We want our students to be able to connect our work from week one on the beginning of the water cycle to our work this week on the ending of the water cycle. Students should be able to state how water leaves their house and returns back to their house and what steps that entails. “Water goes down our drain then into the sewers, then to a wastewater plant, then back to a river, lake or reservoir, then too a water treatment plant, then to a water distribution system, then back to our homes.”

Learning Plan
(using the 5E model--Meredith will explain as needed)

In person	Adaptations for Online *(as needed by phase)*

ENGAGE
- Recap of Freddy the Fish activity from last week
  - Thinking back to the activity with Freddy the Fish, what kinds of things did we pour onto Freddy?
  - We anticipate that students will be able to recall some of the products that they poured on Freedy like oil, food dye or sand. We will then tell students that these are called pollutants.
  - Do you remember some of the pollutants that we saw last week?
  - The students may say some of the things they poured onto Freddy, we will then ask “what did these items represent?” to scaffold them into thinking about the real pollutants
  - How did these pollutants affect Freddy the Fish?
  - We anticipate that students will say that the pollutants harmed Freddy
-Why is water pollution bad?
  - We anticipate that students will say that water pollution is bad because it harms wildlife and that the pollution may not be able to be filtered out and it can come back to our homes. .
  - Was it easier to put the pollutants in the water or to take them out?
  - Students will say that it was easier to put pollutants into the water. This segways into our engage activity of putting household wastewater items into a bowl to show that many of these are easy to filter out of the water.
 	
- Discussion: How is this different from humans polluting the water
- Activity concerning water waste/disposal
  - We’ll ask the students to gather a bowl of water as part of their water system to represent the water in their house.
	ENGAGE
	
	EXPLORE
	
	EXPLAIN

- What are some things you think go down the drain?
- Students will gather three items that they have used in the past that have flushed down their drains- soap, food, toilet paper, etc.
- We will compare and contrast how this water looks vs. the water from last week with Freddy the fish
- They will add these things to their water and we will discuss what happens to these things after they are washed down the drain.
- Where do these things go?
    - Down the drain
    - Through the pipes
- How do these things end up in our water?
    - Flushed down the toilet
    - Go down the sink
    - In the bath tub/shower

EXPLORE

- Students will be asked to create “data sheets” to take data on how water enters and leaves the house
    - What are some ways we can organize this data?
        - We anticipate that students will most likely decide to take qualitative data, writing their observations on the paper, some students may even decide to draw diagrams of their observations
        - As for organizing, students may decide to create their sheet in a paragraph form, writing about each location separately, or they may also do a column format with a location column, how water enters, and how water leaves throughout those locations
- Students’ parents will be asked to set a timer for 10 minutes
- During this time, students will be broken into breakout rooms (depending on the amount of student attendance) with two teachers in each breakout room
- During the 10 minutes, students will be asked to make and write down qualitative data within their houses of where they see water entering and exiting their houses. If

students are able to, they can bring us along with their device as they are making the observations. ● After the 10 minutes is up, students will come back to their computer and explain their observations that they made in their breakout rooms ○ Students will most likely find that sink faucets, shower heads and bathtub taps are ways that they see water entering the house ○ Students will most likely find that kitchen sink drains and bathtub drains are ways that they see water exiting their houses. Some students may even go outside and see waste pipes outside of their houses removing water from the house. ○ Now would be an appropriate time to challenge students (if they didn't make this observation already) about toilets. ■ Toilets don't have faucets or typical drains. So how does water enter and leave our toilets? ● We anticipate that students will understand how water leaves the toilet but not how the water gets into the toilets. This would be a good time to give students a few minutes to go look at a toilet in their bathroom. If they still don't know how water gets into the toilet and toilet bowl, we will scaffold them into understanding about the tank that sits behind toilets and how water is pumped into this tank before entering the toilet bowl. ● Once we have discussed student observations and their data sheets in breakout rooms, we will come back together as a whole class to create one large data sheet with all of their ideas ● Students will share data all together and we will ○ Compile data ○ Compare data ○ Analyze data ○ Organize data ● We will then have a discussion to create one large data sheet as a class compiled of every student's data	

○ We will do so on sa word document or whiteboard feature on zoom (whatever the students think is the best way to represent it) ● Discussion questions for data sheets ○ How do we want to organize our data as a class? ■ At this time, students can work together to determine how they want to organize the class data. Students can make an argument for how they represented their data and why they think it is the best ■ Now is a good time to explain to students why data and organization is important as a scientist. ● Collecting data as scientists is important to make the best, informed decisions about serious topics. ● Why is it important to know how water enters and exits our houses? ○ We anticipate that students may have a hard time with this question. We will use wait time to allow students to ponder. If they still cannot get the answer, we will ask them to refer back to the flint michigan video we watched week 1. ● Now that the class has decided to organize our data, we will start filling out the data sheet. ○ What were the different things we saw in our houses? ○ Students will most likely have similar answers such as pipes, faucets, and drains. There may be a few odd observations such as hose taps, dishwashers/washing machines and drains outside their house. ○ Where were places we saw water in our homes? ■ Student answers may include; kitchen, bathroom, outside ○ How were some of the ways we see water leave our homes?	

■ Students will most likely say that they see water leave their house through drains. Some students may also have some different ways of having water exit their house. (ex. In a bucket due to a broken pipe) **EXPLAIN** ● Where does water go when it leaves our house? ○ Septic tank? ■ We anticipate that students will say something along the lines of that the water travels through pipes out of the house to a reservoir, this is an appropriate time to talk about septic tanks. What is a septic tank? These are tanks that sit under the house that collects waste water. They separate out the sludge and let the rest of the water seep into the ground. ○ Sewer system? ■ (possibly have the students ask parents whether they know if they have a septic tank or not- does this affect how many pipes or drains we saw in the yards of students?) ● Where does the water go once it leaves the sewer? ○ We anticipate that the students will say something along the lines of saying that water travels through pipes to go get treated ■ Where does the water get treated? What is a wastewater plant? This is the place where water goes after it leaves our homes to get cleaned. ● We will watch a video on wastewater treatment plants ○ This video shows the process of how wastewater is cleaned at a treatment plant before it is released back into reservoirs. ○ https://www.youtube.com/watch?v=su3Rk9t2LWk ● We will discuss with the students the video they just watched and ask each student to briefly explain what they saw or think was happening in the video. **ELABORATING/EXTENDING Understanding**	

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)

- Goes back into the cycle- bring this back to week
  - Ask the students to remind us how water gets into our tap. Ask them step by step about the water system
    - Source water, water treatment, water distribution, comes out of our tap through pipes.
    - What happens at these water treatment facilities? How can dirty water exit our house, but we get clean water in our house?
      - We anticipate that students will say that water is filtered at water treatment plants before it is sent back to us. If they are unable to make this connection, we will ask them to refer back to lesson 1.
  - Connect this to what we know now and bring this full circle
    - Water goes down our drains, into sewers, to a wastewater plant, back to source, then to water treatment plant and so on.
- We will discuss with students how wastewater is different from pollution.
- What do you think the difference is between putting food, waste, toilet paper, etc. down the drain than polluting reservoirs?
  - The students may then explain that in our homes the water that goes down our drains after using it is cleaned before it is put back into a natural reservoir.

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

We will do an exit ticket to break down all of the ideas of what we talked about during class, at the end of the discussion.

1. Do you think that the water you've used in your house for laundry, shower, sink can end up in your house again?

2. Why does it not pollute natural bodies of water when we put soap down the drain?

Individual Student Accomodations

Required Accommodations/Modifications:

- We can slow down if students are having trouble understanding what we are teaching.
- We have a teacher per student, so they will have individualized help.
- For students who need extra time, allowing them to have the time that they need.
- We will allow for the students to work with a partner, or have a teacher there to help them
- Give students brain breaks if they need a break from being on zoom

Additional Modifications for Individual Students:

- For students who were not in class last week, we will give the students an overview of the Freddy the Fish activity. We will be doing a recap of the activity, and if any of the students have any other questions about it, we will answer them and explain further.

Materials
REMEMBER to include Quantity. Also differentiate any materials for in person VS online.
These need to be emailed (philland@iu.edu) to Andrea each Wednesday by 5:00pm)

In person	Online ● Big bowl/tupperware for water ● paper/pencil for observations ● Materials will be found in students' homes and will vary.

Week 4

Grade level: 4th Grade

Driving Question for the unit: How do humans impact the water system?

Specific Lesson Question: How do humans pollute bodies of water even when we cannot see it?

Overview

For lesson 4, how will you contribute to answering your overarching unit question?

- This week, students will connect their knowledge of pollutants that can be found in the water and can hurt organisms to how humans put those pollutants in the water through different means. We will also introduce pH testing to further explain how humans impact water systems.

Disciplinary Core Idea Addressed in lesson:	**Science and Engineering Practices Addressed in Lesson:**	**Cross-Cutting Concepts Addressed in Lesson:**
Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)	Engineering will be incorporated through the students making pH strips with berries.	**Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)**

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]

Yes

No

The students will be making pH strips out of berries to test water that they find in their house. This activity incorporates engineering into our science lesson by the students creating a pH strip out of materials that they can find at home when they do not have a regular pH strip available. To make the strips the students will use mashed up berries that will be dried in strips that can be dipped into liquid. The strip will change colors to show the differences in pH.
https://www.stevespanglerscience.com/lab/experiments/berry-ph-paper-sick-science/

*If yes, be sure to CLEARLY state in the Learning Plan below **when and how** STEM will be infused.*

Learning objectives (outcomes):

What do you want students to be able to explain/state in response to the specific lesson question?

Students will be able to explain/state [USE KIDS' WORDS]:

- Students will be able to say "people pollute water by getting fertilizer, oil, cow manure, litter and sediment in water when there are farms, cars, people littering, and construction sites near bodies of water"
- Students will be able to say "different bodies of water have different pH levels depending on what goes in the water"
- Students will be able to say "some water sources are acidic and some are basic"

Learning Plan

(using the 5E model--Meredith will explain as needed)

In person

ENGAGE

- To start off the engagement, we will begin by talking about how the water system works while drawing a diagram on the board
- Before we draw the diagram on the board, students will be asked to draw a water system on their own piece of paper. They will be given the following parts
    - Natural reservoir
    - Faucets
    - Water treatment plant
- Students will then be told that there are more parts to the system but these are some elements
- Once they have created their own diagrams, we will come together as a class and create one ourselves
- We will ask questions about the water system cycle step by step, all while creating a visual of how water flows through the system on the board
- Discussion questions
    - Who remembers where the water in this faucet comes from?
        - Students will most likely answer either pipes or a lake/river etc
    - Where does the water go once it goes down our drains?
        - We anticipate students will say “septic tank” or “it goes through pipes to a water treatment plant”
    - What happens at the water treatment plant?

Adaptations for Online

(as needed by phase)

ENGAGE

We have no online students

EXPLORE

EXPLAIN

- Students will most likely say “it gets filtered there”
- Does anyone remember how the water gets filtered?
    - We assume that not students will know the specific answer and that’s okay, it was just to extend their thinking of water filtration. If they don’t remember, we’ll remind them back to week 1

- After the water treatment plant, then where does the water go?
    - We anticipate that students may have trouble connecting the water treatment plant back to the original reservoir. If they have troubles with this, we will ask them how the water is after it is treated, is it dirty or clean? If it’s clean, doesn’t it have to go anywhere else to be cleaned? Or can it go back to come to us?

- Now that the water is back in the natural reservoir, is it ready for us to drink?
    - We anticipate students will say no
    - What happens before it gets to us?
        - Students will say that it gets treated again

- At this point on the white board, we will have a full diagram of how a water system works and we will then draw arrows in the way that the water flows through it

- Then we will question students of “what happens if the original reservoir looks like the water from Freddy the Fish?”

EXPLORE

- We can see how litter or pollution makes the water dirty, but how is the water actually harmful? How can water be harmful even if we cannot see physical pollution in it?

- How do you think we know there is something harmful in the water if we cannot see the harmful thing?
    - For example, we cannot see fertilizer in water but is it harmful for us to drink or for plants and animals.

- Testing water samples with premade pH strips (NOT BERRY ONES)
    - Begin by testing the pH of water
    - Testing some basic, some acidic mixtures
        - Students will test mixtures of:
            - Water with lemon juice
            - Water with baking soda
            - Regular sink water
            - Water with vinegar
            - Water with dish soap
    - Ideal pH is 7

- Discuss observations with students on this activity

- Creating our own pH strips
    - https://www.stevespanglerscience.com/lab/experiments/berry-ph-paper-sick-science/
    - Students will:
        - Be given strips of paper and a ziploc bag of berries
        - Crush these berries until they look like jam

- add a small amount of water to thin the juice
- Mix it all up and pour berry liquid into a bowl
- Dip strips of paper them into mashed berries
- Push the strips all the way into the berry mush to make sure they are coated with the juice
- Pull the strips between thumb and index finger to remove excess juice and pulp
- Lay the strips onto paper towels and allow them to dry
- Take home strips in ziploc bags and test two water sources in their home (water bottle, sink water, water from fridge or filtered pitcher)

EXPLAIN

- For the first half of the explain, we will go more in depth of what pH is and the pH scale
    - What do you think pH is?
        - We assume students will say that pH is a way that water is polluted in a way that we can't see
        - To that, we will respond the pH is after effect of water pollution
        - pH refers to the amount of hydrogen in water and there is a scale to determine how much water is in the scale
- We will then draw the scale 1-14 on the board
    - What do you think is the sweet spot where water pH should be?
        - We assume students will say "7" or "in the middle"

- What do you think would happen if the water was either too basic or acidic?
    - We assume students will give a wide array of answers to which we would respond “could we drink it?”

- We will have a discussion during the explain about the benefits of using scientific tools such as pH strips and what the pros and cons of homemade pH strips are
    - Why is it beneficial that we can use these?
    - Do you know other scientific tools that you can make at home?
    - Have you ever made any scientific tools at home?

ELABORATING/EXTENDING Understanding

(WHOLE CLASS -- last 30mins together -- building your class Content Storyline)

- Have students each create a personal drawing. Students will be assigned a particular pollutant. The student will be asked to draw a water source with that pollutant in it. Ex:
    - Draw a water source with fertilizer in it. Now, what do you think is surrounding this water source that causes fertilizer to get in there? Draw it.

- Students will share their drawings and we will follow with this discussion:
    - If a water source is polluted with a lot of fertilizer, how do you think this is getting in there?
        - Where do you think this is coming from?

The students may answer that this comes from farms or gardens, among other things.

- What kinds of places do you think are surrounding this water source?

The students may answer farmland, country areas, places with gardens, places that grow food.. ect ○ If a water source is polluted with a lot of cow waste, how do you think this is getting in there? ■ Where do you think this is coming from? The students may answer that these come from farms, or from mulch. ■ What kinds of places do you think are surrounding this water source? The places a student may answer include meat or dairy farms, ranches with cows on them, neighborhoods that use manure... ○ If a water source is polluted with a lot of oil, how do you think this is getting in there? ■ Where do you think this is coming from? The students may answer that the oil can come from cars, boats, planes, and other things along those lines. ■ What kinds of places do you think are surrounding this water source? The students may answer roads, gas stations, airports, and other places ect... ○ If a water source is polluted with a lot of litter and trash, how do you think this is getting in there? The students may answer parties, picnics, and other human activities that lead to litter. ■ Where do you think this is coming from? The students will say from humans and list different ways humans litter like parties, athletic events, picnics, along with other activities. ■ What kinds of places do you think are surrounding this water source?	

The students will say places where a lot of people are, this includes stadiums, parks, houses, and areas with a lot of people. ○ If a water source is polluted with a lot of sediment, how do you think this is getting in there? ■ Where do you think this is coming from? The students may say construction, erosion, rivers, ect... ■ What kinds of places do you think are surrounding this water source? The students may say it's near construction sites, or in places where erosion has occured ect….	

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- Students will meet objective 1 by doing the drawing activity and through class discussion
- Students will meet objective 2 by the class discussion of pH in class

Individual Student Accomodations

Required Accommodations/Modifications:

- We can slow down if students are having trouble understanding what we are teaching.
- We have a teacher per student, so they will have individualized help.
- For students who need extra time, allowing them to have the time that they need.
- We will allow for the students to work with a partner, or have them work with a teacher.
- If the students are struggling making the pH papers, the teachers will be there to help

Additional Modifications for Individual Students:

- No additional modifications for individual students

Materials

REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

These need to be emailed (philland@iu.edu) to Andrea each Wednesday by 5:00pm)

In person (Things highlighted is what we will provide)	**Online** **We don't have any online students :)**
● Cups- 8 cups ● pH paper- 30 strips ● 3 cups of berries (blackberries, blueberries, or strawberries) (½ a cup per student) ● 8 pages of white construction paper (card stock) ● 8 small bowl ● 8 fork ● 8 teaspoon ● 8 ziplock bags ● 8 pairs of scissors ● 2 cups of vinegar ● A container of lemon juice ● 2 cups of dish soap ● 2 cups Baking soda ● Colored Pencils-20 pencils of all colors ● 20 sheets of paper	

Grade level: 4th Grade

Driving Question for the unit: How do humans impact the water system?

Specific Lesson Question: How does human pollution make its way into water sources?

Overview		
For lesson 4, how will you contribute to answering your overarching unit question? ● This contributes to our overall unit because we are finally talking about how humans impact the water system through runoff. Without humans having pollutants on land, there would be no pollutants in the runoff that go to large water reservoirs.		
Disciplinary Core Idea Addressed in lesson: **Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)**	**Science and Engineering Practices Addressed in Lesson:** Engineering is being used in this lesson with students building and constructing their own runoff models.	**Cross-Cutting Concepts Addressed in Lesson:** **Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)**

Will another discipline of STEM (other than science) be included in this lesson? [highlight your response]

Yes

No

We are using engineering in our lesson by having the students build and construct a runoff model. The students will be building a replica of where runoff occurs with the provided materials. The materials they will be given to build this model will be a baking sheet, soil, pebbles, large rocks, sand, leaves, and twigs.

Learning objectives (outcomes):

What do you want students to be able to explain/state in response to the specific lesson question?

Students will be able to explain/state [USE KIDS' WORDS]:

- Students will be able to explain how pollutants get into the water through runoff. The students will be able to say, "When it rains, it causes the different pollutants like fertilizer, oil, litter and harmful chemicals to get pushed into our waterways."

- The students will be able to make inferences about where an area is located based on the pollutants surrounding it. This will look like a student seeing that there is a significant amount of fertilizer, cow manure, pesticides and other harmful chemicals, and they can infer that this is close to a farm.

Learning Plan

(using the 5E model--Meredith will explain as needed)

In person

ENGAGE

- Before we start this lesson, we are going to have a whole class conversation about respect and what that means to respect each other. This won't take long, but it is very important that we discuss this and have a mutual understanding.

- Begin the lesson with a discussion on whether or not the students used their pH strips from last week
    - Did you all use your pH strips that we made last week?
        - We anticipate that some students will say yes and others probably didn't
    - Which water sources did you test with them?
        - We anticipate that students will say from the kitchen faucets and from the shower
    - What did you see happen?
        - We anticipate answers may vary based upon student
    - Did the strips change color a lot?
    - What do you think this color change means for the water in your house?
        - Depending on the change, students will say whether their water is acidic, basic, or neutral
    - Were the colors different in different sources from your house?

Adaptations for Online

(as needed by phase)

ENGAGE

We have no online students

EXPLORE

EXPLAIN

- Can we trust these pH strips 100%? Why or why not?
    - We anticipate that students will say that we can't trust these strips 100% because we made them and they weren't made by a machine/factory. We will then bring up the idea of human error again and how that affects scientific tools that we make
- So now that we know that we can visibly see water pollution and we know how to test water pollution when we don't see anything, how do pollutants get in the water in the first place?
    - Last week Carlos had said something along the lines of "the water goes downhill" as students were leaving so we will emphasize this idea.

EXPLORE

- Water system station activity
    - Students will create a water source in a specific "area" of their choice (whatever human activities the water source is near) by picking out pollutants from the centered table (different shape and color pieces of paper that represent different pollutants) and adding them on top of their piece of paper
    - We will create a legend on the board of different pollutants
        - Pollutants:
            - Oil
            - Litter

- Pesticides/Fertilizer
- Sediment
- Sewage
- Metals

○ These areas will include a farm, construction site, a park, a gas station, a factory, a garden

○ We are using colored papers to demonstrate the pollutants over the actual pollutants because some may be hard to see to the visible eye. Last week we focused on pH and how that can help us see if water is polluted even if we can't see it to the naked eye. We will tell students that this is the "microscopic" level of pollutants since last week they said we can use microscopes to look and find pollutants

○ Once students have made their own "water sample" they will create a data sheet to use to make observations about their classmates samples and make predictions of what their classmates predicted

○ Students will then circle around the classroom and observe the other students' water sources and write down their inference for what they believe each water system is near.

○ We will all come together as a group and share and compile our data together. We will discuss similarities and differences

■ What did you guys notice in (student's name) model?

- Some anticipated answers for this question "I noticed that their model that the water soaked into the ground, or that the water changed the color of the rocks."

They may also say that “there was a lot of litter shown in this model compared to a different one.

■ Was there a lot of one pollutant? Which one?

- The students may say “yes in this model there was a lot of oil, while in my model there was a lot of fertilizer,” Or they could say “no there was a lot of different pollutants”

■ Were there any pollutants you didn’t see?

- The students may answer that there are based on our conversation from last week about pH. There are sometimes pollutants we don’t necessarily see.

■ Where do we think this water sample is near? Why?

- We anticipate that the students will make inferences based on the different pollutants found at each system. They may say “in this model, there is a lot of oil, and litter, I can imagine that this is close to a road or a gas station.”

■ How do you think these things could get into the water?

- We anticipate that students may be able to describe runoff without actually putting a name to it

○ After we have talked about each students sample, we will begin out runoff model activity Runoff model ○ Discussion: ○ What can we do to replicate the process of the pollutants getting into the water? ■ We anticipate that students will say something along the lines of “creating our own river” or “create our own” ○ Students will then be given materials to create their own runoff model ○ Before starting the model, we will discuss student predictions: ■ From what we’ve been learning about pollutants, what do you think we might see happening in our models if we add pollutants at this point in the system? ● Some anticipated answers to this question will be that the water will run down towards a water source and get into the water source (runoff) ● Pollutants would not be good for the plants and animals in this system. Or that the water and rocks will change color. ■ How do you think we will see pollutants getting into the water source? ■ The students may answer, we could see them being near a specific water source, like litter by a river, or oil	

by a road that is near a water source. There could be several answers for this question.

- What about when it rains? Does it soak into the ground?
    - Some anticipated solutions to this question will be that the water will seep into the ground and move down to the water source.

- There will be 2 types of models and each student will be assigned one type
    - One model: top-running water/runoff
        - Baking sheet is separated into two parts by cardboard, one section is a water source, the section next to it is soil. Students can make a little path with their finger to help water go over the top of the soil and into the water source area- runoff
        - Little pieces of packing peanuts and food coloring are picked up by them pouring with the watering can and brought into the watering source.
    - Second model: water/rain soaking down into the ground and going back to the water source
        - each student gets a baking sheet, fills it with soil, pour green “polluted water”over the soil, hole in the baking pan that would go to the water bucket on the floor next to the hole (this is the rain idea)

	layering the soil (pebbles, large rocks, sand, leaves, twigs ● Represent the pollutants that might be in the soil, use droplets of food coloring in their layers, small bits of styrofoam, packing peanuts, fine pieces of things that can move through the hole ● Water will be poured over like rain ● Things can get contaminates from going through the ground	
Don't layer soil part all the way to the top because it is a waste		
<u>EXPLAIN</u> We will go around the class and watch each student's models work one by one. After doing this, we will compile our data by discussing the implications of our experiment. ● What are some things we noticed about the first kind of model?		

● Some anticipated solutions to this is that the students will say “In the first model I noticed that there were pieces of styrofoam and packing peanuts in the water, and the water stayed at the top of the model.” That the students could see the water in this model more clearly and it did not seep into the ground. ● What are some things we noticed about the second kind of model? ● Some anticipated solutions for this will be that the students will say, “In this model, I noticed that the water seeped into the ground and you could not directly see the water, but you can tell it was there based on the color change of the rocks and the leaves.” ● Why did you choose to use this particular material for your model? ● The students may say that they picked the materials because it allowed for them to have a clear representation of what actually happens. They could look at the colored dye and make a guess of what that is in real life. ● Do you think this happens in real life? ● The anticipated solution is that the students will say yes, that water leads into more water and carries the pollutants with the rain. Or they could say no, and we could work to make that connection. ● How did the source water look before and after we poured the rain and runoff water on our models? ● Our water source looked a lot cleaner and was clear it was poured over ● How do we see that pollution surrounding a body of water affects that water source’s pollution level? **<u>ELABORATING/EXTENDING Understanding</u>**	

- What are these things caused by?
    - We anticipate students will say that rain is the main thing causing runoff but we will direct them into saying that it is humans that is the problem
- Start a small discussion on how humans could lessen their impact to prepare for the next lesson.
    - What are some ways you think that humans could help lessen these issues that we saw here today?
        - We anticipate students saying “less littering or adding filters to stop the pollution”
    - From the models we made, what are some ways you think we could fix this problem?
    - Stormwater runoff pollution and how to reduce it (has a top 10 list of how to reduce runoff) (we will go to this after students generated their own ideas)

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- Students will meet objective 1 through the discussion of the results and data they collected on the water in their runoff model.
- Students will meet objective 2 through the discussion after completing the model of the water system station activity.

Individual Student Accomodations

Required Accommodations/Modifications:

- We can slow down if students are having trouble understanding what we are teaching.
- We have a teacher per student, so they will have individualized help.
- For students who need extra time, allowing them to have the time that they need.
- We will allow for the students to work with a partner, or have them work with a teacher.
- If the students are confused or need extra help, we will pair them with a teacher to have them explain the thing they are struggling with
- If students are getting overwhelmed with the topics, we will have a brain break included

Additional Modifications for Individual Students:

- If a student is having a hard time in the class, having one of the teachers pull them aside and have a conversation until they cool down.

Materials

REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

In person (Things highlighted is what we will provide)	**Online** **We don't have any online students :)**
● Foil baking tins (5) ● Soil (8 cups) ● Rocks (8 cups) ● Two packs of food coloring. ● Five watering cans (if not the students can share a few) ● Sand (5 cups) ● Packing peanuts or styrofoam (2 cups) ● Leaves and twigs ● Five buckets ● 8 pieces of paper ● Cardboard	

Week 6

Grade level: 4th Grade

Driving Question for the unit: How do humans impact the water system?

Specific Lesson Question: How can we teach others how humans impact the water system?

Overview		
For lesson 6, how will you contribute to answering your overarching unit question? **This lesson contributes to our overarching unit question because students are displaying their knowledge over the past 5 weeks. They are creating short skits/scenarios etc. to display their knowledge of how humans impact the water system. This will wrap up our unit and come to a final answer of our driving question.**		
Disciplinary Core Idea Addressed in lesson: **Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)**	**Science and Engineering Practices Addressed in Lesson:** No STEM will be infused this week	**Cross-Cutting Concepts Addressed in Lesson:** **Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)**
Will another discipline of STEM (other than science) be included in this lesson? [highlight your response] **Yes** **No**		

Learning objectives (outcomes):

What do you want students to be able to explain/state in response to the specific lesson question?

Students will be able to explain/state [USE KIDS' WORDS]:

- Students will be able to explain that humans impact the water system through pollution and their everyday water use . The students will be able to say "Humans put pollution and other bad things into the waterways through construction, pesticides, fertilizers, and other chemicals that can hurt the animals living in the waterways"

- The students will be able to have a firm understanding of how pollutants get into the waterways. The students will be able to say, "through rain and runoff, pollutants can get into the waterways and have significant effects on plants and animals."

Learning Plan

(using the 5E model--Meredith will explain as needed)

In person

ENGAGE

- We will review/recap the past 5 weeks with students to refresh their memory
    - We will create a poster on the board as a class
    - The poster will section off each week with our driving question at the top
    - Students will discuss what we learned that week and we will record it
        - Do you remember what we did in the first week? What are some things that stuck out to you from what we learned that week?
        - The students may say, “yes I remember we built a water filter and went down to the creek” or they may say it was a long time ago, and they don’t quite remember, so we can help them remember by reminding them of the activities we did. They may remember the video we showed them about Flint, Michigan and the water there.
        - The first lesson we did revolved around cleaning water using a water filter.
        - Do you remember what we did in the second week? What are some things that stuck out to you from what we learned that week?
        - The students may say “yes we did the Freddy the Fish activity and we saw

Adaptations for Online

(as needed by phase)

ENGAGE

We have no online students

EXPLORE

EXPLAIN

	how pollution is harmful to animals" They may discuss how we looked at pictures and videos of pollution in the water ways. Some of the students were not present this week so they may not remember ■ Do you remember what we did in the third week? What are some things that stuck out to you from what we learned that week? ■ The students may talk about how we learned about where water goes after it leaves our houses, and the water filtration plant. We had a lot of discussions surrounding these ideas this day. Some of the students were not present this day. ■ Do you remember what we did in the fourth week? What are some things that stuck out to you from what we learned that week? ■ The students may say, "During the fourth week we looked at the pollution in the water that we could not see, we used pH strips to be able to tell what the pollution is and how it can't always be seen." All of the students were present this week. They could say we also created our own pH strips. ■ Do you remember what we did last week? What are some things that stuck out to you from what we learned? ■ The last week the students may say that they learned about how pollutants get into the water ways through rain. We created the models to show this. ○ Go over:	

- Water System
- Filtration
- Run-Off
- Pollutant
- Water Pollution
- Fertilizer
- pH

- Poster will be left up for students to reference back to and look at for information to help with the creation of their video

- The teachers will also be floating around between the different groups and discussing with them and helping them with the different aspects of their work.

EXPLORE

- For our explore section this week, students will be creating a video to display what they have learned from the rest of our unit.

- Our driving question will be posed as the basis of this video: “How do humans impact the water system?

- The students can create any type of video that that they like, including (but not limited to):

  - News show
  - Public service announcement
  - Play/scenario
  - Infomercial/commercial
  - Teachers teaching a zoom lesson

○ Interview ○ Stop motion/puppet show ○ A how-to video ○ Game show (like jeopardy) ● Students videos should be up to 5 minutes ● Students will be broken into two groups ○ Jackie, Carlos, Ferris ○ Keith and Berkeley ● Students will create scripts, a setting, props, and any other necessities to make their video seem realistic and accurate with materials given ● In these plays, they will be discussing the topics that we previously learned about and addressing them. This will allow for students to use their prior knowledge in a fun and interactive way for all the students to get involved. ● The teachers during this time will be floating around from one group to the other helping the students with their videos. **EXPLAIN** ● Students will share out their videos and we will discuss them ○ Why did you choose this type of video? ○ The students may say because it sounded like fun or because they thought it was the easiest way to teach about these different topics.	

- What did you like about ____'s video?
- The students may say they liked it because they liked how fun it was or that they thought it had a lot of good information.

- Discuss any elements that students may have missed

- Discuss things that students found difficult and easy about this activity
  - What things did you find difficult about this activity?
  - The students may say it was hard to incorporate all of the ideas we have learned into this activity and that it was hard to create a script.

- Discuss how videos are a useful tool to use as scientists
  - How are videos a useful tool as scientists?
  - The students may say that videos are a good way of letting people know the information and allow for everyone to be involved. It also allows for the information to get spread.

ELABORATING/EXTENDING Understanding

- Discussion Questions surrounding our time
  - What has been the thing that has stood out to you most throughout Saturday Science?
    - The students may discuss the pollution, the pH papers, the effect pollutants have on plants and animals, they could talk about water filtration, where water goes when it leaves their houses…

- What is something that you learned that you can implement in your day to day lives?
    - We anticipate students will focus heavily on not polluting water sources
- Looking back to Flint Michigan, what are some ways you think can help? What kind of pollutants do you think is in Flint's water?
    - We anticipate students will say that they can help flint by cleaning their original water source. We believe students won't necessarily know what kind of pollutants are in Flint's water, so we can give them hints of the kind of city Flint is in and we can talk about the pipes in flint as well
- If you saw someone throwing some trash on the ground, what would you say to them and why?
    - We anticipate that students will say that they shouldn't be littering because that litter can get into water and pollute the water.
- If you could summarize what we learned the past 6 weeks in one sentence, what would you say?
    - We anticipate these answers will vary but will include the terms "pollution" "water system" and "harmful"

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will evaluate this based on the quality of script that students create and the quality of the execution of their video

Individual Student Accomodations

Required Accommodations/Modifications:

- We can slow down if students are having trouble understanding what we are teaching.
- We have a teacher per student, so they will have individualized help.
- For students who need extra time, allowing them to have the time that they need.
- We will allow for the students to work with a partner, or have them work with a teacher.
- If the students need a break from the lesson or discussion, we can offer brain breaks

Additional Modifications for Individual Students:

- If a student is having a rough time in the classroom, one of the in-person teachers will take a walk with that student and calm them down.
- If a student is having trouble understanding the lesson, one of the teachers will work with that student specifically to help them understand.

Materials

REMEMBER to include Quantity. Also differentiate any materials for in person VS online.

In person (Things highlighted is what we will provide) ● Painter Tape ● Scotch tape ● Markers-Three packs ● 5 scissors ● Posters- five posters ● Two to Three IPads ● Colored paper- 20 sheets ● White paper- 20 sheet ● Large Post-it Notes- 6	**Online** **We don't have any online students :)**