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| **Water Dawgs Lesson Plan**  **Topic: Water Pollution Prevention**  **Learning Module #19** | | | |
| **Lesson Objectives(s):** | | * SWBAT describe methods for mitigating problems related to urban runoff and polluted streams. * SWBAT create a stream pollution prevention plan to minimize problems related to urban runoff and improve stream water quality, | |
| **Associated NGSS Standard(s):** | | * HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. | |
| **Associated A.P. Environmental Science Standard(s):** | | * STB-1-B-Describe methods for mitigating problems related to urban runoff | |
| **Materials:** | | * PowerPoint * Printed materials:   + Lesson worksheets (WS) – 1 copy per student * Excel file (E1) for Stream Pollution Prevention Activity * Access to computers or laptops – 1 for each student * Headphones – 1 for each student (for Water Blues, Green Solutions activity) | |
| **Instructor to do before lesson:** | | * Print:   + Lesson worksheets (WS) – 1 copy per student * Email excel file to students (E1) for Stream Pollution Prevention Activity * Look over PPT/Lesson plan   + ***NOTE -> The directions to the Stream Pollution Prevention Plan Activity are complicated. Make sure you have read through the directions thoroughly and have also familiarized yourself with the excel file BEFORE the lesson.*** * Make sure Water Blues, Green Solutions (waterblues.org) website is up and active (i.e., hasn’t changed). * Secure student access to computers or laptops. | |
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| **Part of Lesson** | **Time** | **Duration** | **Lesson** |
| **ENGAGE** | 9:00 | 15 min | Opening Activity  \*\*Pass out lesson worksheets (WS).  \*\*Have students answer the following question on their lesson worksheet as a think, pair, share:  Over the past weeks, we have learned all about how and why streams and rivers can become polluted. Today, we are going to be focusing on potential ways to prevent (or mitigate) stream and river pollution.  Question 1: What are some ways that we can prevent our streams and rivers from becoming polluted?  ^^Allow 8 minutes for students to write. Allow 3 min for sharing with a partner, and 4 minutes for a class discussion. |
| **EXPLORE** | 9:15 | 1 hour | Water Blues, Green Solutions  \*\*Play the first 2:33 of the Water Blues, Green Solutions: Full Movie  *🡪 NOTE: you may want to skip the adds/sponsors*  <https://www.waterblues.psu.edu/themes/penn-state/full-movie>  \*\*Explain that instead of watching the full movie, students will explore the website on their own to learn about green solutions to water pollution.  \*\*Have students navigate to  Waterblues.org  \*\*Explain that each tile represents a video or audio clip of different solutions to water pollution. You will spend the next ~20 minutes exploring the website watching and listening to these clips in order to learn about various solutions to water pollution.  \*\*Go over instructions for the activity:  For each clip you choose to watch our listen to on waterblues.org, use the table below to write down:   1. The title of the clip 2. 1-2 sentences about the pollution “solution” described in the clip.   *🡪 NOTE: You may want to watch one clip as a class to show students an example of what to write down in the “pollution solution” column*  \*\*Students should listen to clips through headphones. You should be able to get through at least 5 clips.  ^^Allow students ~20 min to explore website.  \*\*Go around the class and have students pick a “pollution solution” they learned about on the website to:   * Do additional research on this solution * Create an information PowerPoint slide about this solution   *🡪 NOTE: Have each student pick a different “solution” from the website.*  \*\*Explain what the information PowerPoint slides should include:   * Title * 1 or 2 PowerPoint slides * 2 or more images * Description of how the solution helps prevent water pollution   Additional notes:   * You will have approximately 25 min to complete your research and create your PowerPoint slide(s). * When your slides are complete, send them to your instructor. * You will be presenting your slide(s) to the class.   ^^Allow students ~25 min to do research on their pollution solutions and create their slides. |
| *BREAK* | 10:15 | 15 min | *BREAK*  \*\*During this time, make sure all students have sent you their PowerPoint slide(s) and arrange them into a PowerPoint. |
| **EXPLAIN** | 10:30 | 30 min | Solutions to Stream and River Pollution  \*\*Have students come up one at a time to present their PowerPoint slides on pollution solutions.  \*Students will have ~3 minutes to present their slide and 1-2 minutes for questions from the rest of the group.  \*Students do not need to write anything down during the presentations, but they can take notes on their own, if they so choose.  ^^Allow ~30 min for presentations and discussions. |
| **ELABORATE** | 11:00 | 1 hour | Stream Pollution Prevention Plan  \*\*Make sure you have sent the excel file (E1) to students.  \*\*Split students up into partners (or have them pick a partner).  \*\*Go over the directions to the activity using the excel file and the directions which are on the lesson worksheet, and also repeated in the PPT.  *🡪* ***NOTE****: Make sure to note the notes to you (the instructor) below, which will help the activity to go as smoothly as possible.*  \*\*Read out the scenario to students (or have a student read the scenario)  **Scenario:**  You and your partner are a freshwater scientist and landscape architect at Blue Ridge University.  There is a stream that runs through the STEM Campus of Blue Ridge University called Reedy Creek. In a recent water quality monitoring event, you found that Reedy Creek is polluted. You determined that Reedy Creek has high levels of:   * Conductivity * Nitrogen * Phosphorus * *E. coli*   In hopes of improving the water quality of Reedy Creek, you and your partner have just been awarded a $10,000 grant to install eco-friendly design features to the STEM campus of Blue Ridge University.  \*\*Next, have students open up the Excel file and look through each tab.  *🡪* ***NOTE:*** *You may want to save looking through sheets 4 and 5 (the example sheets) for AFTER you have explained the directions.*  Open up the excel file sent you by the instructor.   * Sheet 1 – Reference Map   1. This is a reference map of the campus.   2. You will NOT make changes to this sheet.   3. Notice the map is split up into squares. Each square represents an area of 5 feet x 5 feet. * Sheet 2 – Stream Pollution Prevention Map   1. This is the very similar to the reference map, except you will notice there is now a separate key that includes eco-friendly design features.   2. This is the map you will use for your Stream Pollution Prevention Plan (i.e., the one you WILL change). * Sheet 3 – Budget   1. This sheet includes costs of each design feature. This sheet will also allow you to calculate the total costs of your Stream Pollution Prevention Plan.   2. You will ONLY make changes to the yellow column. Do not change anything in the red column, unless instructed to do so! * Sheet 4 – Example: Steam Pollution Prevention Map   1. This is an example of a Steam Pollution Prevention Plan.   2. In this example, the only eco-friendly design element this team added was making the entire parking lot porous pavement. * Sheet 5 – Example: Budget   1. This is an example of a Costs sheet   2. In this example, the only two eco-friendly design elements this team added were:      1. Making the entire parking lot porous pavement (400 squares, $8000)      2. Creating educational materials (1; $2000)   \*\*Next, explain the directions for the activity to the students:   * You and your partner will have ~50 minutes to design a Stream Pollution Prevention Plan for Reedy Creek at Blue Ridge University. * To do this, you will select the TYPE of eco-friendly design features that you want to include in your plan, and the NUMBER of each (based on 5x5 foot squares). You will create your plan on:   1. Sheet 2 – Stream Pollution Prevention Map – Indicate/design the eco-friendly features you are choosing to add by changing the colors of the squares according to the key.   2. Sheet 3 – Budget ­– Keep track of your costs of the eco-friendly features you are choosing to add by indicating the number of squares of each feature using the yellow column. This will automatically add up your total costs, and the grant money you have left.   *🡪* ***NOTE:*** *This would be a good point to show the students sheets 4 and 5 (the example sheets).*  ***🡪 NOTE: Even after you show students the example Map and Budget, we also highly recommend actually demonstrating to students how to change colors of the squares in the Stream Plan Map (i.e., “add’ design features), and demonstrate how to correctly use the Budget sheet.***   * ***For example, show students how you would add 20 trees in by changing 20 squares to dark green. Then, you would need indicate that feature in the budget by adding “20” in the yellow column next to “Trees.”***   \*\*Go over important notes/rules for the activity:  A few important notes:   * You must stay within your budget ($10,000). * You CANNOT remove buildings, but you CAN remove other features if you so choose (grass, trees, sidewalk, road, parking lot).   1. There is no cost to remove features (only costs are to install features).   2. You can alter the buildings by adding green roofing. * You must balance the needs of the stream with the needs of the students and faculty/staff on campus.   1. For example, you could replace the roads and parking lot with grass… but how would students and teachers get to work?   2. As another example, you replace the sidewalks with dirt, but would this be sustainable in the long term? * There is a suggested key of colors for the eco-friendly design features, but you can change this key if you so choose (i.e., choose different colors). * “Education materials” is not a design feature, but a could be a part of your Stream Pollution Prevention Plan. So, you will need to decide whether to create educational materials (spend all $2000 dollars) for the students at Blue Ridge University or NOT to create educational materials (spend nothing; $0).   1. If you decide to create educational materials, you will insert a “1” in the yellow column beside “Education materials” and then describe what kind of educational materials you plan to create in your presentations.   2. Examples could of informational material (but are not limited to):      1. Informational signs on importance of water quality      2. Brochures on importance of water quality      3. Lesson plans for STEM classes on the University Campus * If there are design features that you want to include in your plan that you DON’T see on the list, just ask your instructor how much that feature should cost per square. Your instructor will help you add it into your costs page. * You can count the number of squares by multiplying, or by using the “=countblank()” command in excel. Your instructor will show you an example, and there are instructions under the “Restoration Design Features” Key.   *🡪****NOTE****: We suggest you demonstrate students how to use the “=countblank()” feature to count squares.*  \*\*Go over what students will need to include in the presentation:   * After you have created your Stream Pollution Prevention Plan, you will have you will have ~5 minutes to present your team’s plan to the rest of the class and ~2 minutes for questions. During the presentation, you will need to: * Use your Stream Prevention Plan Map sheet to:   + Discuss which of the design features you chose to add and why you chose those features.   + Show where you chose to add each of the features (i.e., we decided to plan trees around the Science building). * Use your Budget sheet to:   + Discuss how much you spent on each of the design features, and how much of your budget you had left over (if any).   + If you chose to add educational materials, explain why you chose to add this feature, and what kind of educational materials you would have created.   \*\*Finally, go over final tips:  Before you get started, it would be helpful to discuss with your partner:   * Which design features do we want to include in our plan and why? * Which design features do we not want to include in our plan and why? * Where do we want to place our design features? * How many of each feature do we need to cover the desired area?   Feel free to experiment with your Budget before you decide on your final Plan!  ^^Allot ~10-15 min for directions. Allow students ~45 minutes to create their maps and budget.  \*\*As students work, you should circulate the room, providing help and answering questions as needed.  *🡪* ***NOTE****: Student may want to add a design feature that is not already listed (e.g., maybe they want to build a marsh). Students will need to ask you how much that design element would cost per square (take your best guess), and then they can add it to their design plan.*  \*\*Remind students to email you their excel file once they are done with their Stream Pollution Prevention Plan. |
| **EVALUATE** | 12:00 | 30 min | Stream Pollution Prevention Plan Presentations  \*Students will present their Stream Pollution Plans to the class. They will have ~5 minutes to present their plan to the class and ~2 minutes for questions.  \*\*You should refer to the “Presentations” guidelines (on above, on the worksheet, and in the PowerPoint) for further directions.  ^^Allow 30 min for presentations. |