



Title: Stream Table Investigation	
Author: Jim Magee Brookland High School Brookland	
Course: Environmental Science	Duration: 1-45 minute class
Grade: 11 – 12	
Objective: Students will observe erosional capabilities of moving water as related to earth surface components and relate those to water quality at oil and natural gas drill sites.	
Summary of Lesson: Students will model a stream and show movement and changes in the surface due to changes in stream flow. Following this activity students, will conduct research on EPA regulations and Arkansas Best Management Practices for water quality at oil and natural gas drill sites.	
Standards: Common Core State Standards, Arkansas	
CODE	STANDARD
PD.1.ES.6	Describe the processes of degradation by weathering and erosion
SP.3.ES.3	Explain common problems related to water quality: conservation, usage, supply, treatment, pollutants.
SP.3.ES.2	Investigate the relationships between human consumption of natural resources and the stewardship responsibility for reclamations including disposal of hazardous and non-hazardous waste
SP.3.ES.3	Explain common problems related to water quality: <ul style="list-style-type: none"> • conservation • usage • supply • treatment • pollutants (point and non-point sources)
SP.3.ES.4	Explain problems related to air quality: <ul style="list-style-type: none"> • automobiles • industry • natural emissions



SP.3.ES.6	Research how political systems influence environmental decisions
SP.3.ES.7	Investigate which federal and state agencies have responsibility for environmental monitoring and action
<p>Teacher Excellence Support System (TESS): Domain 1b: Teacher Knowledge of students. (learning types) Domain 1d: Demonstrating knowledge of resources. (use what is available) Domain 3c: Engaging students in learning. (get them involved)</p>	
<p>Instructional Strategies and Practices: Independent research, Simulation, Conducting experiments</p>	
<p>Bloom's Level: Highest Level Only Understanding</p>	
<p>Materials and Resources:</p> <ul style="list-style-type: none"> • Stream tables or wall paper trays. • Sand • Water source such as a watering can with small holes in the spout • Rocks, sticks, leaves, etc. (to create debris, blockages, dams, etc.) • Websites for research: <ul style="list-style-type: none"> http://www.naturalheritage.com/research-data/ahpdownloads.aspx http://lingo.cast.uark.edu/LINGOPUBLIC/reg/siteprep/index.htm www.blm.gov/pgdata/etc/medialib/blm/es/minerals.Par.90359.File.dat/ http://www.api.org/environment-health-and-safety/clean-water/surface-water-quality/surface-water-quality http://cfpub.epa.gov/npdes/stormwater/swppp.cfm 	
<p>Formative Assessment: Student group lab activity written report of results. Teacher made rubric for assessing oral report</p>	
<p>Notes to Teacher:</p> <p>The following was taken from: http://www.oilandgasbmps.org/resources/water_quality.php. Use it to introduce the stream table activity and explain why water quality issues are so important to the oil and natural gas industry.</p> <p><i>“Improved technological developments in directional drilling and hydraulic fracturing, more commonly known as “fracking,” have resulted in an oil and gas production boom nationwide. In October 2013, the U.S. Energy Information Administration announced that the United States would surpass Russia and Saudi Arabia as the world’s largest</i></p>	



producer of oil and natural gas by the end of the year. The boom has resulted in oil and gas development in regions unaccustomed to the industry as well as in regions that have a century-long relationship with oil and gas extraction. However, wastewater discharges, hydraulic fracturing fluid releases, improper casing/cementing, and other accidental spills pose potential water quality risks in areas where directional drilling and hydraulic fracturing technologies are utilized. Rapid development of oil and gas wells, particularly in urban and suburban areas, coupled with the practice of hydraulic fracturing, has sparked concern for water quality and an interest in laws designed to protect water quality”



Student Activity

1. Students fill trays/tables with sand to indicated level.
2. Monitor water flow through sand and observe changes in particles, movement, and erosional properties of water.
3. Students add items from those provided to see how erosion changes due to obstructions to water flow.
4. SUMMARY: Students learn basics of water flow and erosion properties of water. This activity allows them to see how different “objects” can affect the flow of water in a stream system, and thus how natural and man-made items can affect the movement of Earth’s surface materials. Trees, pylons, rocks, piers, docks, etc., all play a role in how water erodes the Earth’s surface.
5. Discuss how the activity relates to water quality on and around oil and natural gas drilling sites.
6. Allow students to self-select research groups of 3 to 4.
7. Each group will explore the mandatory and voluntary practices used by the oil and gas industry in Arkansas to protect water quality on and around well sites. A final report will be presented orally and will include visuals of typical methods used to safeguard the water supply. Encourage students to be creative in developing their report.
8. Provide the following list of websites:
 - <http://www.naturalheritage.com/research-data/ahpdownloads.aspx>
 - <http://lingo.cast.uark.edu/LINGOPUBLIC/reg/siteprep/index.htm>
 - www.blm.gov/pgdata/etc/medialib/blm/es/minerals.Par.90359.File.dat/
 - <http://www.epa.gov/environment-health-and-safety/clean-water/surface-water-quality/surface-water-quality>
 - <http://cfpub.epa.gov/npdes/stormwater/swppp.cfm>
9. Evaluate the reports and visuals with a teacher made rubric.