



**The Secrets Beneath Us**  
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**Mallard Creek High School**

This curriculum unit is recommended for any course typically taught in High Schools Grades 9-12. This unit can be taught during the fall and spring of school the year. However, learning maybe more engaging during the spring due to the effect of brownfields on the environment. This unit will enhance student engagement and the study of specific teaching standards for the Occupational Course of Study program (OCS). Teaching standards to be covered in this unit could include Science, Economics and Technology.

**Keywords:** brownfield, green space, waste, ground water, storm water runoff, hydrology, permeable, impermeable, topography, topsoil, land use, infrastructure, commercial, industrial, legacy, neighborhood, reclaimed, remediation, sediment, soil profile, pollution, nonpoint source pollution, point source pollution, zoning, urban renewal, sustainability

**Teaching Standards:** See [Appendix I](#) for teaching standards addressed in this unit.

**Synopsis:** This curriculum unit will integrate various North Carolina Essential Standards from Science, History and Economics. The objective of this curriculum unit will focus on students' understanding of the economic impact of Brownfields in Mecklenburg County, as well as how we contribute to environmental quality. Students will be introduced to research procedures on brownfields in their community. In addition, students will explore the contaminants of their chosen property and explore the health ramifications of a brownfield in their community. Students will be introduced to lessons and activities that explore how humans have contributed to the conditions of our waterways. In Module 1, students will gain the necessary vocabulary and access to utilizing an interactive map for research. Module 2 will focus on potential reasons the property became contaminated, explore how humans have contributed to brownfields and how humans can affect the future of restoration and sustainability. In Module 3, students will examine the economic effect of the property by creating a sustainable practice poster. The lessons can be extended to engage and illustrate urban stream syndrome near brownfield sites. Students will use an interactive map, journal conclusions and explore real-world examples. Finally, a field trip to the Mecklenburg County Assessor's office will enhance their understanding of the brownfield property exclusion and processes.

*I plan to teach this unit during the 2020-2021 school year to 15 students in Math/Science secondary grades 9-12.*

*I give permission for Charlotte Teachers Institute to publish my curriculum unit in print and online. I understand that I will be credited as the author of my work.*

## **Introduction:**

I am a Special Education teacher for the General Education Math II Inclusion class, in which I provide instructional support and strategies to the inclusion teachers so they can effectively differentiate their lessons to meet the needs of all learners. I adapt general education lessons and teach various subjects, such as reading, writing, and math, to students with mild and moderate disabilities. The most challenging situations that I face are pacing guides that require teachers to teach without taking into consideration that not all children learn at same rate. There are no “one size fits all” models. I develop Individualized Education Programs (IEPs) for each student, planning, organizing, and assigning activities that are specific to each student’s abilities. Therefore, I work with regular education teachers to adapt pacing guides that are modified to meet the unique needs of the students so that they are successful. In addition, I teach Math 1 in the Occupational Course of Study program (OCS). This program is designed to provide a sound foundation in preparation for adult living for students with disabilities. Through participation in a vocationally oriented curriculum and in relevant work experiences, students learn skills necessary to enter the world of work, retain employment, and seek other employment throughout their adult lives. The OCS program is designed for eligible students as determined by the IEP team and their individual skills needed to develop a foundation for work. This course of study consists of three components: (1) academic requirements (2) school and community-based work hour requirements (3) Career Portfolio.

## **School Demographics:**

According to Mallard Creek High Schools website, the school opened in 2007. It is located in the Northeast zone of Charlotte, NC on 24 acres of land formally owned by the Oehler family farm. Mallard Creek has over 2300 students and considers itself culturally diverse. However, the demographics of the school is 67 percent African American, 12 percent white, 12 percent Hispanic, 5 percent Asian and 4 percent multiracial. MCHS offers a wide range of academic programs to meet our diverse students’ needs. Providing virtual learning classes, a Project Lead the Way Academy of Engineering program, an AP Capstone program, and the NC College and Career Promise Program, which allows students to earn college credits while in high school. MCHS average graduation rate is 94 percent. The class of 2019 was offered more than \$11 million in college scholarships. MCHS received a grade of B from the state and has exceeded expected growth for the past five years.

## **Rationale of how the topic idea connects with students:**

Students living near these brownfields in Mecklenburg County are disproportionately exposed to contaminants and are more likely to suffer long-term adverse health conditions. Students will understand how brownfields effect urban waterways, and what can be done to prevent future generations, including their own children, from experiencing the long-term health effects of environmental hazards. Students will study the long-term health implications of living near brownfields as well as how pandemics such as Coronavirus/COVID 19 effect our urban waterways. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3222496/>

## **Content Research:**

According to the North Carolina Environmental Quality (NCEQ), a brownfield is real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or the potential presence of a hazardous substance, pollutant, or contaminant. The United States Environmental Protection Agency's (EPA's) Brownfields Program empowers states, communities, and other stakeholders to work together to prevent, assess, safely clean up, and sustainably reuse brownfields. Community stakeholders across the country have sustainably revitalize brownfields. The EPA supports projects that clean up contamination, preserve existing open space, reduce carbon footprints, reuse existing infrastructure, and revitalize communities. EPA's Brownfields Program provides grants and technical support to communities and other stakeholders that are cleaning up and reusing brownfields (North Carolina Environmental Quality 2020). Communities have a wide range of brownfield properties that include textile mills, gas stations, and abandoned steel plants. Redevelopment brownfield projects are reviewed and selected based on the type environmental benefit, project readiness, local capability, feasibility, sustainability, community need, and geographic diversity.

Charlotte has many abandoned, idled, or underused properties. In some cases, it is because past users have left the property with chemical contamination from their past operations. Uncertainty in the cost of site cleanup keep prospective developers of these properties away. The result are properties that remain both contaminated and abandoned. It can take several years of mitigation and uncertain site cleanup costs (that often can exceed the property value) creating barriers for redevelopment. The North Carolina Brownfields Program is able to provide property tax relief to developers and ensure that the redevelopment is completed safely for the public while helping many local communities to establish jobs, increase the tax base, and improve the quality of life in the surrounding neighborhoods.

On the other hand, gentrification is a growing concern in many urban areas, due to the potential for displacement of lower-income and other vulnerable populations. For example, minutes from uptown Charlotte the Helix South End Townhomes formerly the Kale-Bindex Brownfields site has been redeveloped displacing many area residents due to the new townhouses priced from the low \$200s to the mid \$400s. Gentrification in the area has forced out seniors that can no longer afford the cost of raising property taxes, and affordable housing for more vulnerable populations.

According to the North Carolina Environmental Quality (NCEQ), the property was originally developed in the 1960s and was occupied by Package Products Co. Inc. until 1975. From approximately 1980 until 2005, the property was occupied by Kale-Bindex, a book-binding company. The area surrounding the brownfields property in South End Charlotte has historically been used for industrial and commercial purposes. The Kale-Bindex property was entered into the DEQ's Brownfields Program in July 2012 (Brownfields Project Number 16028-12-060). The property was redeveloped by 2000 Hawkins, LLC. As part of environmental assessment activities on the property, chlorinated solvents were identified in soil, groundwater, soil vapor and indoor air above applicable DEQ standards. The chlorinated solvents found at the site are a class of chemicals that evaporate easily, known as volatile chemicals. When these volatile chemicals get in the soil or groundwater because of spills or leaks at a facility, they can evaporate and get into a building through seams and cracks in the building's foundation. This process is called vapor intrusion. When contaminants move indoors, people can be exposed to them by breathing indoor air. The main chlorinated solvent of concern at this property is trichloroethylene (also called trichloroethene or TCE). TCE is a manmade, colorless liquid used mainly as a solvent to remove grease from metal parts. It is also used in glues and paint

removers. Because of the contaminants present at the site, a land-use restriction was put into place that stated no building would be constructed until vapor intrusion mitigation measures were implemented to the satisfaction of a professional engineer licensed in North Carolina and approved in writing by DEQ. TCE Health Concerns The possible health effects from breathing TCE depend on its level in the air, how long you breathe the air with TCE, and if you are in contact with TCE during the first trimester of pregnancy. TCE at a level of 2.1 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) or more can be of concern for pregnant women in their first trimester because TCE above this level may increase the risk of damage to the heart of the baby during the time the heart is forming. Contact with TCE above 2.1  $\mu\text{g}/\text{m}^3$  does not mean it will cause heart damage to the baby; however, there may be a higher risk of heart damage. Breathing air with TCE over a long period also may affect the immune system of any individual, which fights off infections, and therefore may increase your chances of getting infections. Contact with TCE for a long time may increase the risk of kidney cancer, liver cancer and non-Hodgkin's lymphoma.

The following is an example of the projects timeline and shows processes with mitigation.

- December 2015: environmental consultant Hart & Hickman PC on behalf of the property developer submitted a Vapor Mitigation Plan. The vapor mitigation plan stated that no occupiable space was present on the bottom level of two of the planned buildings (now identified as Buildings 4 and 5), and therefore, no sub-slab depressurization systems were included in those buildings.
- July 2017: A Vapor Mitigation System Installation Report was submitted to DEQ that showed installation of the vapor barrier liner beneath all site buildings and active depressurization systems beneath Buildings 1, 2 and 3.
- November 2018: A site inspection by DEQ staff showed inconsistencies with the property layout as compared to the approved Vapor Mitigation Plan.
- December 2018: DEQ asked the Helix South End Homeowners Association (HOA) to submit a plan to conduct indoor air sampling in Buildings 4 and 5 that would verify vapor mitigation effectiveness.
- February 4, 2019: NC DEQ, DHHS, and the DEQ Secretary's Science Advisory Board confirmed the use of an Action Level of 2.1  $\mu\text{g}/\text{m}^3$  for TCE in indoor air of residential locations based on updated health science.
- April 2019: The HOA submitted an indoor air-sampling plan, which was approved by DEQ's Brownfields Program.
- July 2019: Initial indoor air sample results were collected. TCE results were below the immediate action level of 2.1  $\mu\text{g}/\text{m}^3$  of air but indicated that additional sampling was warranted by the presence of TCE within the units. August 2019: Sampling results were mailed to all townhome units and the Helix South End HOA.
- September 2019: Additional indoor air sampling was conducted within three of four townhome units in Building 5. Sample results showed vapor intrusion and TCE indoor air levels above the residential action level of 2.1  $\mu\text{g}/\text{m}^3$  of air in two units. Residents with TCE above the action level were notified in person. An Austin Air Health Mate Plus filter was provided as an interim measure to homes with results above the action level as well as to other units within Building 5.
- October 2019: Sampling was conducted in a home with an air filtration unit to verify the effectiveness at reducing TCE levels in the indoor air. Results confirmed effectiveness of the filtration system.
- October/November 2019: DEQ discussed the sample results with Hart & Hickman, the property's engineering consultant firm. Openings in walls where utility lines like cable,

telephone or waterlines enter the building could be conduits for vapor intrusion. During these discussions, the consultant firm suggests sealing utility conduits to reduce vapor intrusion.

- December 2019: Utility line openings were sealed in two units in Building 5.
- January 2020: Samples were collected to test effectiveness of sealing the utility conduits or wall openings. Results showed TCE within the units but below immediate action levels. DEQ requested additional sampling.
- August 2020: Additional indoor air sampling in all units within Buildings 4 and 5 was completed.
- September 30, 2020: DEQ received sample results from the August sampling. Results showed TCE above the action level in six of the 12 townhome units, and signs of vapor intrusion in the other six units. October 2020: DEQ staff shared individual results with each townhome owner. Air filters were offered for all residents of buildings 4 and 5 as a precautionary measure (even where TCE indoor air values were below the 2.1 action level) based on site variability, and are encouraged especially in units where people that could get pregnant, live or visit. DEQ conducted a community meeting to answer questions.
- October 5, 2020: Indoor air samples were collected to confirm the effectiveness of the interim indoor air filtration units within the residences where TCE was detected above 2.1  $\mu\text{g}/\text{m}^3$  .  
Next Steps in the process will be:
- Additional sampling is planned to identify where the vapor intrusion pathway is within Buildings 4 and 5. The developer will submit to DEQ a plan to sample soil gas in the sidewalls around Buildings 3, 4 and 5 in mid-October.
- DEQ is actively working with the developer on implementing a permanent approach to address the vapor intrusion pathway. The developer and DEQ are working on a written agreement describing these efforts. The specifics of the permanent solution depend on the source of the vapor intrusion.

Gentrification is a concern because in most urban areas today housing opportunities in working class and lower-income neighborhoods are already scarce, and overcrowding is common. This is exacerbated in cities having large racial or ethnic minority populations, due to the historic consequences of racial/ethnic segregation imposed by custom, public policy, and law, as well as by the more limited financial options of the minority populations. Eventually in areas where gentrification begins, and sometimes sooner rather than later, rents are increased, housing prices increase, and subsequently existing residents are forced out. In addition, gentrification has adverse implications for small businesses in a neighborhood changing the entire cultural landscape of the community (Maantay, M 2008).

**Brownfields  
Module I**

<b>Subject: Biology/Geography</b>	<b>Learning Goal:</b> Students will be able to identify one brownfield in their community by using the interactive map to locate the brownfield within a specified time given by the teacher.	
<b>Essential Standard/Common Core/ECS:</b> OBio.2.2.1 - Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may affect the environment.  USH.H.1.2- Analyze data in historical maps.		<b>Date:</b>
<b>Daily Lesson Academic Objective:</b> Students will be able to identify what a brownfield is and how to locate a brownfield in their community.		
<b>21<sup>st</sup> Century Skills:</b> The following activity will enable students to learn and use relevant information and interactive online resources to research a local brownfield near where they live. Students will be using research, media and technology skills to show work examples that gives them the opportunity to increase their understanding of content as well as, technology skills.		
<b>Student goal(s):</b> When given resources (video, vocabulary, article), students will be able to identify key words and understand the impact of human activities as it relates to brownfields in the community.		
<b>Necessary Prior Knowledge to review or support:</b> Analyze the video and oral reading to obtain the vocabulary to understand the lesson on brownfields.		
<b>Academic Language/Communication plans:</b> Some academic language used in this lesson include brownfields, contamination, groundwater, remediation plan, top soil, urban sprawl, redevelopment, abandon community sites, undeveloped. Students have the opportunity to identify and journal their findings using real world settings. The students will communicate where and how they found the research supporting their answers with evidence.		
<b>Activity:</b>	<b>Description of Activities and Setting</b>	
1. Focus and Review	Brownfield vocabulary and identification.  A brownfield site is any real property that is abandoned, idled or underused where environmental contamination or perceived environmental contamination hinders redevelopment.  The problem comes from the fact that it is very difficult to obtain loans for development on these properties because they come with potential environmental cleanup liability. NC Brownfields Program is designed to ease the liability for prospective developers.	
2. Statement of Objective for Student	The objective today will be to locate a brownfield near where you live and examine the effects of that brownfield in your community.	

3. Teacher Input	<p><a href="#"><u>What is a Brownfield? Video</u></a>  Teacher will introduce vocabulary (practice game or flashcards). Provide and complete <a href="#"><u>guided notes</u></a>, show video and provide instruction for guided and independent practice.</p>
4. Guided Practice	<p>Students will create vocabulary flashcards and demonstrate how to use the interactive map with smartboard and Chromebook practice.  <a href="#"><u>Interactive Brownfields Project Map</u></a></p>
5. Independent Practice	<p>Students will enter their zip code in the research tool to locate and research a brownfield near their home.  <a href="#"><u>Interactive Brownfields Project Map</u></a></p> <p>Students will answer the following questions on the graphic organizer, answering the following questions.</p> <ol style="list-style-type: none"> <li>1. Name of their brownfields project</li> <li>2. Project number and status</li> <li>3. What is the address?</li> <li>4. How did the property I chose become a brownfield?</li> <li>5. Contaminants listed on the brownfield property.</li> </ol>
6. Assessment Methods of all objectives/skills:	Short answer response of 5 questions.
7. Closure	Discussion on steps of how to use the interactive map.
8. Results of all objectives/skills:	Students will be able to answer 4 out of 5 questions correctly about brownfield interactive map.
<p><b>Materials/Technology:</b>  Smart Board, computer, video link, interactive maps, and graphic organizer.</p>	<p><b>Student/Small Group accommodations/modifications:</b>  The teacher will give each student a graphic organizer to record notes from the video to build on prior knowledge.  Electronic flashcards, Smart board and additional practice sheets, scissors, glue stick, highlighters and color markers.  Place the students on a team with at least one student who have mastered the prior concepts.</p>
<p>Plans for relating to personal, cultural and community relevance, self-determination, generalization, and/or maintenance:  Personal, Cultural, and Community Relevance: Students will be able to obtain cultural and community relevance by researching a brownfield in their zip code. Thus, creating a real world experience.  Self-Determination: Students will be able to apply the learned information from particular instances to other environments, and events during the course of their career. Being able to generalize the information learned will give the student a sense of independence and self-worth  Generalization and/or Maintenance: The students will be able to associate and identify real world brownfields.</p>	
<p>Reflection on lesson (What worked- what didn't; adjustments needed to this plan; adjustments to future instruction; justification for changes [research]):  This activity is building prior knowledge of brownfields in the community.</p>	

**Impact of Brownfields  
Module II**

<p><b>Subject: Biology/ History</b></p>	<p><b>Learning Goal:</b> Students will be able to explain the implications of their specific brownfield.</p>
<p><b>Essential Standard/Common Core/ECS:</b> OBio.2.2 - Understand the impact of human activities on the environment (one generation affects the next). USH.H.1.2- Analyze data in historical maps.</p>	<p><b>Date:</b></p>
<p><b>Daily Lesson Academic Objective:</b> Students will develop a deeper understanding of their specific brownfield. Understanding how and why the property that they chose became contaminated, exploring how humans have unintentionally contributed to brownfields and how we can affect the future of restoration and sustainability.</p>	
<p><b>21<sup>st</sup> Century Skills:</b> The following activity will enable students to research and use relevant information with an interactive hazardous sites map. Students will be using research, media and technology skills to show work examples that gives them the opportunity to increase their understanding of content as well as, technology skills.</p>	



<p>Students will also be able to check their assignment with a <a href="#">guiding rubric</a>, giving them a sense of self-direction (life and career skills).</p>	
<p><b>Student goal(s):</b> When given resources (course rubric, video, vocabulary, article), students will be able to create a presentation about their chosen brownfield property.</p>	
<p><b>Necessary Prior Knowledge to review or support:</b> Students have prior knowledge of brownfields from the interactive mapping researched in the previous assignment.</p>	
<p><b>Academic Language/Communication plans:</b> The teacher will use academic language such as brownfield, community, contaminant, development, green space, ground water, infrastructure, land use and sustainability. The teacher will support the academic language in the lesson as well as electronic flashcards <a href="#">here</a>.</p>	
<b>Activity:</b>	<b>Description of Activities and Setting</b>
1. Focus and Review	<p>Students will research and study characteristics of the property selected for their presentation. Students will analyze how their property contaminants affect urban waterways.</p> <p>The questions that will be answered are:</p> <ol style="list-style-type: none"> <li>1. What are the health ramifications of brownfields in communities?</li> <li>2. As a resident of Mecklenburg county: Why should you care about brownfields in your community? What can you do as a resident of Mecklenburg County about brownfields?</li> <li>3. How do brownfields create urban disparities in communities?</li> </ol> <p>Resource: <a href="#">Interactive hazardous sites map here</a></p>
2. Statement of Objective for Student	<p>Students will construct a presentation on brownfields by researching and recording information in journals/graphic organizers as per time set by the teacher.</p>
3. Teacher Input	<p>The teacher model to students how to find the document on their chosen property and, show pictures of his/her chosen brownfield and model to students some observations found about a selected property.</p>
4. Guided Practice	<p>Student will give input to the teacher on what they research and record about the property.</p>
5. Independent Practice	<p>Students will visit the following <a href="#">website</a> to investigate how their chosen property has created disparities in the community and present their finding to the class with a PowerPoint, share point, student made video (this is where you can give students the autonomy of how they want to present their project). However, they will need to answer the questions and meet the criteria in the student rubric. This will take students 2-3 days to organize.</p>
6. Assessment Methods of all objectives/skills:	<p>Teacher will assess journals/graphic organizers daily for progress. Students will use online resources from the Environmental Protection Agency (EPA) and Mecklenburg County websites. Note: Allow time for your school's Media Services to demonstrate and model how to document resources on presentations.</p>
7. Closure	<p>Bring in 2-3 pictures of your brownfield to include in your presentation.</p>

Assessment Results of all objectives/skills:	Students will have a class discussion on the health ramifications of brownfields in their communities.
<b>Materials/Technology:</b> Smart Board, computer, video link, interactive maps, and graphic organizer.	<b>Student/Small Group accommodations/modifications:</b> The teacher will give each student a graphic organizer to record notes from the video to build on prior knowledge. Electronic flashcards, Smart board and additional practice sheets, scissors, glue stick, highlighters and color markers. Place the students on a team with at least one student who have mastered the prior concepts.
<p>Plans for relating to personal, cultural and community relevance, self-determination, generalization, and/or maintenance:</p> <p><u>Personal, Cultural, and Community Relevance:</u> Students will be able to obtain cultural and community relevance by identifying the health ramifications of brownfields in our communities. Thus, creating a real world experience.</p> <p><u>Self-Determination:</u> Students will be able to apply the learned information from particular instances to other environments, and events during the course of their research. For example, reflecting on how brownfields create urban disparities in communities. Being able to generalize the information learned will give the student a sense of independence and self-worth</p> <p><u>Generalization and/or Maintenance:</u> The students will be able to associate and identify as a resident of Mecklenburg County as to why they should care about brownfields in the community.</p>	
<p>Reflection on lesson:</p> <p>This activity may take several days before students are ready to add the next lesson to their presentation on the economic effects and sustainability. Classroom gallery walk of others brownfields to see what ideas others have completed will create a meaningful exchange of ideas yielding better solutions.</p>	

**Economics and Sustainability  
Module III**

<b>Subject: Economics</b>	<b>Learning Goal:</b> Student will examine and understand the economic effect of the property by creating a sustainable practice poster/public service announcement.
<b>Essential Standard/Common Core/ECS:</b> EPF.E.1 Understand economies, markets, and the role economic factors play in making economic decisions. EPF.E.1.3 Explain how supply and demand determine equilibrium price and quantity produced.	<b>Date:</b>
<b>Daily Lesson Academic Objective:</b> Students will be able to examine the economic effect of their property in Mecklenburg County and identify sustainable solutions by sharing ideas through a galley walk. Students will state the problem and provide a solution.	
<b>21<sup>st</sup> Century Skills:</b> The following activity will enable students to learn and use relevant information by creating sustainable practice/public service announcement poster on the implications of their chosen brownfield. Students will be able to communicate and collaborate (Learning and Innovation Skills) with their peers during a galley walk.	
<b>Student goal(s):</b> Students will understand the appropriate procedures for ecological restoration of streams in urban areas and steps to maintain these areas.	
<b>Necessary Prior Knowledge to review or support:</b> Prior knowledge on brownfields through analyzing written documents additional vocabulary will be given for this lesson.	
<b>Academic Language/Communication plans:</b> The teacher will use academic language such as brownfield, community, economic impact, redevelopment, infrastructure, land use and sustainability. The teacher will support the academic language in the lesson as well as electronic flashcards <a href="#">here</a> .	
<b>Activity:</b>	<b>Description of Activities and Setting</b>
1. Focus and Review	Students will observe examples of how brownfields have evolved into valuable spaces and the economic impact. After watching the following video, we are going to take some time to reflect on sustainable practices ( <a href="#">video here</a> ).
2. Statement of Objective for Student	Students will create a sustainable practice poster/public service announcement to present the problem and provide a solution

	concerning brownfields. Resource: <a href="#">Environmental and Economic Benefits here.</a>
3. Teacher Input	Teacher will model the 3 components of the awareness poster. 1. State the problem, 2. Show a picture of the problem, 3. State a solution.
4. Guided Practice	Students will complete a rough draft of their awareness poster with teacher feedback.
5. Independent Practice	Student will construct the final draft of their awareness poster.
6. Assessment Methods of all objectives/skills	Students will be assessed according to a grading rubric on their final product.
7. Closure	Discussion with students on how they have provided solutions to an environmental problem.
8. Assessment Results of all objectives/skills:	Students will present 2 of 3 components correctly on the poster.
<b>Materials/Technology:</b> Posterboard, computer, video link, article link, and graphic organizer.	<b>Student/Small Group accommodations/modifications:</b> Use of graphic organizer and visual aids. Students will give others feedback on posters during the galley walk (group collaboration).
Plans for relating to personal, cultural and community relevance, self-determination, generalization, and/or maintenance: <u>Personal, Cultural, and Community Relevance:</u> Students will be able to obtain cultural and community relevance by identifying the economic impact of brownfields in our communities. Thus, creating a real world experience. <u>Self-Determination:</u> Students will be able to apply the learned information from particular instances to other environments, and events during the course of their research. For example, the galley walk will give students an opportunity to reflecting on how brownfields can create sustainable economic in communities. Being able to generalize the information learned will give the student a sense of independence and self-worth <u>Generalization and/or Maintenance:</u> The students will be able to associate and identify as a resident of Mecklenburg County as to how they can create change with brownfields in the community.	
Reflection on lesson: This lesson can be extended to include: I would suggest students find a passion project associated with their brownfield (i.e. organize cleanup, write to a Congressman, community outreach, or proposal for what the land could be used for, etc.). Have students make a "personal" connection of sorts in an effort to bring awareness, change, sustainability, etc.	
Students could also host a local "expert" to hear the pitches. May have some social activists in the future.	

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## **Appendix I**

### **North Carolina Standard Course of Study**

#### **Ecosystems**

Biology Standard: OBio.2.2 - Understand the impact of human activities on the environment (one generation affects the next).

OBio.2.2.1 - Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, = destruction and introduction of nonnative species) may impact the environment.

OBio.2.2.2 - Explain how the use, protection, and conservation of natural resources by humans impact the environment from one generation to the next.

#### **Economics and Personal Finance Standards**

**EPF.E.1 Understand economies, markets, and the role economic factors play in making economic decisions.**

EPF.E.1.1 Compare how individuals and governments utilize scarce resources in traditional, command, market, and mixed economies.

EPF.E.1.2 Distinguish market structures in terms of economic characteristics and the roles they play in decision-making and opportunity costs.

**EPF.E.1.3 Explain how supply and demand determine equilibrium price and quantity produced.**

EPF.E.1.4 Compare the ways in which incentives and profits influence what is produced and distributed in a market system.

**History/ Geography:** USH.H.1.2- Analyze data in historical maps.

**Math 1 Standard:** NC.M1.S-ID.9 Distinguish between association and causation.

#### **Occupational Course of Study Standards Link**

#### **Extended Social Studies Standard**

4. G.1.2 Explain the impact that human activity has on the availability of natural resources in North Carolina

## Brownfields Guided Notes

Complete the notes after watching the video.

<p><b>Notes:</b></p> <p>Brownfield Contamination Groundwater Remediation Plan Redevelopment Urban Sprawl</p>	<p>A _____ site is any real property that is abandoned, idled or underused where environmental _____ or perceived environmental contamination, hinders redevelopment. The _____ needs to be tested to see if the soil is contaminated. If the site is contaminated a cleanup or _____ Plan is developed. R_____ can minimize _____.</p> <p>It is very difficult to obtain loans for redevelopment on these properties because they come with potential environmental liability.</p> <p>The N.C. Brownfields Program is designed to ease that liability for prospective developers of these properties to facilitate the redevelopment of the property.</p>
<p><b>What could be some possible contaminates?</b></p>	
<p><b>What else can you tell me about Brownfield sites?</b></p>	
<p><b>Questions</b></p>	



**Project Rubric**  
Module II

	<b>Comprehension of Content</b>	<b>Evidence</b>	<b>Organization</b>
What is a brownfield?			
What are examples of Brownfields in our community?			
Where is your Brownfield in the community?			
What are some issues with your chosen property that are unique?			
Does your property require environmental Clean-up and/or Site Redevelopment			
Check your spelling			
Overall Presentation			

Total Possible points: 105

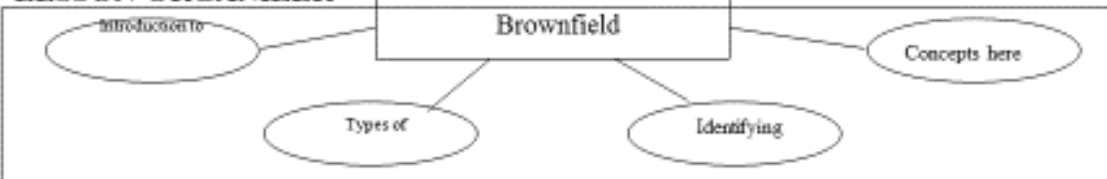
Total Points: \_\_\_\_\_

**Sample Lesson Organizer**

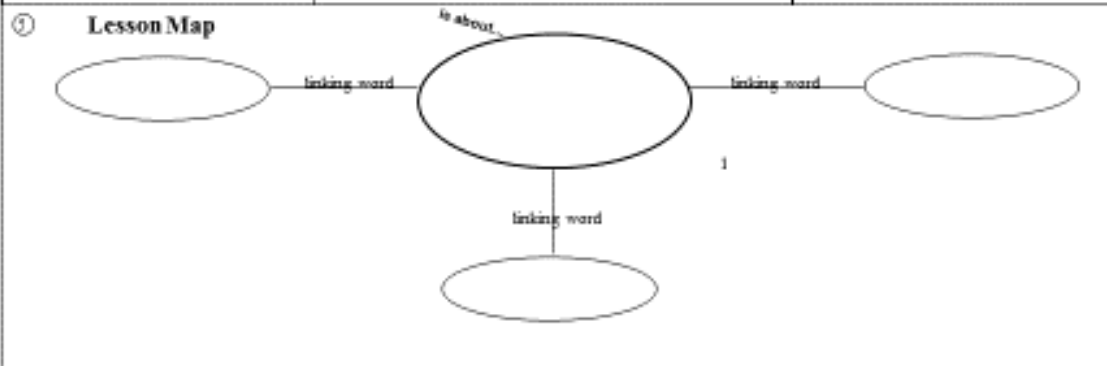
**LESSON ORGANIZER**

④ **UNIT or BACKGROUND**

DATE: NAME:



① <b>Relationships</b>	① <b>LESSON TOPIC</b>	② <b>Task-Related Strategies</b>
Relationship words here	Identifying and Labeling	Student strategy )



④ **Challenge Question** How do we use Parabolas in real life?

① <b>Self-Test Questions</b>	① <b>Tasks:</b>
<ol style="list-style-type: none"> <li>1. What are key points?</li> <li>2. Student will determine _____</li> </ol>	<ol style="list-style-type: none"> <li>1. Students will watch a video and complete guided notes.</li> <li>2. Students will _____</li> </ol>

**Lesson Vocabulary**

**Affordability:** The ability to bear the cost of a good or service without exceptional difficulty within financial capability.

**Barrier:** An object or item that keeps things separated from one another.

**Brownfield:** An underutilized or abandoned property where redevelopment is hampered by environmental contamination or the possibility of the property being contaminated by a hazardous pollutant, usually due to past land use as industrial or commercial facilities. Cleaning up and reinvesting in brownfield properties promotes economic development, protects the environment from further contamination, reduces blight and takes development pressure

**Waste:** Anything discarded during construction and demolition.

**Commercial:** The provision of goods and services for financial profit; includes purchases, sales transactions, growing, processing, manufacturing, etc.

**Community:** All populations inhabiting an area at a specific time. For people, community is a social science construct about the relationships that people may form and can include individuals joined by shared interests, geographic residence, history, or ethnicity.

**Conservation:** The protection and management of resources or property to ensure longevity and preservation.

**Contaminant:** A material or substance (physical, biological, or chemical) that is out of place and may cause harm or damage.

**Contamination:** The existence of undesirable materials in the wrong place, making an area unfit for its intended use.

**Derelict:** Something that is rundown due to neglect and abandonment by the owner; not taken care of.

**Development:** Human induced change of a land area intended to bring about growth. Includes construction of new buildings, zoning, building relocation, improving real estate, paving, excavating, etc.

**Ecosystem:** All living and nonliving components of a community interacting to form an ecological system. Examples include deserts, grasslands, tundra, marshes, lakes, and tropical rain forests.

**Emission:** The release of chemicals, particulates, or pollutants into the air.

**Environment:** All factors living and nonliving that affect an individual throughout the individual's lifecycle.

**Erosion:** The movement of soil particles or sediments by wind or water.

**Expense:** Cost.

**Government:** The organization that exercises authority and regulation over a society for the good and welfare of those under it. A government's power is given by the people.

**Green Space:** Undeveloped areas of a city that are specifically set aside for recreation, aesthetic relief, or wildlife conservation.

**Ground Water:** Water accumulated underneath earth's surface, filling all pores and spaces in rock or soil. It serves as a reservoir for springs and wells and is replenished by surface water.

**Hydrology:** The movement of water through and over the land. Includes evaporation, precipitation, absorption, above and below ground flow, recharge, discharge, and other parts of the hydrologic cycle.

**Impermeable:** An impenetrable surface, where substances cannot pass through or seep into.

**Income:** The amount of money that an individual or business receives over a set period of time in return for providing goods or service.

**Industrial:** Relating to the manufacture of goods. An area that is zoned for industrial use allows factories and other large buildings such as storage facilities.

**Infill:** The acquisition and redevelopment of vacant lots in developed areas; building within existing development patterns.

**Infrastructure:** The public facilities and services that serve the common needs of a community, such as sanitation systems, transportation networks, industry, residential, and commercial areas, parks, schools, etc.

**Land Use:** The way individuals use the land. In planning, land use is often designated zoned.

**Legacy:** Something that is left behind once a person, animal, or thing is gone.

**Neighborhood:** A group of homes; varying in size but defined by geographic boundaries.

**Nonpoint Source Pollution:** Pollution that comes from a diffused source, such as sediment runoff, fertilizer, and pesticides and that are influenced by the topography of the land.

**Permeable:** Can be passed through. Most often used in relation to water.

**Point-Source Pollution:** Specific sources of pollution that are easily identifiable, such as a smokestack or factory drain.

**Pollution:** Contamination of air, water, or soil by undesirable materials. Can be physical, chemical, or biological. Not all pollutants are innately harmful, but when taken out of natural context or in high quantities, they can become pollutants.

**Reclaimed:** The reuse of materials without making it into something new. Reclaiming materials from buildings that are about to be demolished or renovated can save a significant amount of waste from being thrown into landfills and can be cheaper than using new materials.

**Remediation:** The cleanup of a polluted area to an uncontaminated state.

**Sediment:** Soil matter, such as sand, silt, clay, and minerals that has been or is being moved by wind or water.

**Soil Profile:** A vertical section of soil that shows the horizons, or layers of material beneath the surface of the land.

**Storm Water Runoff:** Surplus water runoff resulting from rainfall that does not seep into the earth. Impermeable surfaces in cities and the compaction of soil contribute to large amounts of storm water runoff.

**Topsoil:** The surface layer of soil, rich in organic matter and humus.

**Topography:** A representation of earth's physical land surface showing elevation, position, and slope.

**Urban:** Of or pertaining to a developed area or city.

**Zoning:** The classification of land types designating what type of land use should be placed where in a geographic area, usually based on population density. Zoning's original purpose was to protect people and their environment by ensuring that land use types are evenly distributed throughout an area and that some land use types are separated from others.

### **Additional Resources**

**Questions to be answered by my student's inquiry-based learning would be about local brownfields and urban stream syndrome. Some examples would be:**

1. How does brownfields effect our urban waterways such as Irwin and Sugar Creeks?
2. What are the health ramifications of Brownfields in our communities?
3. As a resident of Mecklenburg county: Why should you care about brownfields in your community. What can you do as a resident of Mecklenburg county about brownfields?
4. How do brownfields create urban disparities in communities-westside see map <https://deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/waste-management-gis-maps/ihs-map-viewer>
5. What is Cellulose nanomaterials (CNs) [https://www.fpl.fs.fed.us/documnts/pdf2016/fpl\\_2016\\_moon001.pdf](https://www.fpl.fs.fed.us/documnts/pdf2016/fpl_2016_moon001.pdf)
6. Which of the reported symptoms of the urban stream syndrome show consistent patterns in urban areas, and which require more study before generalizations about conditions or effects can be made?
7. Which mechanisms drive the symptoms of the urban stream syndrome and what approaches should be used to further our understanding of these mechanisms?
8. What are the appropriate goals for ecological restoration of streams in urban areas and what actions are required to achieve these goals?
9. Do brownfield landowners pay property tax? If not, Why?

### **Readings and resources to use for research**

Students will research and locate local active brownfield sites and pick one to follow:

[https://files.nc.gov/ncdeq/Waste%20Management/DWM/BF/Website/Inventory/BF-Act-Elig\\_Inventory-06012020.pdf](https://files.nc.gov/ncdeq/Waste%20Management/DWM/BF/Website/Inventory/BF-Act-Elig_Inventory-06012020.pdf)

Projects pending eligibility and how these properties made the list of eligible sites:

[https://files.nc.gov/ncdeq/Waste%20Management/DWM/BF/Website/Inventory/BF-Pending\\_Inventory-06012020.pdf](https://files.nc.gov/ncdeq/Waste%20Management/DWM/BF/Website/Inventory/BF-Pending_Inventory-06012020.pdf)

The screenshot shows a web browser window displaying the NCEM website. The main content area features a map of the Charlotte region with many orange square markers indicating the locations of Inactive Hazardous Sites. A search bar is visible on the map. To the right of the map is a vertical sidebar with a list of map categories. The 'Inactive Hazardous Sites Map' is currently selected and highlighted in green. The website's navigation bar at the top is green with white text. The browser's address bar shows the URL: [deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/waste-management-gis-maps/ihs-map-viewer](https://deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/waste-management-gis-maps/ihs-map-viewer). The Windows taskbar at the bottom shows the time as 7:39 AM on 6/13/2020.

**Additional Teacher Resources:**

United States Environmental Protection Agency <https://www.epa.gov/brownfields>

What is a brownfield: <https://www.youtube.com/watch?v=D4RcUacsW3U>

CMS Standards: <https://sites.google.com/dpi.nc.gov/k-12-sci/home?authuser=0>

Brownfield Grants Clean up Contaminated Properties and Promote Economic Redevelopment Nationwide: <https://www.youtube.com/watch?v=AfK-Wd44DHA>  
<https://www.cclr.org/state-resources/north-carolina#state>