

Week One: Urban Development of Waterways and Sources of Urban Pollution

Summary:

Students will see how urban development has altered Memphis waterbodies and land and be able to recognize the controls put in place to manage storm water runoff. Students will learn about the urban water cycle. Students will be able to identify point and non-point source pollution. Students will learn about litter 'hotspots' and litter composition and will also study litter decomposition breakdown times. Students will learn the importance of proper waste disposal and also determine what percentage of the litter gathered is recyclable.

Objective/Activities:

Students will walk part of the Harahan Bridge and observe the river and bluff as it is now and compare it to historical maps. Students will see and learn how the Mississippi River has been channelized due to commerce and how the rivers and streams that flow to the Mississippi have been channelized. Students will be able to see from a distance the impervious area of the City and will learn about the measures added to provide flood control, including the City's MS4. The history of the Gayoso Bayou will be discussed, specifically. The students will learn about the Mississippi River Watershed and the watershed effect as it pertains to storm water as well as the urban water cycle. (Approximate Duration 1-2 hours)

Students will observe sources of litter and be able to identify point and non-point source pollution. Students will learn how litter is carried to waterways. Students will participate in an area clean-up between Riverside Dr. and Kansas Park that is within the Mallory 4-E (McKellar Lake) sub-basin within the Nonconnah Creek basin of the Mississippi River Watershed. Litter collected will be divided by composition/type, counted and/or weighed, and recorded. From this, students will be asked to determine the decomposition times of each type of trash and what percentage of the trash is recyclable. Students will be able to identify proper disposal methods for each type of trash gathered. (Approximate Duration 5-6 hours)

Materials:

Notebook/Pen/Pencil	Decomposition & Recyclable Activity Sheets	Gloves
Trash Bags	Scale	Calculator
	Historical Map	Urban Water Cycle Sheet

Vocabulary:

Watershed, Basin, Sub-Basin, Urban, Urban Water Cycle, Storm Water, Impervious, Runoff, Channelization (pertaining to Memphis waterways), MS4, Gayoso Bayou, bluff, river vs stream, point-source pollution, non-point source pollution.

Making Connections:

Seeing the historical maps and the current City riverfront will give a visual on urban development and the urban water cycle. A clean-up and the trash study will show long-standing effects on the watershed

and environment. The simplest and most effective method of pollution prevention will be hands-on: good housekeeping!

Week Two: Pollution Interception

Summary:

Students will see State and City measures in preventing pollution. Students will compare the trash composition observed within the McKellar Lake trash booms to what they gathered the week prior. Students will learn about chemical pollution and sources and how they are filtered by wetlands. Students will be also be able to confirm evidence of chemical pollution by obtaining lab evidence and biological evidence of waters within channelized urban streams.

Objective/Activities:

Students will visit the McKellar Lake trash booms and learn how it functions and its effectiveness. Students will compare the trash collected within the booms to what they gathered the week before and determine whether or not they think the booms are a necessary expense. (Approximate Duration 1-1/2 - 2 hours)

Students will learn about kinds of pollution (chemical) that are not captured completely by trash booms and clean-ups. Certain green spaces, including wetlands, can filter and remove chemical pollutants. The man-made wetland at T.O. Fuller State Park will be visited. Students will learn about and be able to identify the physical/hydrological, biological, and chemical functions of a wetland. Students will participate in a field wetland assessment and be asked to find and identify key plants and wildlife (or evidence of key animals via tracks and scat) through a nature walk and utilizing binoculars within the wetland. Students will identify the different layers and types of soils (pg 12 Wetland WET book) composing the wetland from a sample gathered by the instructor. Students will then identify the type of wetland from their assessment notes and utilizing Wetland Type Activity sheet (pg 89 Wetland WET book). Students will note the cost of creating this wetland for their continuation next week before determining whether or not they think the wetland is a necessary expense. (Approximate Duration 2-1/2 hours)

Students will take and analyze water samples for evidence of chemical pollution within the City. Samples will be taken at an urban channelized stream, Cypress Creek at Tillman and Summer. Students will perform temperature, pH, copper, phenols, DO, and chlorine field tests. Students will reference their sampling activity sheets to learn what levels of each test is within normal range and discuss possible pollution sources of abnormal amounts. Biological sampling will be discussed, but will be unable to be performed within a channelized stream due to the channelization (part of the comparison). A visual assessment will be performed for life within and around the channelized stream. Students will make an assessment on the stream's condition from the evidence that they have found. (Duration 1-1/2 hours)

Materials:

Notebook/Pen/Pencil Spade Field Guide Binoculars Natural Water Cycle Sheet
Wetland Plant Wetland Wildlife Wetland Soil Wetland Type Activity Sheets
Field Microscopes Lab vials and meters Magnifying glass

Vocabulary:

BMP, Trash Boom, Green Space, Field Guide, Natural Water Cycle, evapotranspiration, groundwater recharge, hydric soils, hydrophytic plants, hydrologic regime, aerobic, anaerobic, sulfurous, mottled (coloring), gleyed (coloring), oxidized, rhizospheres, rootlets, organic, decomposition, wet meadow, habitat, vascular plants, chemical pollutant, wetland, channelized stream, pH, photometer, phenol, DO, Chlorine, Copper.

Making Connections:

Students will be able to see the need for pollution prevention measures and green space by comparing their first week urban experience to this week. Students will be able to identify and see the changes in the natural and urban water cycle and what green spaces provide to restore it. Students begin their waterbody comparisons with their assessment of the urban man-made wetland and their assessment and chemical water sample analyses of the urban channelized stream.

Week Three: Chemical and Biological Comparisons**Summary:**

Students will be able to obtain lab evidence and biological evidence of chemicals within rural non-channelized streams. Students will assess the condition of each stream and compare them to support or disprove their original hypothesis. Students will be able to compare a rural, natural wetland to the man-made wetland they visited the last week to support or disprove their original hypothesis.

Objective/Activities:

The rural natural wetland, Mineral Slough boardwalk, will be visited. Students will again identify the physical/hydrological, biological, and chemical functions of a wetland. Students will participate in a field wetland assessment and be asked to find and identify key plants and wildlife (or evidence of key animals via tracks and scat) through a nature walk and utilizing binoculars within the wetland. Students will identify the different layers and types of soils (pg 12 Wetland WET book) composing the wetland from a sample gathered by the instructor. Students will then identify the type of wetland from their assessment notes and utilizing Wetland Type Activity sheet (pg 89 Wetland WET book). Students will note the

differences between the natural and man-made wetland and will determine whether or not they think the wetland is a necessary expense or if wetlands should be continue to be removed as has been historically done. (Approximate Duration 1-1/2 – 2 hours)

At Bateman Bridge is a rural, natural stream where students will perform chemical and biological sampling. Students will gather samples and perform the same chemical tests as they did at Cypress Creek. Students will reference their sampling activity sheets to learn what levels of each test is within normal range and discuss possible pollution sources of abnormal amounts. Students will also be able to utilize dip nets to perform biological sampling. Macroinvertebrates gathered will be examined with microscopes and/or magnifying glasses and identified with the dichotomos key. Students will utilize their Benthic Macro Activity Sheet to identify the macroinvertebrates pollution tolerance. A visual assessment will be performed for life within and around the natural stream. Students will make an assessment on the stream's condition from the evidence that they have found. (Approximate Duration 2-1/2 -3 hours)

Materials:

Notebook/Pen/Pencil	Spade	Field Guide	Binoculars	Field Microscopes
Lab vials and meters (ref Sharon list)	Magnifying glass	Dip Nets	Spoons	
Sample Bucket	Dichotomos Key	Benthic Macro Activity Sheet		
Wetland Plant	Wetland Wildlife	Wetland Soil	Wetland Type Activity Sheets	

Vocabulary:

Photometer, Phenol, DO, Chlorine, Copper, pH, Macroinvertebrate, Insect Larvae, Chemical Testing, Biological Testing, Dichotomos Key, Benthic, Tolerance, Slough

Making Connections:

Students will be able to identify factors that differentiate urban waterbodies from rural waterbodies and the impacts on watersheds, water cycle, and wildlife and support or disprove their original hypothesis in a scientific paper utilizing all the evidence that they have collected. Students will be able to identify the presence and sources of pollution and pollution prevention measures. Students will be able to ascertain if pollution prevention measures are necessary or not by utilizing all the evidence that they have collected on the condition of rural and urban waterbodies.

NEW! Projected additions with 2018 Green Camp...

- *Trip to Baker's Pond (head waters of the Wolf River) for chemical and biological sampling!*
- *A day at the library devoted solely to helping participants with their paper!*

