Lesson Plan – Week 2 – July 9-July 11
History of Mill Creek – How does a Natural Watershed become an Urban Watershed?
Two and One-Half Hours

Goals:

- Students will be introduced to natural and urban watershed concepts
- Students will learn how humanity has altered the natural landscape
- Students will learn map reading skills
- Students will learn basics about the city's sewer drainage system
- Students will begin to compare and contrast the environment of their present Sulzberger Middle School neighborhood with the neighborhood of 1918 (or 1895)

Objectives:

- Students will review glossary of key words for this week's lesson
- Students will begin to discuss the elements of a natural watershed
- Students will begin to discuss the elements of an urban watershed
- Students will review historic stream maps and identify Mill Creek and its relation to the Schuylkill River
- Students will review city sewer maps and identify the Mill Creek sewer and its relation to the city's drainage system.
- Students will study a 1918 or 1895 map of the Sulzberger Middle School neighborhood and talk about the homes, buildings, factories and institutions that existed.
- Students will review archival photographs, census records and historical summaries about the nature of the long-gone facilities
- Students will study an up-to-date orthographic map of the Sulzberger Middle School neighborhood and discuss the existing homes, schools and vacant lots.
- Students will be asked to talk about their neighborhood's transition and the possible causes.
- Students will be introduced to public policy – Mayor Street's Blight Elimination Program.

Related Activities for the Lesson:

Activity # 1 – Vacant Lot Site work – Students will document the condition of the lot prior to its clearing. Students will record what exists on the lot, what existed on the lot in the past, and its future.

Activity #3 – Watershed walk – students will trace the path of the Mill Creek sewer and maintain a checklist of visual evidence of stormwater runoff/water-related problems. A virtual watershed tour of this walk will be created for the school's website.

Activity #4 – What's Under the Ground? – students will review infrastructure maps of the neighborhood and trace the path of the old Mill Creek on top of the maps. What do they notice about the path of the sewer and creek?

Activity #6 – Macroinvertebrates and stream water quality – visit to Cobbs Creek for kicknetting demonstration

Glossary of Watershed Project Terms

Best Management Practice (BMP): A structural or non-structural device designed to temporarily store or treat stormwater runoff in order to lessen flooding, reduce pollution and provide a natural or pleasant amenity.

Buffer: An area adjacent to a shoreline, wetland or stream where development is restricted or prohibited.

Census: A national count of population, broken down into information on age, ethnic background, income level, education level, family size and makeup and other information that provides the U.S. government with a characterization of the nation and population trends. A census is performed every 10 years.

Combined Sewer Overflow (CSO): The release of untreated sewage into streams or rivers when heavy rains cause combined sanitary and storm sewers to fill to capacity and spill over before reaching the sewer treatment plant.

Contaminants: Pollution.

Floodplain: Areas adjacent to a stream or river that are subject to flooding or inundation during severe storm events (Often called a 100 year floodplain. It would include the area or flooding that occurs, on average, once every 100 years).

Fresh water: Water that is not salty.

Habitat: A home or place where certain groups of plants and animals live in balance and create a healthy ecosystem.

Impervious Cover: Any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall,e.g., covered by concrete, asphalt, etc.

Inorganic pollutants: Inorganic pollutants consist of suspended and dissolved solids such as silt, salts, and other minerals carried into streams from streets or exposed soil.

Macroinvertebrates: Animals that have no backbone and are visible without magnification.

Monitoring: The repeated observation of condition, especially to detect and give warning of change.

Non-Point Source pollution: Pollution that is carried into streams by stormwater runoff. When it rains, the runoff collects pollutants from streets, lawns, parking lots (oil, gasoline, fertilizer, pesticides, litter, animal wastes) and carries pollutants into the stream.

Organic pollutants: Organic pollutants come from the decompostion of living organisms, either plants or animals, and their by-products.

Point Source pollution: Pipes connected to a stormwater or sewer collection system or facilities are considered "point sources," as the pollution empties into the stream at the end of the pipe.

Riparian buffer: A strip of land along a stream where trees, shrubs, and small plants are encouraged to grow. Buffers help keep a stream healthy by reducing erosion to streambanks and by acting as a natural soil filter.

Storm sewer: The underground pipe that carries rainwater off pavements, roofs and lawns and into a nearby stream.

Streambed: The stream bottom or surface over which a stream flows.

Stream flow: Measured as the volume of water. Variations in flow and velocity have major impacts on streambanks, habitat, fish and other aquatic organisms.

Swimmable: A term signifying that water is safe for human contact, such as wading and swimming but not drinking.

Total coliform: Coliforms are bacteria which are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present.

Toxic pollutants: Toxic pollutants are heavy metals such as cadmium, mercury, chromium, iron and lead) and chemical compounds (PCBs, DDT) that are lethal to organisms or interfere with their normal biological processes at certain concentrations.

Vacant lot: An area of land that does not have a home or building. Many vacant lots in Philadelphia were once occupied by a building that was later abandoned and then demolished.

Watershed: The watershed of a creek, stream or river is all of the land that sheds water into that stream when it rains. When rain falls on land, it drains or runs off to the nearest stream or river that is downhill.

Wetland: A soggy habitat such as a swamp, bog or estuary that stores floodwaters and functions as a nursery to many species of fish, amphibians and reptiles. Wetlands also act

as natural filters for rivers and streams by removing the pollutants from stormwater runoff.

Lesson Narrative:

Historic Streams

If you look at a mid-19th century map of what is now the City of Philadelphia, you will see what are called "historic" streams that are tributaries to the Delaware and Schuylkill Rivers. Streams by names such as Hollander's and Shackaminsing Creeks (South Philadelphia), Mill Creek (West Philadelphia), Dock Creek (Center City), Cohocksink Creek and Gunner's Run (North Philadelphia), Wingohocking and Wakeling Creeks (lower Northeast Philadelphia) are all "underground" now. As the City grew, sewers were laid in the streambeds to capture the flow of these streams. Streams were diverted into the new sewers at the stream's headwaters (where the stream begins or where it entered the city) or at a segment of the stream where development was planned. The stream's tributaries were often added to the sewer collection system through a "spur" (a pipe connected to the sewer). The sewers then carried these streams to the nearest creek or river. The old streambeds and their floodplains were filled in by developers.

The sewer and the stream's floodplain were buried and the area brought up to a chosen grade for building. When completed, the ground elevation of the new neighborhood was sometimes as much as forty feet above its old elevation. In some areas of the city, "virgin" soil was used to bury the sewer. Other areas were filled with coal ash and cinders mixed with materials such as incinerator waste. These materials needed to be compacted well to prevent settlement. Much of this construction occurred in the late 19th and early 20th centuries and records are not available as to the exact materials used.

Watersheds

A watershed is all the land that drains to a specific body of water. When rain falls on land, it runs off by gravity to lower elevations to the nearest creek or stream that is downhill. A watershed is not limited by municipal and county boundaries because it is created by natural land formations.

The history of a neighborhood is often contained in the history of its watershed – of the land which drains into the creeks. In Philadelphia, prior to significant settlement in the 17th and 18th centuries, Native Americans lived in a respectful co-existence with the environment, taking only what they needed to survive. But settlers of the “New World” found plentiful land and pristine streams, prime real estate for farming and building mills for water power. But the most radical changes occurred following the Civil War, when the Philadelphia region became one of the greatest industrial areas in the world. Immigration, coal, and the accessibility of abundant water spurred the building of roads and railways. For the next century, up until World War II, local rail lines allowed for the expansion of communities growing around stations along the railway corridors.

Philadelphia and the immediate suburbs grew into “the City of Homes” (row homes) and the “Streetcar Suburbs” developed. Workers commuted into the city or to industries along the Delaware River. Floodplains were built upon, wetlands were filled, and streambeds diverted or covered. Once these streams were invisible and diverted into pipes, they became a convenient means for industries and residences to dispose of their wastes.

The city’s watersheds experienced another period of significant change in the last half of the 20th century, which witnessed the building of expressways and the widening of existing routes. Suburban development followed so that communities were built which were intricately bound to their cars. Housing characteristics changed. People wanted more space, and much of this space became paved. Acres of land in the city and suburbs which were once covered by grass and trees were soon covered with asphalt, concrete and rooftops. Land that once was able to absorb rainfall by allowing the stormwater runoff to filter through the soil and into the ground, recharging the ground water table, had become “impervious,” meaning that rainwater could not filter into the soil, but instead would runoff, into manmade drains and pipes.

These changes have often wracked havoc with the natural characteristics and flow patterns of streams. Both man’s intervention as well as natural forces associated with heavy flows from stormwater runoff have straightened once slowly meandering streams, scouring streambeds, eroding stream banks, and essentially making it difficult for aquatic life to thrive. When a stream’s natural floodplain is gone, periodic flooding extends to homes and property.

As we know, the human relationship with watersheds has not always been a healthy one. Progress often meant filling in wetlands, which act as natural filters, cleaning stormwater runoff and protecting our streams. The streams’ natural floodplains, the land adjoining the streams, were paved, destroying their natural buffers. Factories were built, and sewers were laid in the stream corridors to wash away their waste.

Throughout our history, the impact of these changes to the land and its streams was not fully understood. We are only beginning to address the problems caused by shortsighted land use and development. Urbanization and other seemingly harmless development have increased the volumes and velocity of stormwater runoff, so that any contaminant lying in the street, such as oil, gasoline, fertilizers and pesticides, gets picked up in the flow and deposited into the streams. This development, particularly in the floodplains, has exposed homes and businesses to more frequent flooding.

We didn’t always understand the impact of our actions on water quality, aquatic life, or the natural landscape. We couldn’t even measure some pollutants in the levels that we are finding them now because the instruments to do so didn’t exist. But the news is finally getting better. Over the past three decades, state and federal laws such as the Clean Water Act, the Pennsylvania Clean Streams Law, watershed management guidelines, and hazardous wastes disposal regulations, have been signed into law and implemented. New techniques and sustainable designs are available to build in a manner that is kinder to the environment.

City Neighborhoods

From our knowledge today, settlement problems can occur in neighborhoods built on top of buried floodplains that were filled in with uncompacted ash or soil. Over time, homes and buildings can settle as rainwater, or water from other sources, is absorbed into the soil. In addition, other environmental factors, such as seasonal changes, can cause even compacted soil to freeze and thaw. When this fill becomes saturated with water, settlement becomes more pronounced. What can we do today to prevent such settlement and to protect our homes and neighborhoods? We can't change the way that Philadelphia was developed, but we can safeguard our neighborhoods by ensuring that a continuous source of water is not leaking into the ground.

In the natural watershed, most precipitation such as rainwater infiltrates into the ground where it is cleaned and becomes part of groundwater supplies. In urban watersheds like our neighborhoods, pavement has replaced permeable surfaces, and rainwater cannot sink into the soil. Imagine that you threw trash on the ground, or sprayed chemicals on your garden, or dumped oil down the sewer. When it rains, what happens to these pollutants? They are picked up by the rainwater and flow over your watershed into a body of water. Storm sewers and combined sewers are also part of your watershed and they often lead directly to a creek or river. Sewers follow the natural drainage pattern of the land, doing the job the natural watershed once did --- collecting rainwater and delivering it to streams and rivers

If the sewers copy the drainage patterns of the natural watershed, why do we have water problems or vacant land? The vacant land that exists throughout the city is the result of many factors. When a creek like Mill Creek was put into a sewer and buried, the material used to bury the sewer may not have been the best material for building. When water leaked into the land from pipes or was saturated from groundwater, the soil may have settled, making the homes or buildings unsafe. Homes may also have their own water problems created when a roof leaks, or rainleaders are not properly connected, or if a water service or sewer lateral is broken. Vacant lots may also be the result of economic forces --- a factory shuts down, people move out of a neighborhood and no one replaces them.

Today, vacant land can provide opportunities to a neighborhood to recreate the natural features that once existed. Many examples of such opportunities already exist in the city --- community gardens, tree nurseries, playgrounds. These more natural reuses of vacant land can foster a beneficial harmony between the urban watershed that we live in and the natural watershed that was long ago buried.

<u>Discussion Questions</u>

Where do you live?
Where do your friends live?

Did you know you live in a watershed?
Which one?
Which watershed is Mill Creek a part of?

Share results of 2000 census

Who lived here long ago? Lenape Indians

Who lived here in 1918?

Share results of 1918 census – ethnic makeup, jobs, ages, lifestyle

Look at collected archival photos and talk about who/what these people/buildings were (list our collected photos).

How does the neighborhood look now?
Why is there vacant land?
Why are homes falling apart?
What can be done with vacant land?

What happened to Mill Creek?
Where is it now?

How does the sewer work?
Where does the water go now?

What are the differences between the historic stream map and the map showing the city's sewer system? What are the similarities?

<u>Materials Needed</u>

- Glossary
- Historic stream map (one poster size and handouts)
- Sewer Maps (one poster size and handouts)
- 1918 map (one poster size and handouts)
- Orthographic map (one poster size and handouts)
- Archival photos (copies to post and kids to look at like exhibit)
- Explanation of archival photos (captions)
- Historical summaries of 1918 institutions
- Census record summaries
- Vacant lot map (poster size and handouts)

<u>Student Assessments</u>

Topic: Mill Creek History

I know that…. I want to know….. I learned that….

Have students share with one another (orally) during last half hour of class