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### GIS Map Report of the Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center

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GIS Map Report of the Robert Porter Allen Natural Area  
at the Sylvan Dell Environmental Center

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August 2021

**Bucknell**  
UNIVERSITY

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## Background

As technology continues to flourish in modern day, many people forget just how important it is to connect with the nature that surrounds them. The Sylvan Dell Farm and Robert Porter Allen Natural Area in South Williamsport is being developed to do just that, reconnect the local community with their natural environment. As an intern for the Place Studies program at Bucknell University's Center for Sustainability and the Environment and partnering with Brian S. Auman Landscape Architecture, LLC I have been developing an Ecological Restoration Plan for the Sylvan Dell Farm and Robert Porter Allen Natural Area. As the Sylvan Dell Farm and Robert Porter Allen Natural Area holds one of the largest remaining floodplain wetlands on the West Branch of the Susquehanna River, the primary goal of this restoration plan is to restore and expand the wetland to bring it back to its original size and shape. Using GIS mapping software I have been able to create a basemap that provides the necessary details to orient the site and its features on a map, and find the best areas within the Sylvan Dell parcel to expand the wetlands. This requires overlaying different sets of modern data, as well as historic maps, for the information needed to inform the wetland habitat restoration. GIS mapping the site has led me to uncover past flowlines running throughout the entire Sylvan Dell site, and an abandoned river channel that the current wetland now occupies. In addition, various kinds of data relating to soil classifications and hydric properties has uncovered other possible areas for the wetland's expansion. The wetland restoration design is intended to serve as a case study for MS4 (Municipal Separate Storm Sewer System) compliance with US EPA and PA DEP requirements for urban runoff treatment in a cost effective manner. This Ecological Restoration Plan will inform the final restoration design, performed by US Fish and Wildlife Service in spring of 2022 with funding provided by NAWCA (North American Wetland Conservation Act).

## Introduction

Sylvan Dell is a 227 acre farmstead in South Williamsport, PA, bordering the West Branch of the Susquehanna River. Acquired with local and state funding, the Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center will be managed by the Southside Regional Recreational Authority. The site encompasses a diverse set of natural ecosystems including West Branch Susquehanna River frontage, riparian forests, upland and oak savanna meadows, and the largest remaining floodplain wetland along the West Branch of the Susquehanna River. Once termed the Gibson Swamp, this famous wetland had a profound influence on the early life and work of famed Ornithologist Robert Porter Allen. As tribute to Allen's innovative research and pioneering efforts to conserve the bird's nesting habitats, the Southern end of the Sylvan Dell Environmental Center will be developed as the Robert Porter Natural Area to conserve and protect the wetland habitat.

While this project will conserve and protect the nesting habitats for numerous bird species and the largest remaining floodplain wetland along the West Branch of the Susquehanna River, the main focus is still on the local Williamsport community. As a small city, Williamsport sits at an interesting crossroads between the natural environment and modern infrastructure. While the city is surrounded by untouched nature, most of this land is used for farming or privately owned. This aligns with modern nature-deficit disorder, the idea that human beings, especially children, are now spending less time outdoors, resulting in a wide range of behavioral problems. A connection to the environment is necessary for a healthy lifestyle, it has even been proven that people concentrate better after spending time outdoors. In addition, Williamsport is a designated Environmental Justice area with at least 20% of the population below the federal poverty line made up of at least 30% minorities. The creation of the park at Sylvan Dell will provide the local community with increased tourism, revenue and job opportunities.

## Goals and Methods

The main goal of this Physical Ecological Restoration Plan was to create a comprehensive set of maps using GIS highlighting the various features of the Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center. These maps were then spatially analyzed to uncover the best possible areas for wetland restoration and expansion. The maps were specifically designed with this in mind, making sure to direct the reader's attention to the most important features for the wetland restoration and expansion. Various map iterations were made and revised to create the most useful set of map designs for this specific project. The main goals throughout this process were as follows:

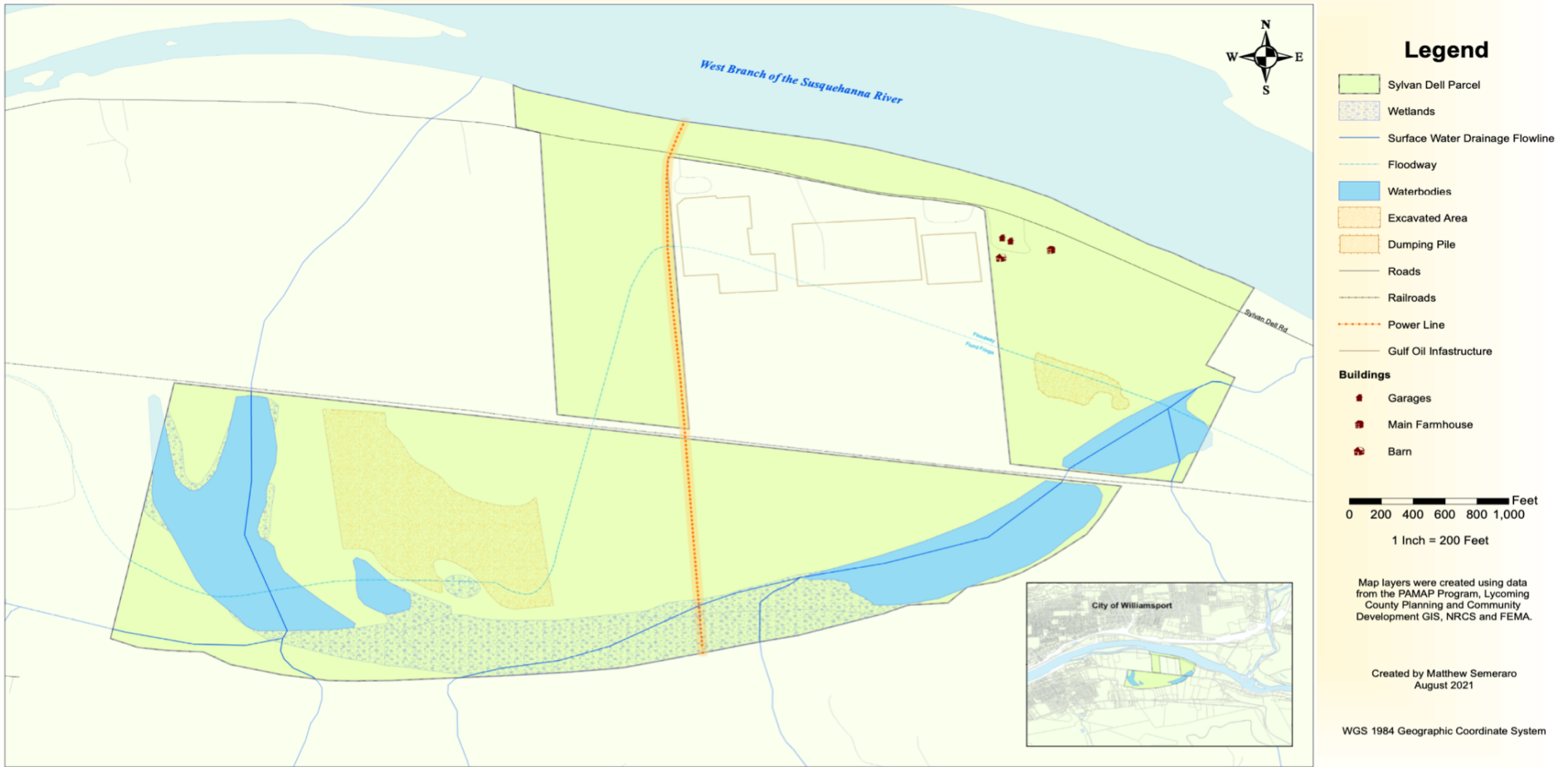
- Basemap the site with key features to orient its location on a map
- Investigate historic flowlines and wetland channels to find areas for possible restoration and expansion
- Study Geomorphic changes within the site
- Locate specific areas for wetland restoration and expansion utilizing LIDAR data, soil classification and hydric content data to bring it back to its original size and shape
- Proper Stormwater Management utilizing MS4 requirements for clean urban runoff treatment

# Hydrography and Restorable Wetlands

## **Hydrography:**

This map's data is focused around explaining the hydrography and water features within the Robert Porter Allen Natural Area and Sylvan Dell Environmental Center. As the main objectives of this ecological restoration are to restore and expand the wetland in addition to complying with sustainable MS4 stormwater runoff regulations, it is essential to understand the hydrography of the Sylvan Dell site. The main hydrologic features include waterbodies, wetlands, surface water drainage flowlines, the floodway and the flood fringe. Waterbodies represent permanent accumulations of water while wetlands consist of saturated hydric soils. Surface water drainage flowlines represent the stream segments or reaches that make up the surface water drainage system. This is a key aspect to the site's compliance with MS4 regulations to naturally filter stormwater runoff as the flowlines illustrate the paths runoff takes. In addition, the surface water drainage flowlines illustrate the path of what was likely once quite a large stream segment that cut off the Susquehanna River into the Sylvan Dell site and then back into the river. The floodway represents the initial part of the floodplain on the site, the area of greatest risk in a potential flood, while the flood fringe represents the remaining portion of the floodplain with lower but still moderate risk. In addition to the hydrologic features, additional key features are also included on the map to help the viewer place where certain hydrologic features are on the Sylvan Dell site. These key features include: an excavated area, a dumping pile, roads, railroads, a power line, Gulf Oil infrastructure, and three buildings on the property.

# Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center Hydrography

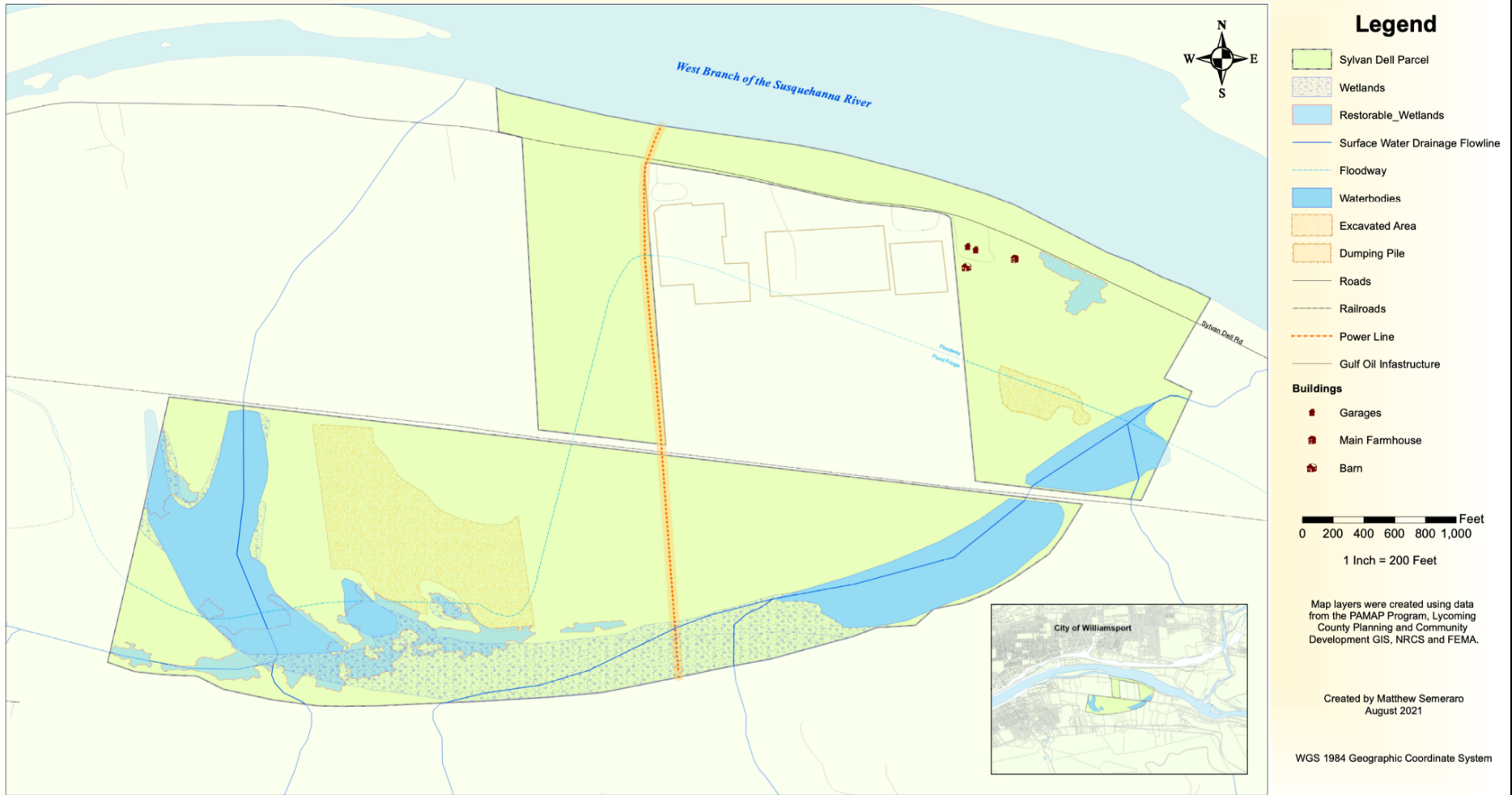




**Restorable Wetlands:**

While this map may look similar to the hydrology map its main focus is potential restorable wetland sites. This data from the University of Vermont Spatial Analysis Laboratory depicts agricultural fields with the necessary topographic, hydrologic flow and climate characteristics indicative of a wetland. If different land uses were practiced at these sites, they could be restored as wetlands. While the ecological restoration plan is to restore and expand more wetland area than this data indicates as restorable, it is a solid starting point to understand the necessary features of restorable wetlands.

# Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center Restorable Wetlands



# LIDAR Contours

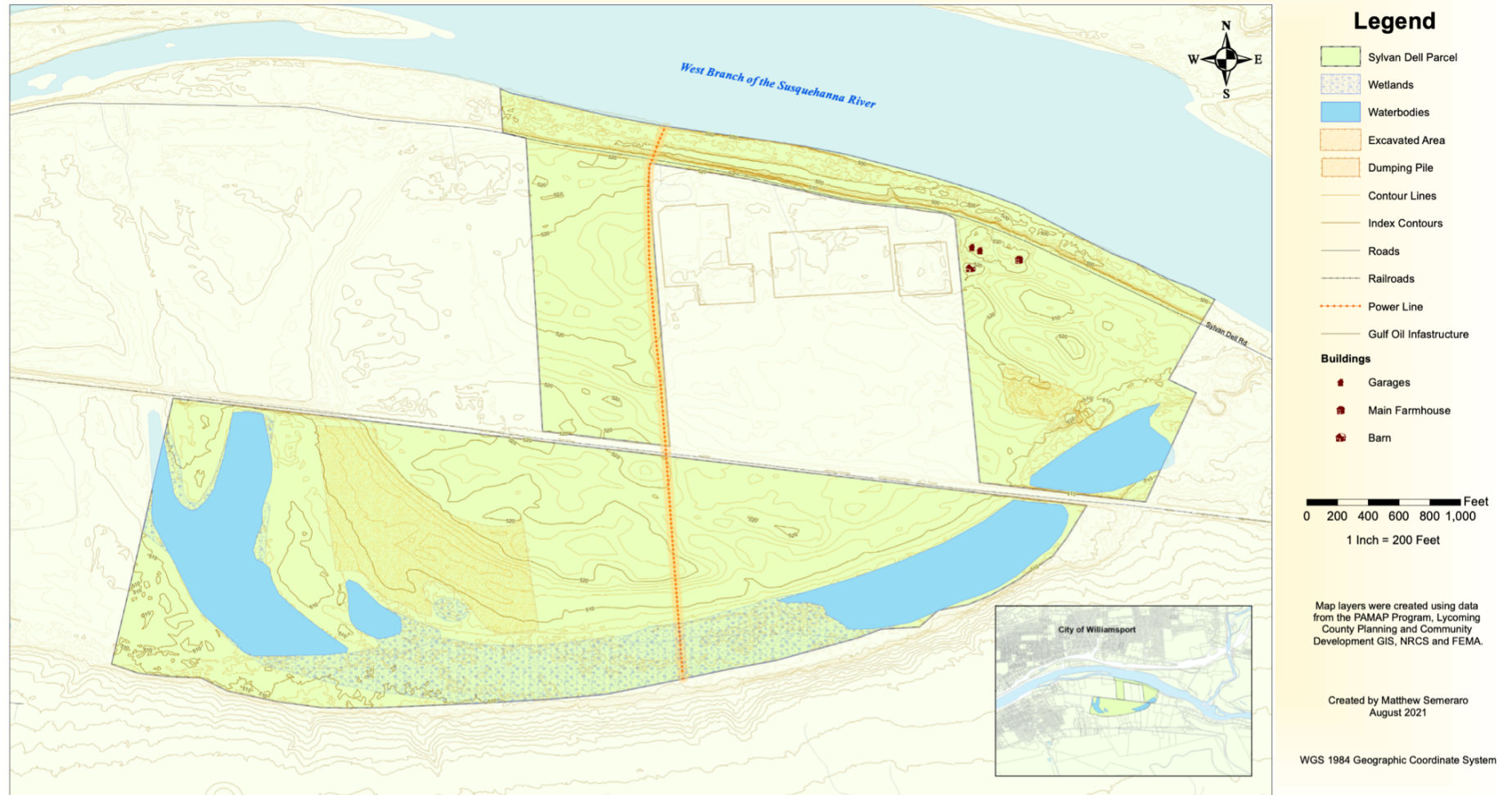
## **LIDAR Contours:**

The main focus of this map is the topography of the Robert Porter Allen Natural Area and Sylvan Dell Environmental Center. Using precise LIDAR data obtained from the PAMAP Program, contour lines are used to illustrate elevation differences on the site. Each contour line represents a 2 foot elevation difference, with bolded index contours every 10 feet. Index contours are also labelled within the Sylvan Dell site. The main objective of this map was to visualize the topographic profile of the Sylvan Dell site and, more specifically, the wetland within the Robert Porter Allen Natural Area south of the train tracks. While the site doesn't have any drastic topography (it ranges from 500' - 520') an essential element to restoring and expanding the wetland is understanding the topographic profile of the wetland bed. This is to uncover areas along the wetland most suitable for expansion and to illustrate the profile of the original wetland bed. Bends and curves in contours lines near the wetland may indicate past streams or other original water features. In addition to contour lines some other key features of the site are included on this map. These additional features allow the viewer to place where specific contour lines lie within the Sylvan Dell site. These key features include: waterbodies, the wetland, an excavated area, a dumping pile, roads, railroads, a power line, Gulf Oil infrastructure, and three buildings on the property.

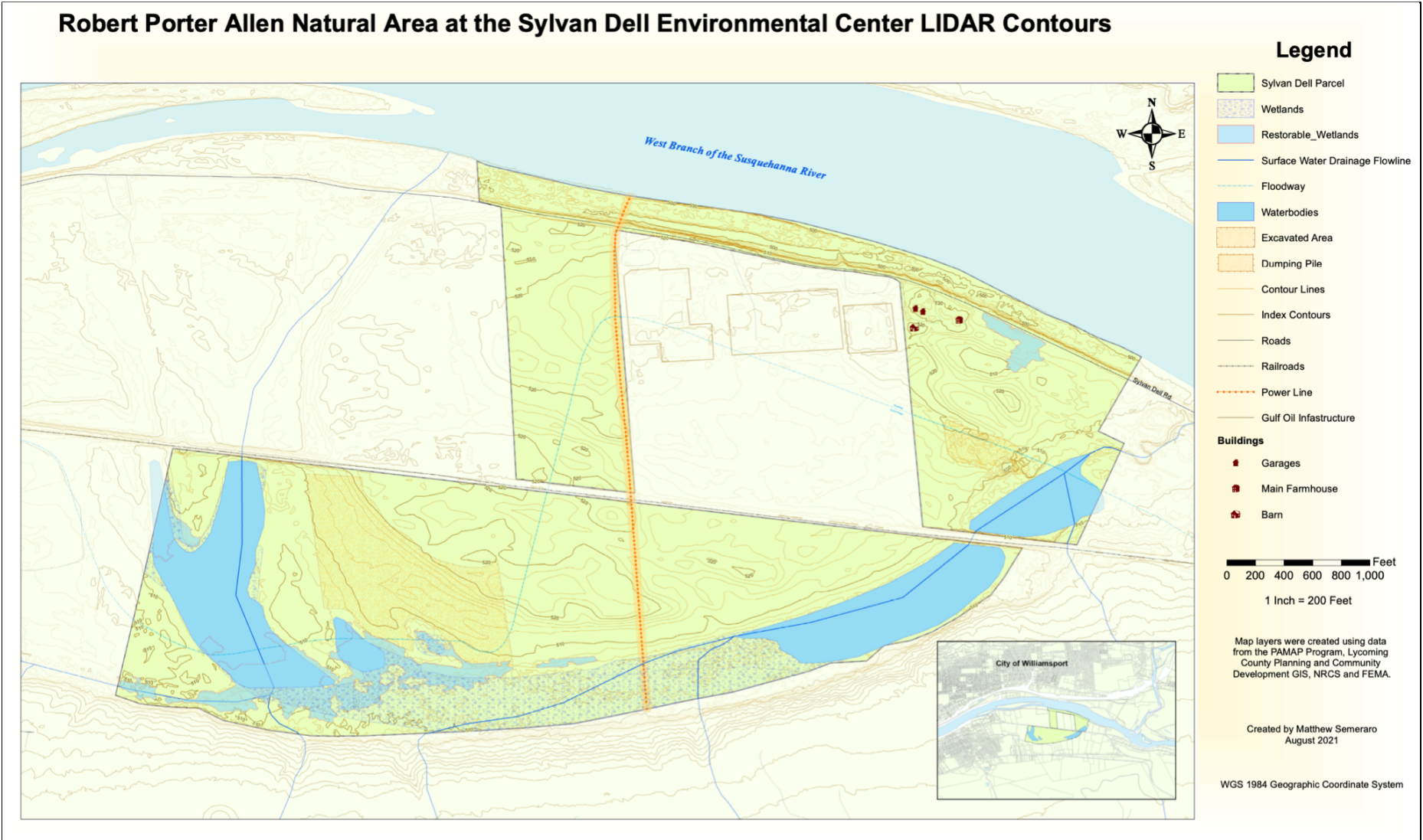
## **Detailed LIDAR Contours:**

While this map also focuses on the topography of the Sylvan Dell site, additional hydrologic features and restorable wetland sites are incorporated. Hydrologic features such as the floodway, flood fringe and surface water drainage flowlines are added in addition to the restorable wetland sites. Overlaying different data as shown in this map illustrates how these different layers work together to communicate the same message. One is able to see surface water flowlines within the surface water drainage flowline data but also within the contour lines as they bend and curve with water flow. This is especially prevalent on the southern end of the map. The hill leading down to the wetland includes multiple surface water drainage flowlines with clear contour bends underneath them. The eastern end of the map by Sylvan Dell road illustrates an old stream outline clearly with the contour lines, and a flowline is shown directly above them. While this shows how contour lines and flowlines work together, restorable wetland sites are included to understand the topographic profile of these areas.

# Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center LIDAR Contours

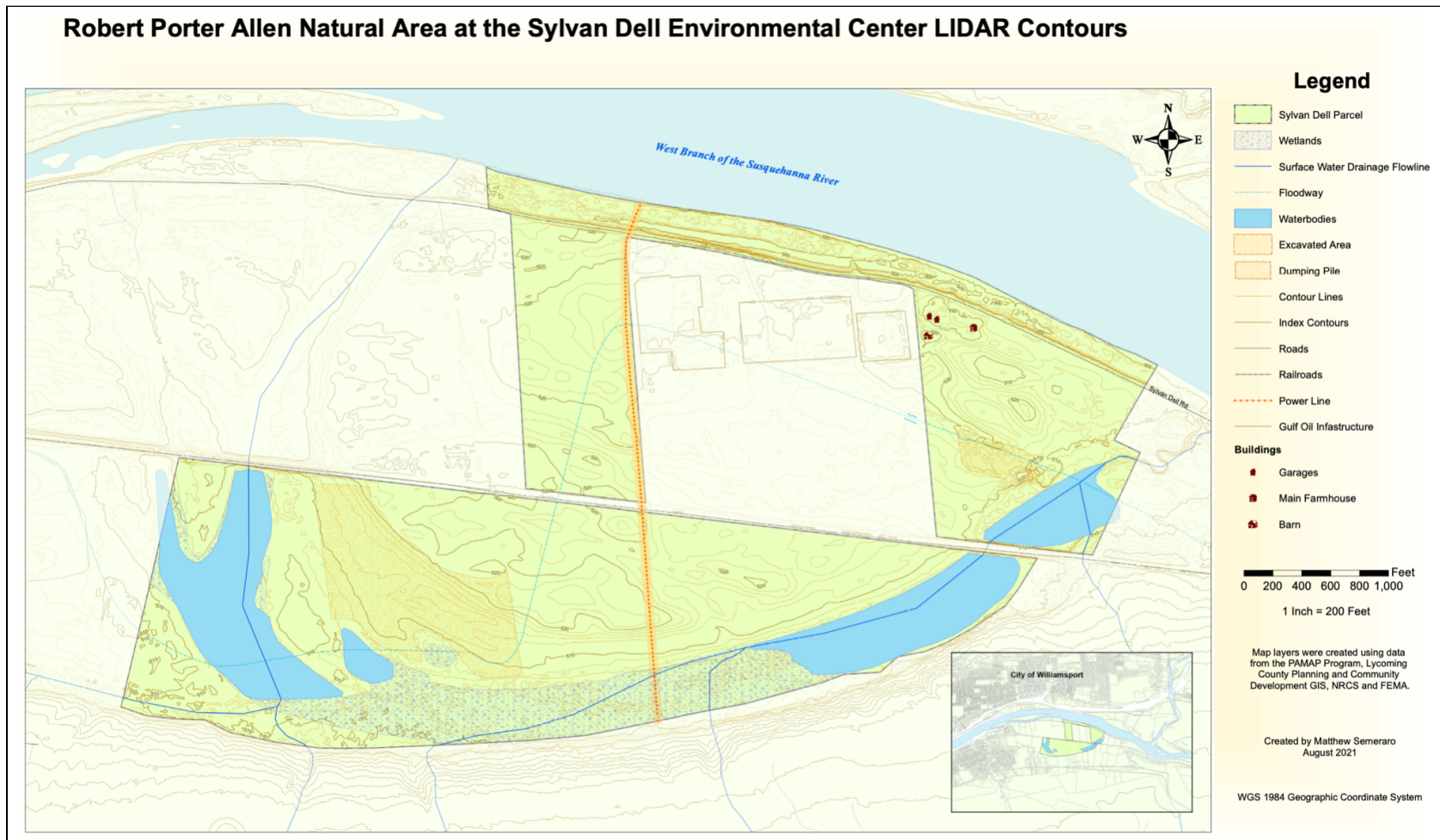


# Detailed LIDAR Contours



## Supplementary Maps

This map references the previous Detailed LIDAR Contours map, including all the same data except the designated restorable wetland areas. It can be used to illustrate additional possible areas for wetland restoration and expansion by utilizing the entire topographic profile of the site and the surface water drainage flowlines, without focusing on pre-designated areas for wetland restoration.

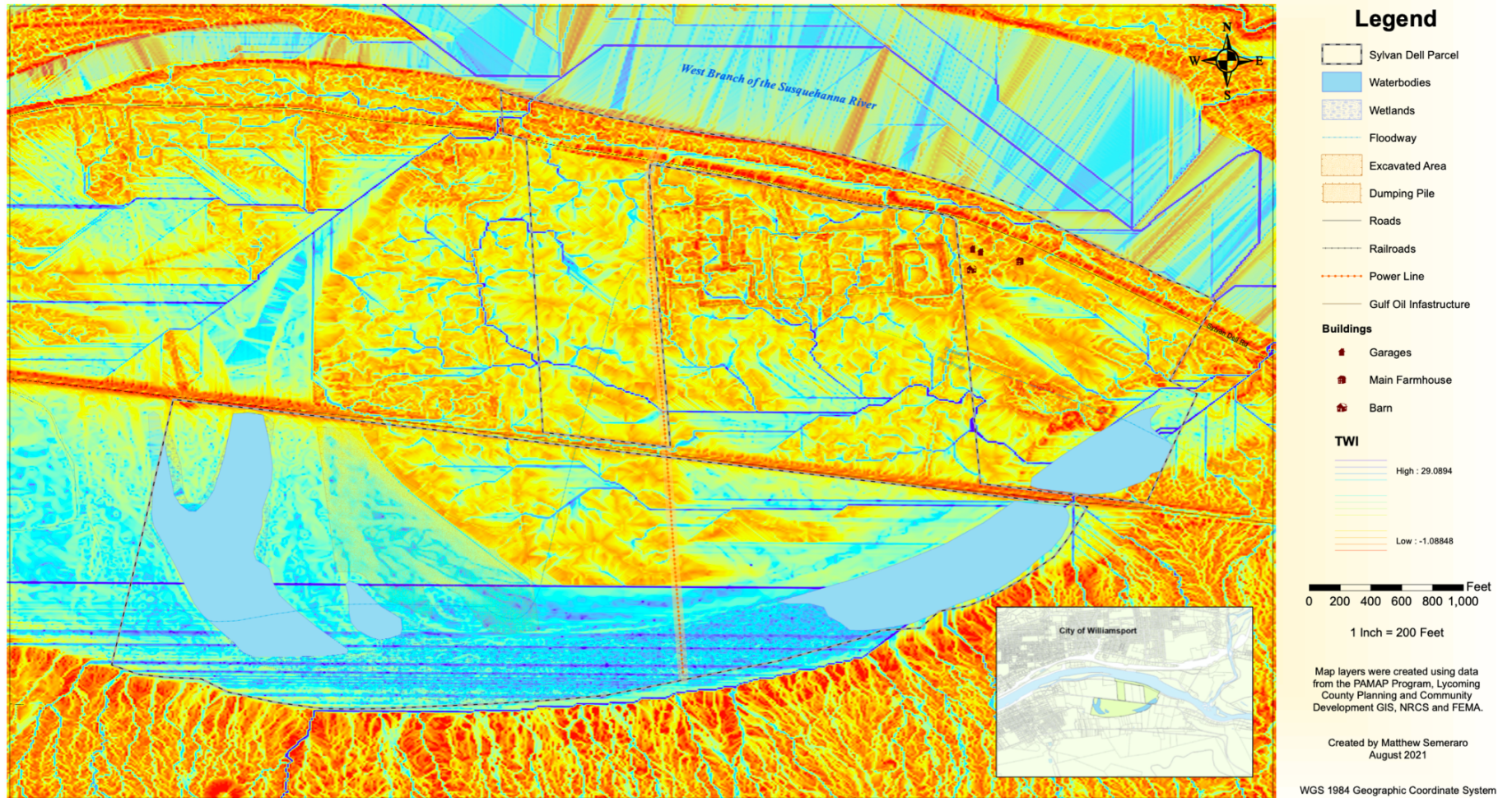


# Topographic Wetness Index

## **Topographic Wetness Index:**

The data shown on this map illustrates the topographic wetness index of the Robert Porter Allen Natural Area and Sylvan Dell Environmental Center. This raster dataset was derived from LIDAR elevation points produced by the PAMAP Program. The topographic wetness index or topographic convergence index is a hydrological-based topographic index that illustrates the area's accumulation and retention of water under steady-state conditions. This is defined as  $L_n$ , the contributing area's tendency to capture and receive water versus the slope angles tendency to excavate water. Areas shown in blue have a high topographic wetness index and therefore accumulate and retain more water than those areas shown in red with a low topographic wetness index. As a result, this map illustrates possible past, present and future stream segments and wetlands. Not only does this data illustrate the areas likely to accumulate and retain the most water, but also how these areas compare to the rest of the site and how far they extend. This is crucial to the ecological restoration plan as restoring the wetland requires finding areas along the wetland bed that will retain water once expanded.

### Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center Topographic Wetness Index



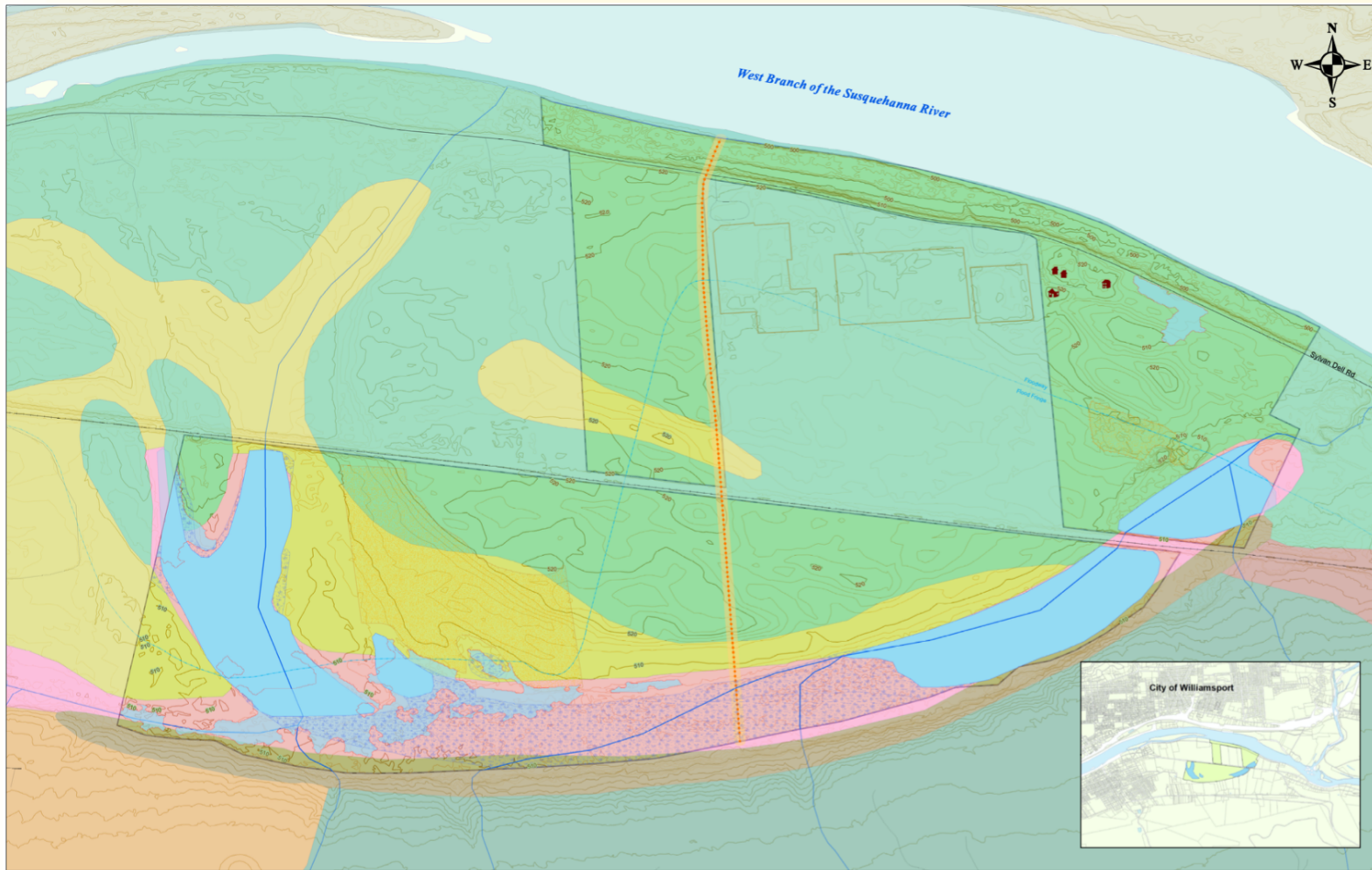


# Wetlands Restoration

## **Wetlands Restoration:**

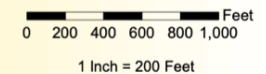
This map contains numerous central features to illustrate how these different data layers work together to inform the restoration and expansion of the wetlands within the Robert Porter Allen Natural Area. Using precise LIDAR data obtained from the PAMAP Program, contour lines are used to illustrate elevation differences on the site while soil classifications are included to show to different soils content of the site. Each contour line represents a 2 foot elevation difference, with bolded index contours every 10 feet. Index contours are also labelled within the Sylvan Dell site. Hydrologic features such as waterbodies, the wetland, the floodway, flood fringe and surface water drainage flowlines are added in addition to restorable wetland sites. This map was created to illustrate how these layers work together to allow us to find the best areas to restore and expand the wetland. While the contour lines show the topographic profile of the wetland bed, soil classifications are used to show where different soils are most prevalent on the site. Different soils have different water retention properties, therefore expanding the wetland requires an understanding of the specific soils and their location on the site. For example almost all of the wetland sits on Holly Silt Loam, a soil composed of smaller sized particles that retain water. This makes the Holly Silt Loam preferable for wetland restoration and expansion, there is even a chance that the Holly Silt Loam indicates some of the extent of the original wetland. Other similar soils, such as the bordering Basher Silt Loam may also be preferable for wetland expansion due to its smaller particle size. This map comes full circle in the wetlands restoration plan by encompassing soils and their different properties, contours lines to show topographic profiles, hydrology to show runoff flows and restorable wetland sites to compare with.

# Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center Wetlands Restoration



## Legend

- Sylvan Dell Parcel
  - Waterbodies
  - Wetlands
  - Restorable\_Wetlands
  - Surface Water Drainage Flowline
  - Floodway
  - Excavated Area
  - Dumping Pile
  - Contour Lines
  - Index Contours
  - Roads
  - Railroads
  - Power Line
  - Gulf Oil Infrastructure
- Buildings**
- Garages
  - Main Farmhouse
  - Barn
- Soil Classifications**
- Basher Silt Loam, occasionally flooded
  - Buchanan, very stony loam
  - Dekalb, very stony sandy loam
  - Dekalb & Lehigh, very stony sandy loams
  - Holly Silt Loam
  - Laidig Channery Silt Loam
  - Linden Loam
  - Linden Loam, occasionally flooded



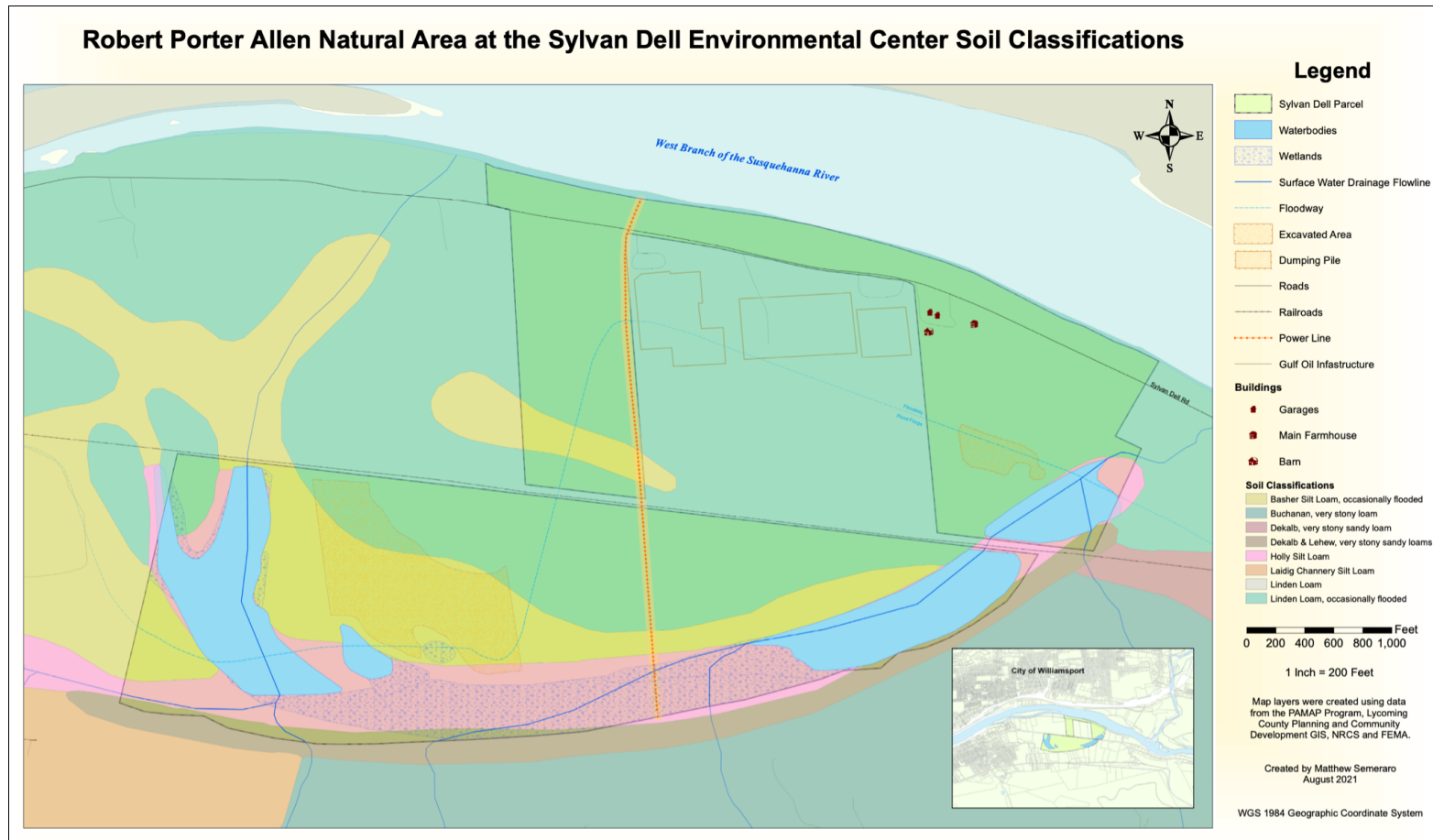
Map layers were created using data from the PAMAP Program, Lycoming County Planning and Community Development GIS, NRCS and FEMA.

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August 2021

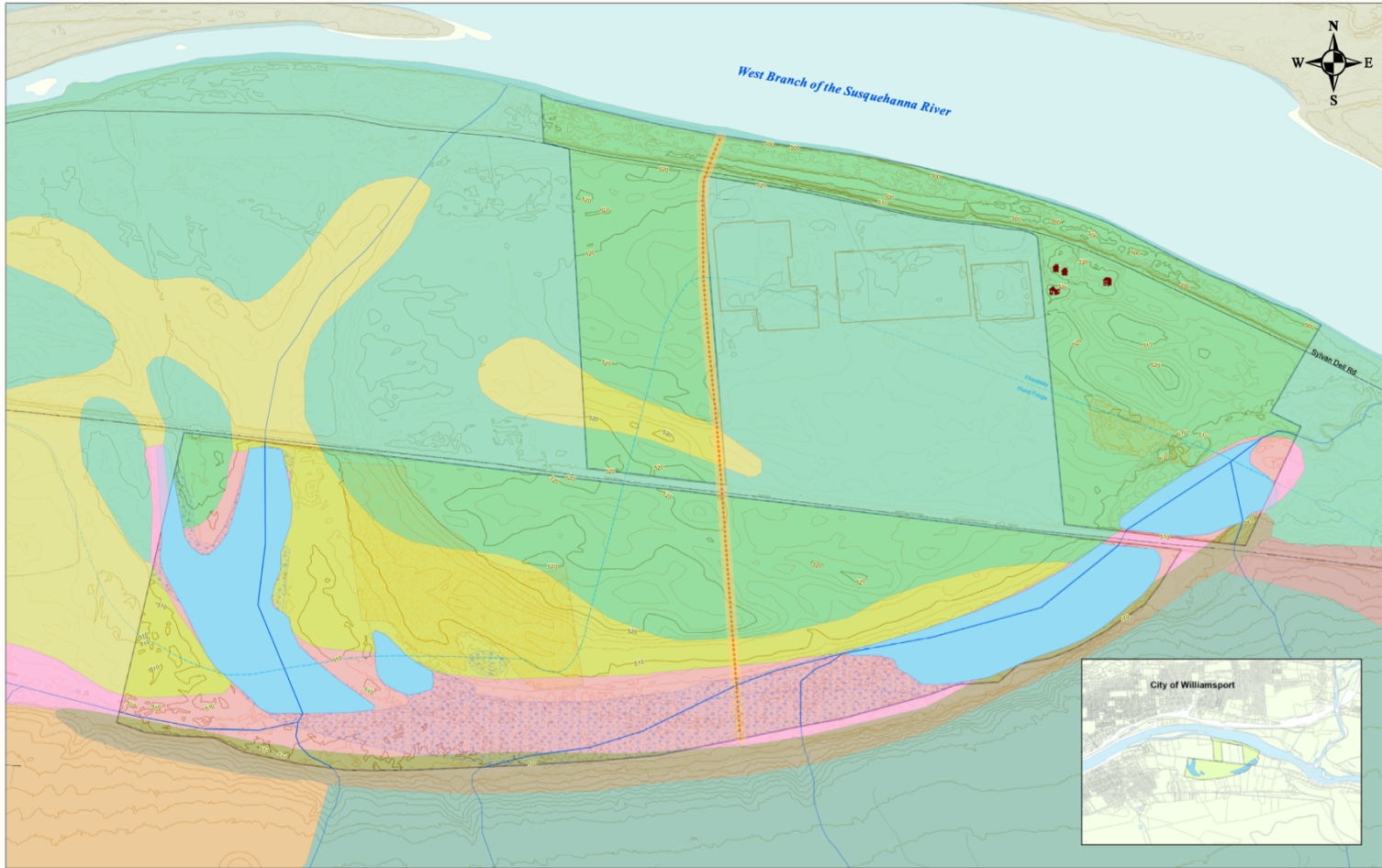
WGS 1984 Geographic Coordinate System

## Supplementary Maps

These additional supplementary maps reference the previous Wetlands Restoration map. The first of these is a simple Soil Classifications map to illustrate the different soils and hydrography on the site, without the LIDAR contour lines. The second supplementary map is very similar to the Wetlands Restoration map, including all the same data except this excludes the pre-designated restorable wetland areas. This allows for the viewer to focus more on the topography and soil content of the wetland bed to find their own areas for possible wetland restoration and expansion.



# Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center Wetlands Restoration



### Legend

- Sylvan Dell Parcel
- Waterbodies
- Wetlands
- Surface Water Drainage Flowline
- Floodway
- Excavated Area
- Dumping Pile
- Contour Lines
- Index Contours
- Roads
- Railroads
- Power Line
- Gulf Oil Infrastructure

#### Buildings

- Garages
- Main Farmhouse
- Barn

#### Soil Classifications

- Basher Silt Loam, occasionally flooded
- Buchanan, very stony loam
- Dekalb, very stony sandy loam
- Dekalb & Lelew, very stony sandy loams
- Holly Silt Loam
- Laidig Channery Silt Loam
- Linden Loam
- Linden Loam, occasionally flooded

0 200 400 600 800 1,000 Feet

1 Inch = 200 Feet

Map layers were created using data from the PAMAP Program, Lycoming County Planning and Community Development GIS, NRCS and FEMA.

Created by Matthew Semeraro  
August 2021

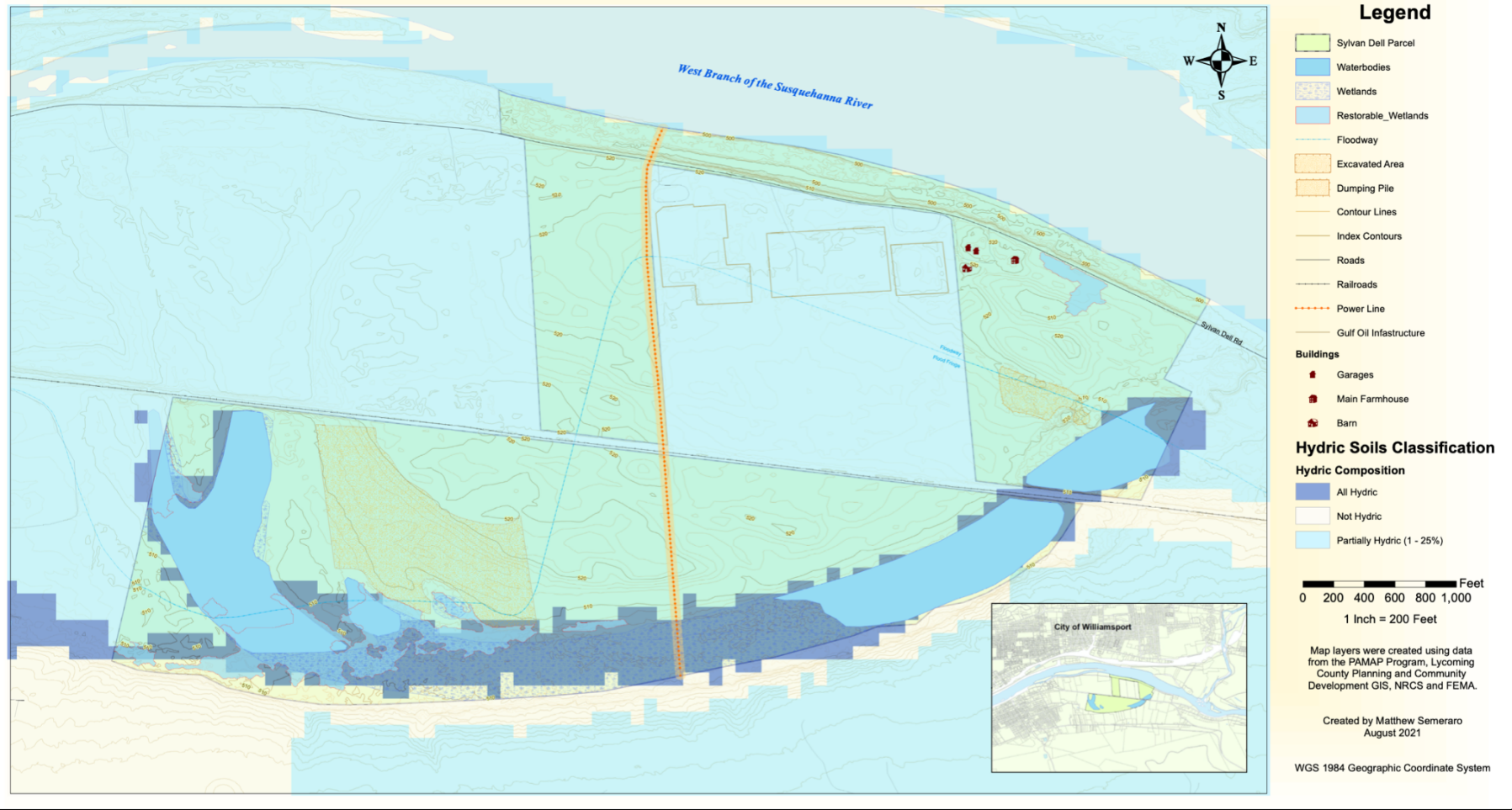
WGS 1984 Geographic Coordinate System

## LIDAR Contours and Hydric Soils

### **LIDAR Contours & Hydric Soils:**

This map focuses more closely on the hydric content of the soils within the Robert Porter Allen Natural Area and Sylvan Dell Environmental Center. While the soils classifications data layer focuses on the different soils on the site, this layer focuses on their hydric composition. Hydric composition refers to permanent or seasonal saturation of soil by water, as found in wetlands. As a result, the hydric composition of the soils on the site illustrate the best areas for the wetland restoration and expansion. Areas shown in dark blue are composed of all hydric soils, the best conditions for wetland expansion. Areas shown in light blue, or green-blue within the Sylvan Dell site, are composed of partially hydric soils where the wetland may be able to be expanded into. In white are non-hydric soil areas where the wetland cannot be expanded. Contour lines are included as well to illustrate the topographic profile of the wetland bed and within the area composed of all hydric soils.

# Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center LIDAR Contours & Hydric Soils



## Conclusion

The main goal of the Ecological Restoration Plan is to restore and expand the current wetlands within the Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center. Through spatial analysis using GIS I was able to uncover many new and important features on the Sylvan Dell site. As shown within the Hydrology map on page 6, both past and present surface water drainage flowlines have been uncovered, a vital source in restoring the wetland as a case study for MS4 (Municipal Separate Storm Sewer System) compliance with US EPA and PA DEP requirements for urban runoff treatment. In addition, other maps such as the LIDAR Contours shown on pages 9 and 10 illustrate topographic contours and depressions that can be utilized as preferable areas along the wetland bed for restoration and expansion. The Topographic Wetness Index shown on page 13 illustrates areas on the site of high water accumulation and flow, possibly uncovering additional historic flowlines and preferable areas in which wetland restoration or expansion would last with high water accumulation. Other maps shown like the Wetlands Restoration on page 15 encompass multiple maps and datasets into one complete plan that highlights specific areas of low elevation with the right soil content for a wetland area. These findings illustrate the most advantageous zones for wetland restoration and expansion on the site; and provide the necessary information to design the Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center in compliance with MS4 stormwater runoff regulations for clean and green urban runoff treatment. Not only will the Robert Porter Allen Natural Area at the Sylvan Dell Environmental Center reconnect the local community with the beautiful nature that surrounds them, but it will do so in a sustainable and effective manner for all wildlife.

## Acknowledgments

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- Dr. Shaunna Barnhart, Director Place Studies Program
- Brian Auman, BSA/LA
- Kathi Hannaford, GIS Consultant