Abstract

An Internship in Environmental Science
Evans, Mechwart, Hambleton and Tilton (EMH&T), Incorporated

By Eric Thomas Nagy

The Institute of Environmental Sciences (IES) at Miami University has offered a Master of Environmental Science since 1969. I have completed the class work needed for a Masters Degree concentrating in ‘Resource Analysis’. The program required a practicum, internship or thesis to complete the degree. As do most IES students, I chose the internship option so that I could gain valuable hands-on experience in environmental consulting. I have always been interested in consulting work because it represented a bridge between environmentalists and developers who often entertain opposite goals. Here I could use my botanical and environmental background to ensure that developers and government entities develop the landscape within the framework of Ohio’s laws. In addition, I could work with engineers at EMH&T, Inc. to minimize the effects of development upon the environment under the current laws. I completed the internship with Evans, Mechwart, Hambleton and Tilton (EMH&T) Inc. in Columbus, Ohio.
An Internship in Environmental Science

Evans, Mechwart, Hambleton and Tilton (EMH&T), Incorporated

Submitted to the Faculty of Miami University
in partial fulfillment of the requirements for the degree of
Master of Environmental Science
Institute of Environmental Sciences

By
Eric Thomas Nagy
Miami University
Oxford, OH
2005

Advisor_________________
Dr. Jerry E. Green

Advisor_________________
Dr. Michael A. Vincent

Advisor_________________
Dr. Gene E. Willeke
Table of Contents

Introduction ......................................................................................................................... 1
EMH&T Inc. .......................................................................................................................... 1
Scope of the Internship ......................................................................................................... 2

Wetland and Stream Delineation and Permitting ................................................................. 4
  Preliminary Investigation ................................................................................................. 4
  Delineation ....................................................................................................................... 7
    Defining Wetland Delineation
    Literature and Map Review
    Vegetation
    Soils
    Hydrology
    Field Methods
  Minimal Impacts Permitting ............................................................................................ 22
  Individual Permits ............................................................................................................ 29
  Wetland Mitigation .......................................................................................................... 32
  Wetland and Stream Monitoring ..................................................................................... 37

Additional Consulting Work .............................................................................................. 41
  Indiana Bat Tree Surveys ................................................................................................. 41
  EMH&T Wetland Basin .................................................................................................... 47
  GPS ................................................................................................................................ 49
  Ohio Rapid Assessment Methodology ............................................................................ 53

Conclusion ........................................................................................................................... 62

References ............................................................................................................................ 66

List of Figures
  Figure 1: Plant Indicator Status Categories
  Figure 2: Generalized Soil Profile Cross Section
  Figure 3: Flow Chart for a Wetland Delineation – Site Visit Unnecessary
  Figure 4: Flow Chart for a Wetland Delineation – Site Visit Necessary
  Figure 5: EMH&T, Inc. Wetland Data Form
  Figure 6: Flow Chart for a Wetland Delineation- Site Visit Necessary in Part
  Figure 7: COE Districts and Major Watersheds in the State of Ohio
  Figure 8: Diagram of an outlet structure used in the Mitigation Wetland
  Figure 9: Indiana Bat Decline from 1983-1997
Figure 10: Hibernating Populations of Indiana Bats by State
Figure 11: Annual Indiana Bat Chronology
Figure 12: Inferred Indiana Bat Migration Routes
Figure 13: Wetland FactorsDegraded by Human Influence
Figure 14: Scoring Breakdown for ORAM and VIBI
Figure 15: Lists of Wetland Indicator Species and Invasive Species for ORAM
Figure 16: ORAM x 5.0 Short Form

List of Appendices

A  Preliminary Investigation Letter
B  Delineation Report
C  Nationwide Permit Application
D  Wetland Monitoring Report
Acknowledgements

I could not have completed this internship, degree or report without the influence and help of a number of individuals. First, the faculty and staff I have worked with at Miami University in both the Botany Department and the Institute of Environmental Sciences have provided an enjoyable learning experience for the past six years. I would like to offer a special thanks to my internship committee of Dr. Gene Willeke, Dr. Jerry Green and Dr. Michael Vincent for their help.

I would like to thank the Individuals at EMH&T, Inc. for the training I received during my internship. They have patiently taught me the skills needed to work as an environmental consultant. Thanks to Sandy Doyle-Ahern for giving me a great career opportunity and for being available to provide professional guidance. I would especially like to thank Rob Milligan and Melissa Queen-Darby for being always available, helpful and friendly over the past six months. The employees at EMH&T, Inc. have made the transition into the workplace easy and enjoyable for me.

I would not be where I am today without the help and support of my family. My parents, Tom and Julie Nagy, taught me to be honest, hardworking and disciplined. They also provided the opportunity to attend college and supported me throughout the process. Additionally I would like to thank my brother, Michael, who has been especially helpful during the past few months. Finally, my grandparents who have given loving support over the years, which contributed to my success.
Introduction

The Institute of Environmental Sciences (IES) at Miami University has offered a Master of Environmental Science since 1969. It was established by a group of professors at Miami University who were interested in creating a truly interdisciplinary graduate program for the newly emerging field of environmental science. Over the years, IES has placed many environmental professionals in the State of Ohio and the United States.

I have completed the class work needed for a Masters Degree concentrating in ‘Resource Analysis’. In addition to requiring the core classes, the program has provided an opportunity to take classes in GIS, landscape analysis, environmental law and a variety of other classes. The program required a practicum, internship or thesis to complete the degree. As do most IES students, I chose the internship option so that I could gain valuable hands-on experience in environmental consulting.

I have always been interested in consulting work because it represented a bridge between environmentalists and developers who often entertain opposite goals. Here I could use my botanical and environmental background to ensure that developers and government entities develop the landscape within the framework of Ohio’s laws. In addition, I could work with engineers at EMH&T, Inc. to minimize the effects of development upon the environment under the current laws. I completed the internship with Evans, Mechwart, Hambleton and Tilton (EMH&T) Inc. in Columbus, Ohio. In the following report all references to the clients of EMH&T were omitted to preserve client confidentiality.

EMH&T Inc.

My six-month internship with EMH&T Inc. in Columbus, Ohio began on February 21, 2005. The firm was started by G.E. Evans in 1926 and has been operating under its current name since 1954. EMH&T, Inc. is a consulting firm made up of civil engineers, land surveyors, GIS specialists, construction managers, environmental scientists, landscape architects and land planners. EMH&T, Inc. offers consulting in the areas of civil engineering, land surveying, environmental management, landscape architecture and land planning.

The Environmental Division consists of environmental scientists trained in biology, botany, zoology, and aquatic ecology as well as archaeological and architectural historians. The division offers: preliminary investigations, delineations, permitting and monitoring, endangered species
surveys, phase I and phase II environmental assessments, mitigation, restoration planning and
design, ecological surveys, cultural resource surveys and various other services. EMH&T, Inc.
works for private developers, government organizations and anyone else in need of
environmental services.

Scope of the Internship

The environmental division at EMH&T Inc. does a large amount of environmental
consulting business in central Ohio. The division continues to experience steady growth and has
earned the respect of the regulating authorities. The environmental division is large, employing
eight environmental scientists, three environmental engineers, six archeologists, and an
environmental technician. Since February, 2005 EMH&T Inc. has added three additional
environmental scientists. The large organization provides opportunities to work with
experienced environmental professionals who do all aspects of environmental work. This
internship provides a mix of field work, technical writing and communication with clients and
governmental regulators alike.

My specific duties include: completing preliminary investigations (PIs) on properties to be
developed, conducting wetland delineations, permitting, undertaking habitat evaluations, wetland
and storm water basin planting, and mitigation site monitoring. PIs are the first consideration of
a property to be developed to determine what impacts upon streams and wetlands will need to be
addressed during delineation. Delineations and permit applications are completed as needed
according to the laws under the Clean Water Act. Each property is unique, and presents different
permitting requirements. Permitting applications require a good understanding of the laws and
regulations, which are enforced by government bodies with jurisdiction in your area. During the
past six months, I have worked in two states, Ohio and Indiana, each of which uses different
processes in order to permit and regulate the impacts upon streams and wetlands. While the
process is similar in both states, the people and organizations treat a permitting scenario
differently depending upon their interpretation of the laws.

At EMH&T I interact and communicate with a variety of government organizations
including: Ohio Department of Natural Resources (ODNR), Ohio Environmental Protection
Agency (OEPA), the U.S. Fish and Wildlife Service (USFWS), the USDA - Natural Resources
Conservation Service (NRCS), the Ohio Environmental Protection Agency (OEPA), the Indiana
Department of Environmental Management (IDEM) and the U.S. Army Corps of Engineers (COE) in both the Huntington and Louisville Districts.

A large portion of my internship involves working along with other employees at EMH&T to ensure private developers who build houses, condominiums, apartment complexes, golf courses, etc. are operating within the law. EMH&T considers a property and informed the client of what the proposed development will require and how to minimize the impacts of development on regulated waters of the U.S. If it is profitable for the developer to do so, this is followed by communicating and/or negotiating with the regulating government agencies to see that the development is done legally. This includes both wetland and stream delineation and obtaining the associated permits.

It is important to understand what authority the government has given to restrict private land use. In most cases in the United States, a land owner has the freedom to do what he or she pleases with the land that they own. However, the United States has jurisdiction to regulate adverse effects upon waters of the U.S. given to it by the Rivers and Harbors Act of 1899, the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. According to the Army Corps of Engineers (COE), a loss of waters of the United States “includes the filled area and other waters that are permanently adversely affected by flooding, excavation, or drainage because of the regulated activity.” In addition, the COE also has power to ensure any land use does not adversely affect an endangered species by power granted by the Endangered Species Act. Recently, the COE has been using this power to enforce a seasonal restriction on tree clearing because of adverse affects upon the Indiana Bat. This topic is discussed in more detail later within this document.

The federal government only has jurisdiction over waters that are connected to the navigable waterways of the United States. This includes all tributaries to these navigable waterways, assuming they contain enough flow to sustain a high water mark. This also includes lakes and wetlands online or hydraulically connected to a water of the United States. In addition, most states have passed their own water quality laws that exceed that of the federal government. These are regulated by a state agency, in Ohio this is the Ohio Environmental Protection Agency (OEPA).

Therefore, in Ohio both the COE and OEPA must be involved in the process to get the proper permits for impacts to waters of the United States or isolated wetlands. If there are only
minor impacts to streams and wetlands on a property in Ohio, Nationwide Permit (NWP) notifications must be sent to the U.S. Army Corps of Engineers (COE) under the Rivers and Harbors Act of 1899, section 404 of the Clean Water act, and the Marine Protection Research and Sanctuaries Act. If there are substantial impacts to streams and wetlands in Ohio, then Individual Permit applications through the COE and the OEPA are required.

While most wetlands are hydraulically connected regulated waters of the U.S., some wetlands are isolated from them. These wetlands lose their protection when a court ruling decides that isolated wetlands can not be protected by the federal government. Since then, most states, including Ohio, have passed laws protecting these resources. Now an isolated permitting process is completely separate from those waters regulated as waters of the U.S. and isolated permits are issued through OEPA.

In Indiana, minor impacts to streams require an application for a Regional General Permit (RGP) that must be applied for through the Army Corps of Engineers (COE). In some cases, an Individual 401 Water Quality Certification through the Indiana Department of Environmental Management (IDEM) is also required for even minor impacts. If there are substantial impacts to streams and wetlands in Indiana, then Individual Permits through the COE and the IDEM are required. The regulations governing the determination of impacts in both states are handed down by the regulating authorities and change every few years.

In the following report, the central Ohio development process is outlined from beginning to end including the laws and regulations governing this process. During this process, I will provide examples of both what I have learned and my specific experiences during the Internship. After discussing permitting experiences, I will explain some other jobs that I have been trained to perform while working at EMH&T, Inc. Most of the documents I produce at EMH&T, Inc. are adapted from old reports, but with new, relevant information added.

Wetland and Stream Delineation and Permitting

Preliminary Investigations

Most projects at EMH&T Inc.’s environmental division result from a client or engineer inquiry regarding permitting concerns on a subject property. Often these concerns are raised before a client has purchased the property and EMH&T, Inc.’s investigation may have a profound impact on the development of the site. In order to address these concerns, a
Preliminary Investigation (PI) is completed for a subject property. An environmental consultant evaluates a property to be developed and explains what impacts upon streams and wetlands should be addressed. The product at this stage is a letter to the developer outlining the basic topography, streams, and wetlands on the property and any concerns about the proposed development. A PI is prepared for the exclusive use of the contracted company.

Before visiting a site, a thorough map review of the subject property is completed. The review consists of five different maps of the site, which give the investigator information to as the type of wetlands and streams that may be found on the subject property. These maps are scanned into a computer and the site’s borders drawn, so that they can be referenced in the PI letter. Figures 1 through 5 refer to the PI letter, not items found within the body of this report (please see an example PI included as Appendix A). Figure 1 is an area location map that shows the roads, railroads, major water features, city limits, townships, county boundaries, etc. Figure 2 is part of a USGS 7.5 Series Quadrangle Map which shows the area in detail including the topographic contours. Figure 3 is a soils map taken from the county soil survey. The soils on a property are cross referenced with a list of hydric soils and a list of non-hydric soils with hydric components for the county in question. Figure 4 is a FEMA Flood Map which shows any floodplains and floodways in which the property is located. Finally, the National Wetland Inventory Map is included as Figure 5, which shows all the wetlands that have been mapped from aerial photographs.

The map review gives the researcher a good indication of what might be found on a site, but he or she must be cautious because details may be missed when mapping areas at such a large scale. In addition, maps may be outdated as they are updated at approximately ten to twenty year intervals. Thus, most of the findings depend on the site visit to the subject property.

During a site visit, the consultant searches for any jurisdictional waters of the United States, which may include ephemeral, intermittent and/or perennial streams; ponds or lakes online with these streams; jurisdictional wetlands; and isolated wetlands. While at the site a wetland scientist takes notes on the hydrology, vegetation, and soils; draws maps; and tries to get an accurate picture of how the water is flowing across the subject property. In order to do this, it is important to know the jurisdictional definitions and understand the regulations within that particular subject property. A consultant must recognize that regulations and definitions can change from state to state and from COE District to COE District.
Finally, an employee must inform the client whether delineation and/or permits will be necessary in order to develop the property. The investigator makes recommendations at the end of the letter so that the developer can accurately know the environmental costs associated with development. The recommendations section should be concise so that the developer can see simply what the concerns are on the site and what he or she can do to address these concerns. Again, Appendix A shows a complete example of a Preliminary Investigation and the referenced figures.

My specific responsibility is to produce a PI letter or a simple but thorough view of any jurisdictional waters on the subject property. I use a computer to look at photocopy scans of the five figures and draw in the property boundaries. This gives me an understanding of the mapped waters and the contours upon the site. I then write my letter to the client and discuss the land’s location, elevation, slope, mapped soils and mapped jurisdictional waters. I also consult the county soil survey and read about the soil’s capacity to hold water. By the time I visit the property for a site visit, I can picture in my mind how the water is flowing on the property.

I find the site visit to be the most useful and valuable information within the PI letter. Maps in central Ohio are often incomplete and/or outdated. When visiting a property, I take the following materials: several plant identification books, a digital camera, a Munsell soil guide, a soil probe, a map of the soils with the hydric soils highlighted, a clip board, several writing utensils and an aerial photograph if one is available for the project. I find detailed directions to the site and gain permission to be on the site.

Once I arrive at the site, I drive any open fields with the company vehicle to cover the areas that are clearly visible. I then find, photograph and document the approximate location of any jurisdictional streams on the property. I usually start by walking the major stream and then follow any tributaries upstream until they end or exit the property. I follow up by looking at any woodlots or depressions that might be sheltering wetland areas. If I find such an area, I take photographs in case we need them in the future. Then I look for areas that have or would have wetland hydrology during the growing season. If this is present, I look for the wetland vegetation present onsite. Finally, I use the soil probe to take soil samples in the potential wetland and compare that to the Munsell color guide. I then record the location of the potential wetland on my aerial photograph and return to the office.
Sometimes jurisdictional wetlands are clearly distinguishable and sometimes a decision is a judgment call. At times I review the pictures and samples that I took onsite in order to make the correct decision. I try not to let anything outside of the Army Corp’s wetland and stream definitions influence my decision regarding jurisdictional status. Finally, I write a paragraph into the PI letter explaining the size and location of the jurisdictional or potentially jurisdictional areas on the property. I then write my recommendations of what the property owner should do to obtain permits upon the subject property.

During the course of my internship I completed between 20 and 30 PI letters. Most of the properties contain Category 1 and 2 wetlands and/or portions of streams. I would often come back and make a presentation to Rob on what I found on the property and discuss the jurisdictional status of any marginal areas. Often times these PI letters turn into delineations and permit projects for our department. Accurately assessing the sizes and locations are most important at this stage in the process.

Delineation
Defining Wetland and Stream Delineation

The second step in the development of a property that contains jurisdictional Waters of the U.S., including streams and wetlands, is the identification of their jurisdictional boundaries. Wetlands are defined as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (Environmental Laboratory, 1987).

According to the Environmental Laboratory, all wetlands share characteristics in three general areas: vegetation, hydrology and soils. The prevalent vegetation must consist of those plants adapted to life in inundated or saturated conditions. The soils must be classified as hydric or show signs of reducing soils conditions. Wetland hydrology includes areas being permanently or periodically inundated or saturated at some time during the growing season (1987). Each of these three general areas of wetlands is discussed in detail later in this document. There are two major wetland classes, jurisdictional and isolated, which are discussed later in this document.

Secondly, streams are also identified and delineated. In my opinion, stream delineation is more straightforward and also more subjective than wetland delineation. A stream becomes
jurisdictional where it has an apparent Ordinary High Water Mark (OHWM), or a mark on the stream bank where the water level would be after an average rain event. During the growing season, which is approximately mid April to mid October in Ohio, this mark is often shown by the place where rapid water flow stops the growth of vegetation. A line of erosion is used to delineate streams in the winter months. The exact location of the start of a stream is often determined by the scientist’s opinion and experience.

In addition to delineating the existence of a stream, a consultant must place that stream in one of three classes. The three stream classes include: ephemeral, intermittent and perennial. Ephemeral streams are those streams that have an OHWM but lack a direct connection to the groundwater. These streams only contain water directly following a precipitation event and often do not have a diverse substrate or a riffle/pool type environment. According to the COE, “an ephemeral stream has flowing water only during and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow” (COE, 2002).

Intermittent streams are those streams that have a seasonal connection to the groundwater but do not contain water through the entire growing season. In late summer, these streams do not have a continuous above ground component except directly following a precipitation event. However, these streams often have much channel diversity and riffle/pool environments. According to the COE, “an intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow” (COE, 2002).

Perennial streams are those streams and rivers with a direct and year round connection to the groundwater. These streams and rivers contain water all year, except during periods of drought. In their natural state, these rivers and streams would have a riffle/pool environment and channel diversity. According to the COE, “a perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow” (COE, 2002).
It is important to mark the center line of small streams and the full bank widths of larger perennial streams when completing delineation. Because stream delineation is more straightforward than that of wetlands, there is less guidance set forth by the COE. Because of the complicated nature of wetland delineation it is explained below in much greater detail, but that does not make the accurate assessment and delineation of streams any less important.

**Literature and Map Review**

Before the field work for a wetland delineation is completed, there must be a thorough literature review of the area. This is similar to the PI literature review except that it is more in-depth. The guidelines for such a literature review are set forth by the *Corps of Engineers Wetlands Delineation Manual*. These guidelines ask that certain references be studied for a property.

In general EMH&T looks at an area location map, a USGS quadrangle map, a soils map, a FEMA Flood Map and a NWI map, which cover five of the ten listed references. In addition, the investigator should consult the county soils manual for the drainage capacity, permeability, and depth of the water table in hydric soils or soils with hydric components. It is also important to consult the *Monthly Water Inventory Report*, which is available online, to investigate the precipitation levels for the six months prior to the investigation. This will allow the investigator to know what hydrology to expect within wetland areas at the current time. More important than finding every reference listed, is using the information from the literature and map review to understand how the water flows across the site.

The manual also asks for additional information. This includes remote sensing data, specifically aerial photography; USGS land use and land cover maps; environmental impact assessments; and local individuals or experts. If the survey plans or engineering designs exist, these are also good references so that a picture of the proposed development begins to take place. EMH&T looks at most of these in certain circumstances depending on their applicability to each individual delineation. In most cases, a thorough literature review for a property is completed by the end of the permitting process. The COE and OEPA will ask that additional references be consulted if they feel it is needed.

**Vegetation**

If the plant community is dominated by those species that persist in saturated soils, the vegetation supports wetland conditions. Species that have an indicator status of OBL, FACW or
FAC are considered to be typically adapted for life in anaerobic soil conditions (Figure 1). When addressing the vegetation of the site, emphasis is placed on the makeup of the plant community not upon individual plants found within that community (Environmental Laboratory, 1987).

![Table 1: Plant indicator status categories as developed by the USFWS (Environmental Laboratory, 1987).](image)

The investigator must be able to identify whether the majority of the plant species are wetland or upland indicators and use his or her best professional judgment in determining the presence or absence of dominant wetland vegetation. Environmental Laboratory states that many factors influence a specific plant community, but wetland plant communities are those that are controlled by the hydrology of the area (1987). This is based on the scientific understanding that “plants lacking morphological, physiological, and/or reproductive adaptations cannot grow, effectively compete, reproduce, and/or persist in areas that are subject to prolonged inundation or saturated soil conditions (Environmental Laboratory, 1987).” Hydrophytic vegetation is present if one of the following indicators is present: more than 50% of the dominant species are wetland indicator species; plants having morphological, physiological and/or reproductive adaptations to deal with hydric conditions; and/or documented presence of a wetland community (Environmental Laboratory, 1987).
Soils

Hydric soils are those that form under anaerobic conditions which results in a reducing environment (Environmental Laboratory, 1987). Environmental Laboratory continues that many components are reduced chemically when inundation removes oxygen from the soil. This in turn causes indicative soil colors and textures. In general these soils develop a dark color and a silty clay texture. Hydric soils include those that develop under inundation and saturation and are usually gray and/or mottled in the B-horizon. In order to correctly classify such hydric soils, a soil scientist should understand the soil cross section which divides any soils into horizons (Figure 2). Soils will meet the definition and criteria for hydric soils if they: are organic soils, are mineral soils containing at least 20 percent organic matter if no clay is present or 30 percent organic matter if clay is present, contain sulfidic material, lack dissolved oxygen, have reducing soil conditions, have colors of hydric soils, are on the hydric soils list, and/or have iron and manganese concretions. The soil’s presence or absence from a list of an area’s hydric soils is the criteria used most often to identify wetland soils (1987).

Figure 2: Generalized soil profile cross section (Environmental Laboratory, 1987).
**Hydrology**

Wetland hydrology refers to the presence of water in the soils either through inundation or saturation during some time during the growing season (Environmental Laboratory, 1987). Often this is a difficult task because the hydrology may only be present at a site during the early spring and/or late fall. Environmental Laboratory continues secondary characteristics such as buttressed roots, gray leaves, drainage patterns, etc. become necessary for hydrology evidence during the dry season. Numerous factors including precipitation regimes, groundwater, surface water, and vegetative cover can influence the hydrology of an area. This means that the conditions can very greatly from year to year and it is important to identify the “normal hydrologic conditions”. The wetland hydrology condition is met if any of the following are found for a site: drainage patterns, drift lines, sediment deposition, watermarks, stream gage data, flood predictions, historic records, visual observation of saturated soils, and visual observation of inundation (1987).

**Field Methods**

Before going into the field an investigator must decide if they are completing a routine or comprehensive delineation. Nearly all delineations are routine, because comprehensive delineations are not usually cost effective in the development process. Routine delineations use rapid assessment methods that are generally simple to use. Comprehensive delineations are wetland determinations that are only used when rigorous documentation is required. Usually, there will only be one area, vegetation, hydrology or soils that are disputed in which case only a comprehensive delineation in that area will need to be completed. In all cases, a routine delineation should be completed first. This section focuses solely on routine delineations, since rarely are comprehensive delineations cost effective.

The PI serves as an initial information gathering step that identifies what type and level of delineation will be used. According to the Environmental Laboratory, three levels of investigation for any wetland delineator. Level 1 includes wetlands for which enough information has been obtained to make an onsite inspection unnecessary. Figure 3 is a flow chart showing the steps to follow when completing this type of delineation (1987). This type of information uses data previously collected, mapping and/or remote sensing information to understand the wetland boundaries on a site. At EMH&T this type of delineation is rarely used.
by any environmental scientist because it is easy to overlook an unmapped wetland or stream. A responsible environmental scientist always visits a site to complete a wetland delineation.

According to Environmental Laboratory, level 2 includes those properties where there is not sufficient information available to make a wetland determination. In this case an onsite inspection is necessary (1987). At EMH&T Inc. it is common practice to inspect all properties, even when the mapping and aerials do not show any wetland areas. Figure 4 is a flow chart showing the steps to follow when completing this type of onsite delineation (Environmental Laboratory, 1987). A level two determination eliminates any error caused by outdated information or poor resolution on aerial photographs.
Figure 3: A flow chart identifying the steps for a wetland determination when a site visit is determined to be unnecessary (Environmental Laboratory, 1987).

Wetland Data sheets, for which an example is shown in Figure 5, are used at both wetland and upland points to relate to others the wetland features present at or absent from a delineated area. The size of the wetland area determines the thoroughness of the delineation. According to Environmental Laboratory, if the wetland area is below 5 acres in size, then a simple delineation
can be accomplished. You simply supply a wetland data sheet and an upland data sheet for every plant community type. If the wetland area is above 5 acres in size, which is rare in central Ohio because of wetland fragmentation caused largely by agriculture, then a more complex routine delineation with transects should be completed. Wetland data sheets are then supplied at specific intervals that have been set by the Environmental Laboratory (1987). Finally, Level 3 is a combination of Levels 1 and 2 for scenarios when there is sufficient information to characterize part but not all of a project area (Environmental Laboratory, 1987). For this option, much of the project area must be inspected onsite. Figure 6 is a flow chart depicting how this type of routine delineation is to be completed. Basically, a delineator uses Level 1 to delineate as much as possible and then follow the procedures in Level 2 for the remainder of the property. The use of literature to provide the delineation of soils and mapped wetlands are the only examples of Level 3 wetland delineation used at EMH&T Inc. The company often uses the soil’s manual to provide information about a wetland, instead of taking soils samples, unless the soils have been disturbed on a property.

When delineating a property, a scientist should note any human disturbances that have altered one or more of the wetland indicators. If a disturbance creates a wetland where one would not naturally exist by altering the soils or hydrology he or she may have grounds to call that wetland non-jurisdictional. For example, I investigate a property where a pond has been excavated then later filled. In this depression, I find wetland vegetation, but because the soils are disturbed it is likely that the COE would find those wetlands to be non-jurisdictional. Therefore, this area is not flagged as a wetland.
Figure 4(a): Flow chart of wetland determination when an onsite inspection is determined to be necessary (Environmental Laboratory, 1987).
Figure 4(b): Flow chart of wetland determination when an onsite inspection is determined to be necessary (Environmental Laboratory, 1987).
## DATA FORM - ROUTINE WETLAND DETERMINATION

<table>
<thead>
<tr>
<th>Project/ Site</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicant/ Owner</td>
<td>County</td>
</tr>
<tr>
<td>Investigator</td>
<td>EMH&amp;T, Inc.</td>
</tr>
<tr>
<td>State</td>
<td>Ohio</td>
</tr>
<tr>
<td>Do normal circumstances exist on the site?</td>
<td>Y  N</td>
</tr>
<tr>
<td>Is site significantly disturbed (Atypical situation)?</td>
<td>Y  N</td>
</tr>
<tr>
<td>Is the area a potential problem area?</td>
<td>Y  N</td>
</tr>
</tbody>
</table>

### VEGETATION

<table>
<thead>
<tr>
<th>Dominant Species</th>
<th>Stratum</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Percent of Dominant Species that are OBL, FACW, or FAC

Notes

### HYDROLOGY

<table>
<thead>
<tr>
<th>Recorded Data (Describe in remarks)</th>
<th>Primary Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream, Lake or Tide Gauge</td>
<td>Inundated</td>
</tr>
<tr>
<td>Aerial Photographs</td>
<td>Saturated in upper 12”</td>
</tr>
<tr>
<td>Other</td>
<td>Water marks</td>
</tr>
<tr>
<td>X No recorded data available</td>
<td>Drift lines</td>
</tr>
<tr>
<td></td>
<td>Sediment deposits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Observations</th>
<th>(inches)</th>
<th>Secondary Indicators (2+ required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of Surface Water</td>
<td></td>
<td>Drainage patterns</td>
</tr>
<tr>
<td>Depth to Free Water in Pit</td>
<td></td>
<td>Oxidized root channels in upper 12”</td>
</tr>
<tr>
<td>Depth to Saturated Soil</td>
<td></td>
<td>Water-stained leaves</td>
</tr>
<tr>
<td>Other (explain in notes)</td>
<td></td>
<td>Local soil survey data</td>
</tr>
</tbody>
</table>

Notes

### SOILS

<table>
<thead>
<tr>
<th>Series and phase</th>
<th>On hydric soils list</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matrix color</td>
<td>Mottle color</td>
<td>Low chroma/ gleyed</td>
<td>Yes</td>
</tr>
<tr>
<td>Other indicators</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### WETLAND DETERMINATION

| Hydrophytic vegetation present? | Yes | No |
| Wetland hydrology present?     | Yes | No |
| Hydric soils present?          | Yes | No |
| Is this data point within a wetland? | Yes | No |

Figure 5: Wetland delineation data form used at EMH&T, Inc. during the internship.
Figure 6 (a): Flow chart explaining how to complete a wetland determination when an onsite inspection is necessary for part, but not all, of a property (Environmental Laboratory, 1987).
Figure 6(b): Flow chart explaining how to complete a wetland determination when an onsite inspection is necessary for part, but not all, of a property (Environmental Laboratory, 1987).

All areas considered jurisdictional wetlands are flagged with surveying tape along the boundary. The investigator uses their best professional judgment to place a wetland boundary in the correct place. This is difficult since most boundaries are a gradient from wetland conditions
to upland conditions. The rule is to be inclusive when completing a delineation on marginal areas. If a wetland scientist decides to rule an area as non-jurisdictional, they must document this decision with supporting evidence. Often times, the Army Corps of Engineers (COE) will check work on a site to verify that a consultant has correctly identified all the wetlands upon a property. Therefore, it is important to honestly assess the entire property, being careful to not miss any wetland areas. After the wetland is verified by the Army Corps of Engineers it remains in effect for five years from the date of the Corps’ letter. After that time period expires a new delineation must be completed. Appendix B is an example of an EMH&T Inc. delineation document.

When completing a delineation report, I first complete the initial literature review and map review in the same way as I would the Preliminary Investigation, but the field work on site is more in depth. When completing the fieldwork for a delineation, I take the following materials: several plant identification books, a digital camera, a Munsell soil guide, a soil probe, a soils map with the hydric soils highlighted, a clipboard, several writing utensils, an aerial photograph if one is available for the study area, delineation data forms, several ORAM forms and flagging tape. On several delineations I take the GPS to field survey the wetland boundaries and stream centerlines. Finally, I look up detailed directions to the site and gain permission to be on the site.

Most often between two and four people delineate properties at EMH&T, Inc., especially on larger jobs, although I have delineated several smaller jobs on my own. After arriving at a site, I first look over the map with my coworker(s) and come up with a plan for that particular property. If more than one person is delineating a property usually we stick together and search the areas for wetlands and streams. Often times, a PI has already been completed and the approximate wetland locations are known. Therefore, we usually know before we arrive on site the sizes, locations and qualities of the jurisdictional waters.

For the streams, I begin by walking the largest stream and then follow any tributaries upstream until they end or exit the property. The stream centerlines are flagged and photographed thoroughly. For large, perennial streams I either flag the top-of-bank or depend upon existing mapping. I try to record the photograph locations on a map or aerial so that I know for certain where they were taken.

For wetland areas, I look at the information in the same way as I do for a Preliminary Investigation to decide if the area is a jurisdictional wetland. If the wetland is jurisdictional, I
identify the wetland boundary at one location, then work my way around the outside flagging the boundary as I go. In places where the hydrology ends abruptly, the boundary is obvious and distinct. In other locations the hydrology slowly tapers out, as does the wetland vegetation. In such areas I use the soils to identify the wetland boundary. If the soils do not show a change, then I usually put the wetland line in the center of the wetland to upland gradient.

After flagging the wetland boundary, I take the photographs of the wetland and record the locations. Then I complete a wetland data form for every distinct plant community inside the boundary and also complete an upland data form at every point. I also fill out an ORAM form for every wetland to get a quantitative score so that proper protection can be awarded. At times, it is necessary to use the GPS to survey the boundary at the same time of the delineation. This is one of my specific tasks and I discuss this later in this document. On most delineations, a survey crew is sent to a delineated site in order to pick up the flags and give us accurate mapping of the wetland delineation.

During the course of my internship I delineated approximately ten properties. On at least two delineations, I was sent to the site alone to flag the boundaries, fill out data forms and GPS the flags. Most of the properties contain Category 2 wetlands and/or portions of streams. I found the key being efficient is to have data forms, maps and other paperwork organized in the field and condensed to make it easier. I also use a hunting vest to hold all of my books and other tools so that I am able to take more reference materials with me into the field.

Delineations are straightforward and most often not difficult. Some forested wetlands can be a challenge in late summer and fall when the hydrology dries up. Yet secondary indicators like water marks on trees and water stained leaves are giveaways at any time during the year. Herbaceous wetlands usually have obvious wetland vegetation and more distinct boundaries than do forested wetlands. Streams are not difficult to delineate and centerlines are simple to find. When performing delineations, I focus on the definitions and regulations and try to designate all the wetlands fairly. Often times I compare the wetlands to my experiences in other locations to make decisions.

**Minimal Impacts Permitting**

Permitting for minimal impacts is different in every state and includes Regional General Permits (RGP) in Indiana and Nationwide Permits (NWP) in Ohio. The federal government sets
minimal protection standards for the United States. However, states can surpass these regulations with their own laws and regulations. Local regulations require even greater environmental protection. Therefore permitting depends upon the state, county and city/township in which the land is located. This section discusses permitting in both Indiana and Ohio as well as a few other items that must be included as part of the application.

Indiana has different guidelines and laws governing the permitting process than does Ohio. Indiana has suspended some of their Nationwide Permits and instead enacted Regional General Permits (RGP) for impacts to Water’s of the U.S. less than 1.0 acre. However, if you are affecting over 0.10 acre of wetland or streams and/or over 300 foot of stream, a developing party must obtain a 401-Water Quality Certification through IDEM, which is the equivalent organization in Indiana to the OEPA in Ohio. In addition, if a developer is relocating, encapsulates or channelizes any amount of stream they must obtain a 401-WQC permit from IDEM. The only exception to this rule exists when encapsulating less than 150 linear feet of a stream for the purpose of a road crossing.

At times where IDEM regulators decide that a project is degrading an area’s watershed, IDEM requires a 401-WQC even if a developing party impacting minimal amounts of Waters of the U.S. This includes impacts occurring to a watershed through a single project or by cumulative projects in the area. On my permitting project in Indiana, I encourage the client to minimize impacts to Waters of the U.S. in an effort to avoid a 401-WQC. Later, IDEM informs me that due to cumulative development in the area they are requiring the client to obtain a 401 WQC from IDEM. Any consultant should ask the regulators to explain their lawful definition of “a more than minimal” impact when dealing with water quality when viewed individually or collectively with other projects in the area. Regulators must provide reasons based upon facts or regulations, not based on feelings. However, in this case there would have been little chance of arguing this point, because this region of Indianapolis was experiencing obvious and rapid development.

In order to free up resources for complicated problems, the COE has issued nationwide permits for the filling of streams and wetlands in Ohio from March 18, 2002 to March 18, 2007 through Public Notice No. 200200248-OH (COE, 2002). The Corps draws its authority from and has published these permits under the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. A long list of
general and activity specific regulations control when and to whom these permits are issued. The Nationwide Permit General Conditions lay out the rules governing all permits issued. However, activity specific regulations broken down into forty-four categories govern how impacts must be carried out to comply with the COE.

For most residential or commercial development in Ohio, if an entity affects less than 300 feet of ephemeral stream and less than 200 feet of perennial or intermittent streams and/or less than 0.5 acre of wetland, the entity is eligible for a Nationwide Permit #39 through the COE. In the case of most nationwide permits, the individual, company, or government agency that is filling streams or wetlands is obligated to notify the COE of their plans. Notification of such impacts is mandatory when performing many impacts, but in some circumstances it is not necessary. For this reason, it is important for consultants to read and understand the COE’s general and activity specific regulations and communicate regularly with the Corps District that the impact is located within. Such impacts do not usually require an Individual 401 Water Quality Certification from OEPA. An example of an Ohio Nationwide Permit Application is shown in Appendix C.

In either Indiana or Ohio, a number of other organizations must be notified of the project so that no areas of historic significance or endangered species are affected. It is important to locate archeologically important sites or documented endangered species sightings. The Archeology Division at EMH&T Inc. works on our projects unless the client has a preference for another firm. This division produces an archeological literature review or Phase I report based on what level the Historic and Preservation Office will require for the site. If the site has an area of historic significance a Phase II report is required. The project manager at the consulting firm or the Corps will usually send correspondence to this office.

In addition, to address the Endangered Species Act the consultant is required to look into the site’s capacity to support the federal and state endangered or threatened species. The first step is for IDNR or ODNR to consult the Natural Heritage Database to determine if any endangered species habitat or protected areas exist within a one mile radius of the site. In addition, for projects of any size the Corps completes correspondence with USFWS to ensure that there will be no impact to the federally listed Indiana Bat. This usually involves an email from EMH&T Inc. or from the Corps to USFWS providing field notes about the property and a map showing the delineation and the development plan for the property.
Figure 7 shows the four COE Districts in Ohio, including: Buffalo, Huntington, Louisville and Pittsburg. This is most often the lead organization overseeing the process on projects impacting Waters of the U.S. The process that the Corps uses to complete this oversight comes from an executive order put into effect by President Jimmy Carter. This is known as the eight step process, although few organizations call it by name. Rather, this is considered by most organizations to be business as usual. The Corps and OEPA use this method to coordinate with the other organizations in an attempt to complete an orderly and quick review. However, delays are common within the process since one small mistake can cause setbacks.

I have completed 8-10 Nationwide Permits since my internship began at EMH&T. The vast majority of these have been Nationwide #39, which is a permit for residential or commercial development. In addition, I have dealt with Nationwide #13 which is a permit for bank stabilization. I have obtained a few temporary impact permits associated with utility line crossings on streams authorized under Nationwide #12. Finally, for my project in Indiana I am still involved in obtaining a Regional General Permit through the COE.

The Nationwide Permit #39 is the most common and most in depth minimal impact permit that I am involved in at EMH&T, Inc. The application reports are basic and are only approximately 6-8 pages in length. In order to apply for a Nationwide Permit #39, a delineation report must accompany the permit application.

Sometimes, a delineation is completed for the subject property and is verified by the COE before the Nationwide permit application. At other times, our office combines the delineation report and permit application into one document. Regardless, the delineation field work and delineation map is completed before the permit application, so that all impacts to Waters of the U.S. are shown.

Once the delineation map is prepared, the consultant begins gathering the necessary information for the site. To start I usually write a letter to the Ohio Department of Natural Resources asking for a National Heritage Database Search. I also ask for a development plan and a brief description from the engineer involved on the project. In addition, it is common practice to have the archeologists prepare a Literature Review of the site.
Next, if the Archeological Literature Review shows that there is a high likelihood of turning up significantly historical artifacts, then I use the development plan and the Literature Review to ask the COE for a permit area determination. Since they only have jurisdiction over streams and wetlands, any portions of the property that can be built without impacting these features are not under their permitting control. As a consultant, I ask for a permit area
determination that determines if any portion of the property would need to be dug for a Phase I archeological survey.

I encounter such a situation once during my internship for a project adjacent to the Olentangy River Basin. River basins contain historical sites because both prehistoric and historical peoples create settlements along waterways. Because over half the property can be developed without crossing any streams, the COE finds that the client needs to complete a Phase I report for less than half of the total area. This permit area determination saves the client a large amount of time and money. Although, if a Phase I upon the permit area on the property turns up any significant archeological finds, the entire site may need a Phase I.

I also consider the likelihood of the property to harbor forested land suitable for the Indiana Bat. Basically, if the property contains Indiana Bat habitat, I advise the client to cut the timber during between September 15 and April 15. However, if this is not possible then I send an aerial photograph, a development plan and an explanation of any possible Indiana Bat habitat to the COE for a determination. The COE asks for an estimate for the amount of forested land on the property. They would in turn send this to the USFWS who makes the final determination when it comes to bat habitat. On certain projects, like for instance if the Office of Housing and Urban Development is involved in the project, the COE is not the lead agency on the project. In these circumstances, I organize the archeological and Indiana Bat habitat correspondence myself.

Next, I give the COE a project description telling how many houses, access roads, utility lines etc. are needed. I thoroughly discuss all stream crossings/impacts and wetland impacts individually. I cite the development plan as a Figure at the end of the report so that they have a clear understanding of what will happen with the development.

I gather most of this information and give a clear picture of all the effects of development on the site. Then I proceed with writing the final portions of the document. This includes a description of all possible federal and state listed endangered and threatened species for that particular county. I also describe if their habitat exists upon the subject property or if the development could affect those species if they exist downstream. Although the Indiana Bat is the most encountered endangered species, I also have seen a few sites that have a potential to affect endangered freshwater mussels in the Big Darby and Olentangy Rivers.

Then, I write why we can not avoid the impacts to waters of the United States and how we were minimizing those impacts. I usually state that it was not possible to avoid the impacts
because they are needed to have the development. In this respect, as long as a client is not unnecessarily impacting waters of the United States, the COE rarely finds a problem. I also show engineering adjustments to the site plans which are made to avoid as much linear feet of stream impact and acreage of wetland impact as possible. Again, as long as the client shows he or she is trying to avoid as much stream and wetland as possible, the COE will usually proceed with a permit.

Finally, in my report I write about the mitigation plan for all the impacts to waters of the United States. This includes a discussion about the amount of acreage being bought at a mitigation site, usually Little Scioto. In addition, I discuss the amount of onsite mitigation. For a Nationwide Permit #39 this is typically a 25-30 foot wide preservation zone around any remaining linear footage of stream. This insures that all unimpacted stream has at least this protection in the future. Usually, this is enough stream mitigation for a Nationwide Permit site. Sometimes it is necessary to improve a buffer zone by adding riparian trees and shrubs to ensure that the stream does not have erosion issues. In addition, I state that the client will use best management practices (BMPs) to ensure that no erosion or sediment problems occur from the development.

At the end, I simply conclude by summarizing the rest of the document and updating the citations. I make it a common practice to let the document set one day before I start the necessary revision. I revise the document and give it to any co-worker to review, since all documents must be revised before leaving the department. I also must fill out an application and have it signed by the client. In addition, I get together a mitigation bank agreement for a project. The check must be cut to the mitigation bank before the document is sent to the COE. The document is then printed and sent to both the client and the COE.

I work on Nationwide Permit #39 in Ohio since Indiana no longer uses it. The existence of Nationwide Permits gives developers an incentive to minimize impacts to their property. During my internship, I handle many of these projects and become comfortable with managing these projects. Individual Permits are more complicated and require much more communication with the stakeholders in order to reach an acceptable permit application. I discuss this type of permitting next.
Individual Permits

Individual Permits are required by regulatory agencies for projects making significant impacts to a watershed. In Indiana an impact requiring a 404-Individual Permit from the COE, is any impact to Waters of the U.S. over 1.0 acre including both streams and wetlands. For the purposes of a 401-WQC from IDEM, a significant impact also includes any impact over 0.10 acre of jurisdictional waters including streams and wetlands or any impact under 0.10 acre of jurisdictional waters which impacts over 300 linear feet of streams. In addition, if a developer relocates, encapsulates or encases a stream for any purpose it is considered a significant impact. Road crossings are considered significant if you encapsulate a stream over 150 linear feet for that purpose.

In Ohio, a significant impact includes residential and commercial development impacting over 0.5 acre of jurisdictional wetland, over 300 linear feet of ephemeral stream and/or over 200 feet of intermittent and/or perennial stream. It also includes any other impact not defined under a Nationwide Permit. When trying to avoid an Individual Permit, a client can only impact up to 200 linear feet of perennial or intermittent stream; however they can impact up to 300 feet of ephemeral stream in addition to that 200 linear feet.

The COE only has jurisdiction over Waters of the U.S. Jurisdictional wetlands are those wetlands that are found with a hydrologic connection to a Water of the U.S., usually a jurisdictional stream. Some wetlands are isolated from other water bodies and therefore the COE does not have jurisdiction over them. However, the Ohio EPA and IDEM do have jurisdiction over each state’s isolated wetlands and require permits for impacts. The laws and regulations surrounding isolated wetlands are different from those surrounding jurisdictional wetlands.

I have not worked on an individual permit application in Ohio during my internship; however, I am the Project Manager for an Individual Section 401 Water Quality Certification Permit through the Indiana Department of Environmental Management (Indiana’s equivalent to the Ohio EPA). The project also requires a Regional General Permit from the Army Corps of Engineers, which will be obtained after the 401-WQC. The property involved has approximately 700+ linear feet of intermittent stream, 284 linear feet of perennial stream and 0.06 acre of jurisdictional wetland. In order to obtain the permits, I study information gathered on permitting regulations in Indiana. I spend many hours reading and understanding what impacts these
regulations allowed and what process they required. I also talk with a contact at the Louisville District COE and research several regulatory internet sites.

The client’s original design is to relocate approximately 200 linear feet of intermittent stream for additional lot space, culvert approximately 150 linear feet of the intermittent stream for a road crossing, and fill approximately 0.06 acre of jurisdictional, emergent wetland for a sewer line impact. I begin working toward this goal by obtaining a site plan showing the specifics of these impacts. My first goal was to obtain an acceptable site plan showing the stream impacts. It took several months of asking the engineer for this item, before I actually received a decent development plan.

Because the project is located in Indiana, I attend few meetings and most of my discussions are held with the site engineer over the phone. However, this summer I attend my only meeting with regulatory officials for the entire project which is a site visit with IDEM, the COE and the engineer. At that point everyone involved needs a site visit to observe and discuss the impacts on site. At the site visit, I find out that both IDEM and the COE are adamantly opposed to the stream relocation, because they believe the small tributary to Bee Camp Creek is a “nice” stream. A more experienced environmental scientist would have asked what rapid assessment tool Indiana relied on to determine stream functionality (such as the QHEI in Ohio). Being inexperienced, I did not question their assessment and worked to avoid the relocation. It ends up that relocation in this case is unnecessary and most likely not cost efficient.

After this discussion and several phone conversations with IDEM, the conclusion is reached that it would be in the client’s best interest to not relocate any stream and to only impact 0.06 acre of wetland and approximately 160 linear feet of stream for the road crossing. The reason for this is the streams on the property have few signs of previous impact and have large, forested buffers. This means there is no opportunity to improve any jurisdictional waters in return for the impacts. As a result, the client reluctantly decides to avoid the stream relocation project. If they would have proceeded with relocation of approximately 200 linear feet of space, I expect that IDEM would have required significant offsite mitigation or would have denied the permit.

IDEM also asks that the stream crossing be moved downstream to an area already impacted by a 15 foot culvert. To me it seems unnecessary to spend time and money on a new site plan to move the road in order to save 10 linear feet of stream. However, the engineer agreed quickly to
do this before I could object. So the road is redesigned so that impact to the stream occurs at a
different location.

In addition, there is a discussion of avoiding the herbaceous wetland. Our department head,
Sandy Doyle-Ahern, actually suggests this approach in order to avoid mitigation. If the client
would have only needed a temporary impact for a utility line crossing, then the wetland could
have been returned to preconstruction contours. This would avoid the need for mitigation.
However, the client decides to fill the wetland in order to provide yard space for two lots.
Because they agree to avoid so much impact on the streams, I decided not to press them for
avoidance on the wetland. This position is strengthened when the regulators show little concern
for this low quality wetland impact during the site visit.

Also on the site visit, I am told by the regulator at IDEM that Indiana does not allow wetland
shelves to be used for compensatory mitigation if the client is using them to treat stormwater.
She tells me that homeowners often do not appreciate the reasons for the wetlands and do not
provide the proper respect and care. For this reason, many wetland shelves are destroyed and do
not serve as benefits to water quality. She adds that IDEM does not allow conservation
easements on streams to be used as mitigation because the County Surveyors can declare the
stream a “county regulated drain” and cut down the riparian buffer. These are two common
mitigation tools in Ohio that will encounter opposition in Indiana. However, I believe that
IDEM accepts this as mitigation, but they do not officially call it mitigation.

In addition to the impacts caused by development, the Hamilton County surveyor’s office is
requiring the client to place hardened protection on a bend in Bee Camp Creek to “protect” the
stream banks from erosion. So, in order to get the zoning approval this impact must be included
in the IDEM permit on Bee Camp Creek. This is an example of two government agencies with
directly conflicting ideologies. The county surveyors believe that channelizing streams is the
best way to deal with flooding and erosion problems. IDEM and the COE have changed their
thinking to believing these problems should be resolved by leaving larger buffers, more wetlands
and streams. These regulators do not see bank stabilization as that necessary and are opposed to
hardened means of relocation including gabion baskets and rip-rap. In order to develop this
property, there must be some type of compromise between the two agencies. At this time, this is
the final unresolved issue for the project and I continue to wait on the engineer to find out what
type of impact will be proposed by the county surveyors. Unless a solution is offered soon, I will
likely propose hardened stream bank stabilization on the application and work with the regulators to resolve this issue on the permit.

After working on this project for most of my internship, I write a 401/404 application that I hope IDEM, the COE, the engineer and the client will accept it. My job is simply to learn how to permit in Indiana and obtain the permits needed by M/I homes to build a sub-division. There remains the unresolved stream bank stabilization issue, but hopefully I can resolve this soon and finish.

My main regret on the project is that I did not submit an application and start negotiations with the regulators earlier in the project. Because there is an open dialog between regulators and consultants, negotiations for impacts and accepted mitigation occurs after the application is submitted. Since I am unfamiliar with the people from IDEM and the Louisville District COE, it has been difficult to know upfront what the regulators will accept under their permits and what they will require in mitigation. Since so much of the permitting process is obtained through negotiation, in the future I will push harder for a client’s goals realizing that it is the regulatory agencies’ jobs to set the limits.

**Wetland Mitigation**

Pooled mitigation banks have been a subject of debate for at least fifteen years in Ohio. These banks have both positive and negative aspects that are continually disputed at public hearings in Central Ohio. Mitigation banks usually purchase agricultural land containing hydric soils and allow it to revert back to wetland conditions. Wetland conditions are initially helped by breaking drain tile and creating earthen embankments to hold in spring precipitation and/or floodwaters. In successful situations, the land quickly reverts back to a wetland from the seed bank already lying dormant in the soils. Soon after this happens developers buy credit for wetlands which are planned for development throughout the watershed.

OEPA has been skeptical when it comes to large, pooled mitigation banks, basing this opposition on three main reasons. First, the Ohio EPA is opposed to making it easy to fill wetlands, since the development of wetlands is a threat to Ohio’s ecosystems, water resources and wildlife. However, the small, urban wetlands most often filled do not hold the diversity of plant and animal life that is found in successful mitigation banks. Collectively these wetlands do provide a value to areas for water quality and flood protection. Secondly, environmental
watershed groups are increasingly applying pressure to EPA to establish small urban mitigation banks within the same watershed as the developed wetlands. If enough people can place pressure on the legislature, OEPA will notice their concerns. Thirdly, the OEPA and environmental watershed groups are concerned with water quality over the entire region rather than wildlife habitat in one location.

First, it is important to realize the benefits that large mitigation banks provide to Ohio. Ecological studies have shown for decades that large connected ecosystems provide more protection to diversity than do small fragmented ecosystems. If large mitigation banks are established properly and are allowed to grow to large sizes outside urban development, they may be more valuable to diversity and wildlife than small isolated pockets within urban sprawl.

Mitigation bank economics provide an important, but often overlooked point of debate. Urban mitigation sites have much higher land prices than rural mitigation banks and force up the price of credit. In the long run, this could hurt developers, future homeowners and wetland mitigation. If developers are forced to pay large mitigation costs they will pass this on to the consumer. It also will cause developers to be less likely to support higher mitigation ratios in the future. If additional large mitigation banks are established around Columbus it would create competition and lower mitigation prices. The environmental movement has largely been contradictory to the American economy, and here lies an opportunity to expand an environmental business. Mitigation is a business which, if overseen closely by the OEPA and COE, can provide security to preserved wetlands into the future.

Recently, the price of mitigation for this bank has increased to $20,000 dollars an acre. The price of mitigation credit has risen twice in the past six months and will continue to go up until there is more market competition. The price has been pushed up by the OEPA requiring additional monitoring and tree planting in the mitigation bank. Even though this cost is pushing up the cost of buying a house in Central Ohio, consumers must learn to bear the costs of having a clean environment. As with all environmental benefits, the cost of clean water will be passed on to the citizens living in the region.

Despite these benefits to wetlands in Central Ohio, there are some problems associated with large wetland banks. First, they make mitigation for wetland fill easy for government regulators. It provides a way for developers to buy their way out of any environmental obligations into the future. They do not have to spend time or money on monitoring the wetland, since this
responsibility is transferred to the owner of the wetland bank. More than that, the banks allow regulators an alternative to forcing developers to minimize impacts on the property. Developers use this to their advantage, when filling medium or low quality wetlands.

Also, watershed groups moving into these areas are opposed to further degradation of water quality. They tend to fight new development that proposes to fill wetlands or streams of any size. They site a cumulative loss of “nature’s kidneys” as their opposition to this development. These groups are highly opposed to allowing developers to buy mitigation credit a hundred miles from where the fill is taking place. They want their area to see the benefits of water quality in the streams running through their neighborhoods. Their solution is to establish small mitigation banks among new residential and commercial buildings despite the added expense. In addition these urban mitigation banks have a smaller chance for success since they are approximately 50 acres and fed by urban runoff.

Finally, the water quality in urban development does suffer when wetlands are filled for two reasons. First, when development is constructed more urban runoff is added to the local watersheds. There is less upland buffer to absorb the water and more pollutants available to the runoff. Second, as wetlands are filled, there is less chance for pollutants to be filtered out of the water. These two factors obviously lower water quality downstream of any developed wetlands. Cumulatively wetlands in the Columbus area provide better water quality for the city and for the Scioto, Ohio and Mississippi Rivers as well as the Gulf of Mexico. The export of wetlands out of the area’s sub-watersheds does degrade the water quality in the greater Columbus area.

When wetlands are filled in central Ohio there are two options available, mitigate on-site or by wetland mitigation credit at the Little Scioto Mitigation Bank. The Little Scioto Mitigation Bank is over 700 acres of emergent and forested wetland found west of Marion, Ohio within the floodplain of the Little Scioto River. This bank represents a successful, large mitigation bank in Ohio. At Little Scioto the hydrology can be controlled by a series of berms with water control devices. This bank is located in the floodplain of the Little Scioto River which provides spring floodwaters that are caught earthen embankments. The water can be let out slowly over the late spring and early summer through outlet structures as shown in Figure 8, creating more inundation than would naturally exist. This shows that these banks are best if they can be established around a constant, annual source of water, whether it be surface water or groundwater.
In addition, the mitigation bank is established west of the city of Marion, Ohio. Marion has been a heavy industrial city for over a century. Much of the industrial waste, including heavy metals, has been dumped into the Little Scioto River. These metals are now buried under the sediment in the watershed. Establishing a wetland around this contamination can only help the breakdown and/or storage of any components which leach out of the river bed. Since the waters from the Little Scioto flow into the Scioto River and through downtown Columbus, this added water quality is in the city’s best interest.

During the spring and fall migration, the wetland is used by waterfowl as a resting and feeding stop. The wetland is located within the Central Flyway and provides a valuable resting place to many birds. In addition, other species of fowl use the wetland year round. Some of the
birds that use the bank are endangered species including the Bald Eagle and the Great Egret. The wetland is not only a sanctuary for birds, but for amphibians, reptiles, insects and mammals as well. This year I recall observing an Eastern Garter Snake, which is considered a species of concern in Ohio. The wildlife diversity at such a wetland is probably the greatest argument for large mitigation banks. Please see photos of the mitigation bank, contained in the Exhibits section of this report.

As discussed previously, small wetland pockets throughout Central Ohio are being mitigated in an area far away from existing wetlands, causing controversy. A large mitigation bank has many benefits, but there are some serious issues that must be addressed. After five years of pressure, the OEPA smaller mitigation banks in sub-watersheds. The process will continue to change in the future, and hopefully help protect and replace a valuable state resource.

Because EMH&T, Inc. has been such a large player in the creation of the bank, it has given me the opportunity to critically examine the large mitigation bank. I have had plenty of opportunity during my internship to view the Little Scioto Mitigation Bank. I have completed both spring and fall monitoring at the site. In addition, I have helped complete a delineation of the site to see if more wetland had developed since it is originally delineated. I have seen firsthand the quality habitat provided for wildlife. Yet through permitting, this mitigation bank has made it easier to export wetlands from the City of Columbus.

The delineation field work at Little Scioto in July is the best opportunity to see the wetland. Our firm uses the old delineation map as a guide to our way around the wetland. The owner of the site allows us to use his two ATVs in order to speed up this process. Driving around the wetland edge we use flagging tape to mark the new wetland boundary. On average we take a wetland data point for every 10 to 15 flags on the wetland. In most areas, the wetland has expanded outward from the original wetland boundary. In addition, the owner has lowered the water depths in a few places causing areas that had been open water to develop into jurisdictional wetland. It is amazing to see how a couple inches of change in water depth can have a profound affect upon the vegetative community.

I also complete spring and late summer monitoring at LSMB. Monitoring transects have been established when the bank first opened and the sampling points along these transects are marked with ten foot high white poles. The spring monitoring takes exactly one day with two people to visit the site and measure the water depths. The summer monitoring is more inclusive
and takes four people one day to finish. At that time, I record all the vegetation and water depths at each sampling point. Again, this experience gives me a chance to view many different types of herbaceous vegetative communities at different water depths. It also is a good opportunity to notice the wetland to upland gradient and to think about where to stop the jurisdictional boundary of a wetland.

In addition, I am able to view wildlife that I had never seen in such abundance. Many types of waterfowl use this wetland in the summer months and even more during the spring and fall migrations. I am able to view flocks of Blue Heron and Great Egrets catching fish and frogs in the shallow water. I also see a juvenile Bald Eagle perched in a tree at the wetland. The other wildlife I see at the wetland is that which is common to Ohio. Yet, few large areas of wetland habitat remain in Ohio and it is exhilarating to see them in this type of natural surrounding.

Using these experiences as a guide, I have personally compared the mitigation bank with that of smaller on-site mitigation. After weighing the positives of large mitigation banks against the negatives, it is my opinion in the current climate the large mitigation bank is an acceptable solution to filling wetlands. I believe it does more for Ohio’s waters than small, disturbed wetlands that have narrow buffer zones. For me, small isolated wetland pockets fragmented in an urban environment can not be the best solution to encroachment upon wetland areas. Developing the upland areas around these pockets leads to a slow destruction through pollution and changes in the hydrologic regime. In direct contrast, the non fragmented, large mitigation bank is able to handle more pollution and changes in the hydraulic regime of surrounding areas.

**Wetland and Stream Monitoring**

Mitigation of wetlands takes place when a client fills a wetland in the United States. As part of the proper permits the regulating authorities usually require monitoring on mitigation wetlands and streams for five years. In the case of mitigation banking, the bank takes on the responsibility of completing the monitoring reports. In small, site specific mitigation projects, such as stream relocations or wetland basins, the client completes the monitoring reports.

Five year continuous monitoring is required by the COE permits as a condition of mitigation on streams and wetlands. This monitoring ensures that the mitigation site is reverting back according to the standards put forth by the State of Ohio. If the wetland or stream relocation does not show problems after five years, it is assumed by the COE that wetland conditions will
persist into the future. There are two types of monitoring on wetland mitigation sites: spring monitoring completed in May and summer monitoring completed in September. Stream mitigation sites are monitored only once annually in mid-summer. To be consistent, monitoring transects are established when the mitigation site is begun and stations along those transects are established and marked with a large pole. In smaller wetland sites sampling quadrants take the place of transects.

In the spring, wetland monitoring is only geared to study the hydrology of an area. A qualified environmental scientist travels each of the transect stations and records the level of the water table. If the area is inundated, the scientist marks down the water depth in inches. If the area is not inundated, the scientist uses a soil probe and/or a shovel to identify at what soil depth saturation occurs. It is important to look at hydrology in the spring, because by late summer some of the hydrology has disappeared because of evapotranspiration and dry conditions.

Late summer monitoring of wetland mitigation sites occurs in August and early September. At that time, hydrology, soils and vegetation were monitored in an attempt to monitor the wetlands development. This information is included into a report submitted the COE once a year along with photo exhibits. After fall monitoring is completed the reports are completed and submitted to the regulating authorities before the end of the year. Because of the staffing constraints of the COE and OEPA, monitoring reports are rarely scrutinized unless a problem becomes obvious.

Monitoring reports should do more to link the yearly development of the wetlands and access their development over time. The photos taken at set positions in the wetlands provide the best link in monitoring reports from year to year. Yet, in truth more stringent measures should be set by the government agencies concerning development of the wetlands. If they truly want to understand the success or failure of a wetland, monitoring needs to continue for at least 10 years. During that time, more detailed and standardized data should be taken each year. This data should be correlated in the final assessment report. In addition, this data should be correlated not only from year to year, but with other central Ohio wetland data to accurately decide the success of a wetland. The current system allows consultants to present a few data forms of mostly qualitative data in such a way that shows every wetland mitigation project as a success.
The regulators are beginning to require more stringent monitoring standards. For example, one of our stream relocation permits requires the client to complete macroinvertebrate sampling during three out of five years of monitoring. It also requires the client to collect the typical monitoring data including photographs, vegetative information, cross-sectional data, longitudinal data, and soils information. I have been given the task to organize the field work and write the first year monitoring report for this particular site.

First, I research how to study macroinvertebrates in Primary Headwater Streams, using information taken from the OEPA website. I find that by using a Headwater Macroinvertebrate Field Evaluation Index (HMFEI) datasheet prepared by the OEPA the stream can be assigned a quantitative score. This datasheet requires the user to key out the macroinvertebrates to Phylum and Family. For a few organisms it is necessary to key them out to the Genus level. In short, the user of the HMFEI does not need to be an expert on macroinvertebrates, but should have general knowledge of this area. The qualitative score can be compared to benchmarks set by the OEPA and to other stream relocation projects. Second, our office lacks the gear to sample the macroinvertebrates, so I purchase equipment including two enamel baking dishes, a D shaped net, forceps and water bottles. Third, I find that several people in our office have sampled macroinvertebrates during other work experience.

On site, Melissa Queen-Darby and I sample the relocated stream for macroinvertebrates as best as possible. The channel is deep and proves hard to sample, but by spot checking rocks we are able to look for evidence of macroinvertebrates. Then we go back through the same stretch of stream and kick seined with the D-Net for macroinvertebrates. We place the contents of our kick seining into a white enamel pan and searched for different types of organisms. After only a half-hour of sampling we are able to find enough macroinvertebrates to give the stream a score of 10. It was clear to me that a lack of true riffle areas as well as an abundance of silt limited the macroinvertebrate community to a limited number of tolerant taxa.

Also during the same monitoring site visit, I use surveying equipment to find the elevation of the stream bottom in both riffles and pools. An engineer at our company is gracious enough to give me a quick introduction to surveying. I then use these simple surveying techniques to give the regulators an as built longitudinal cross section of the stream. Then, I establish four transects at two riffles and two pools. At each transect, I measure the cross sectional information including the width of the channel and floodplain. I also record the
dominant vegetative species in the community including the planted trees and shrubs in the riparian buffers. The final monitoring criteria ask that test pits be dug to ensure that the contractors actually used topsoil when constructing the floodplain. Rob Milligan completes this task while Melissa and I are sampling the macroinvertebrates.

The monitoring reports that I write at EMH&T, Inc. are vague and are not objective. In order to improve the reports next year, I suggest that they are written in a scientific manner and offer more objective criticism. I believe that the data collected should be reported in a report that resembles a scientific paper. That means more time and effort needs to go into explaining the background and methods sections. I believe the writer should research how similar monitoring has turned out in the past. The report should explain a methodology of exactly how the data is collected. Finally, the discussion in these reports needs to be more objective. I understand that as consultants it is our duty to represent our clients when presenting monitoring reports. However, I believe when there is a problem present this should be addressed instead of ignored in the report. Under the current environment, consultants state in every report that the wetland is a success, even if in reality the site shows room for improvement. In the future, I will try to present reports that account what is truly successful and what is truly unsuccessful in stream and wetland mitigation. An example of an EMH&T, Inc. wetland monitoring report is presented in Appendix D.

The regulating agencies are beginning to tighten the standards on these reports. However, they need more funding so that they can spend the appropriate time needed to read the monitoring reports. I believe that our clients should be required to take the responsibility of insuring that the wetlands are developing as planned. However, in today’s climate, the regulators do not have a plan for what to do if a wetland is not successful, and so most monitoring reports for wetland mitigation sites are accepted. If they would enforce this issue with the clients, the Homebuilders Association may decide go to the courts and legislatures and change the rules. This would undermine the strength of the regulating authorities, and so some restraint in this area is advisable.
Additional Consulting Work

Indiana Bat Tree Surveys

According to the Indiana Bat Recovery Plan, the Indiana Bat has suffered a 60% reduction in number since the early 1960s and is now an endangered species (Figures 9 and 10) (USFWS, 1999). The Indiana Bat is protected by the Endangered Species Act, which disallows any “take” of an organism. The bats have two distinct seasonal habitat types including caves in the winter months and trees with exfoliating bark in the summer months (Figure 11). Caves are considered “critical” habitat and are protected year round. The destruction of non-critical habitat when the bats are present is also not allowed unless an applicant can “prove” there are no bats present.

In order to understand why non-critical summer habitat is protected you must understand the habits of the species. The bats enter hibernation in caves after mating, usually between mid-September and late December. The bats hibernate through the winter months and begin emerging as early as mid-April. As shown in Figure 12, they migrate both small and great distances (up to several hundred miles), where the females give birth to their young. During these months the bats forage at night for many types of insects in riparian buffers and in open canopied, upland forest. The bats return in September to their caves in order to mate, which creates a phenomenon known as swarming. Females enter into hibernation as soon as they mate, while the males remain active longer in order to have as many opportunities to mate as possible.

The focus on protection has in the past focused almost exclusively on the species’ critical winter habitat. Indiana bats use caves to hibernate during the winter months. Most of these caves are found in Karst regions including Kentucky, Indiana, Illinois, Missouri, and Arkansas. The species can also hibernate in old mines in states like Kentucky, Virginia and West Virginia. Although these mid-Atlantic and Midwestern states support the majority of the surviving bats, their range extends as far north as New England and as far south as Florida and Texas.
Figure 9: Indiana bat decline from 1983 through 1997 (USFWS, 1999).

Figure 10: Hibernating populations of Indiana Bats by state (USFWS, 1999).
Figure 11: Annual chronology of the Indiana Bat (USFWS, 1999).

Figure 12: Inferred migration routes of Indiana Bats based on banding data (USFWS, 1999).
The bats require specific temperature range during the winter in order for them to be able to maintain a low metabolism necessary to survive on their fat supplies for the entire winter. The most recent studies suggest this range to be 37 to 43 degrees Fahrenheit, which only includes a limited number of caves (Humphrey, 1978; Ricter et al., 1993). In the southern extent of their hibernation range the bats use the coldest parts of the caves, which serve to catch cold air. In their northern reaches, the bats look for more protected and warmer areas within the caves.

Lately, the focus in Ohio is on the Indiana Bat’s summer habitat, which includes trees with exfoliating bark. Ohio has only one known hibernation location, a cave in Preble County, while the summer range of the bat includes the areas between the hibernation caves and Michigan, Northern Iowa and southern New England. This range includes every county in the State of Ohio. Exfoliating bark on either dead or living trees provide protected habitat for the creature. In addition, they prefer to roost in trees on the southern edge of woodlots or in more open environments that are heated by moderate amounts of sunlight. Shagbark and Shellbark Hickory have a large amount of exfoliating bark and are perfect examples of Indiana Bat habitat. Yet, the Indiana Bat is not species specific and will take refuge in any tree that offers protection including dead or dying trees. The bats feed over rivers and streams as well as the adjacent riparian corridor. The bats prefer forest types are Oak and Hickory upland forests and Elm-Ash-Cottonwood in riparian areas. These are dominant upland forest types for most Midwestern states.

The Indiana Bat has been a federally listed endangered species since 1967, but little has been done to protect its summer habitat. In the past efforts have been put forward to keep human disturbances from killing large numbers of bats in hibernation caves. However, recently the USFWS and the COE have been cooperating to require developers to “prove” there are no Indiana Bats within any mature woods on a site. Mist-net surveys are the only way to “prove” the absence of bats in an area with the right habitat. This causes costly delays to applicants during the permitting process.

In order to avoid mist-net surveys companies want to clear the property during the winter months. The regulation states that Indiana Bat habitat can only be cleared between September 15 and April 15, while the bats are most assuredly hibernating. As soon as the bats emerge, all clearing must be halted during the summer months. This was the first year that the COE decided to enforce this provision within the law, creating time constraints for egger developers. Instead
of protecting the bat habitat, developers cleared as many lots as possible before the bats could use it during the summer of 2005. At their request, our department marked trees that could be used by the Indiana Bat so that they could be cut before the April 15th deadline.

The Indiana Bat regulation can cause enforcement problems for the COE. Because the Corps is understaffed, some people in our division fear that some environmental consulting firms may advise their clients that they can clear a property during the summer and not be caught. In the future, this could lead to a loss in business if developers use other firms that are less ethical. The Indiana Bat provides an example of the economical constraints that are placed upon environmental consultants by the business world.

After reading the *Indiana Bat Revised Recovery Plan*, I believe that some regulators at the U.S. Division of Wildlife and/or the COE attempting to use development to fund studies on the bat. The recovery plan admits that little is known about the bat’s summer habitat and migration. When emerging from their hibernation in April the bats disperse throughout the Midwest making them hard to track and study. The lack of money available to the government agencies prohibits them from completing a large scale study on the bat. In order to rectify this problem, habitat managers have introduced a management plan that would force developers to (1) complete Indiana Bat studies on many potentially developable woodlots and (2) not further endanger the bat with forest harvesting and/or clearing. The plan also discusses the exact procedure to use when completing the mist net surveys. Because of this standardization, researchers will be able to incorporate the collected data into a regional scale study on the bat, while at the same time protecting any critical summer habitat (1999).

Although it is important to protect forested habitats in Ohio, ultimately this species’ success will most likely depend on the ability to protect winter hibernation caves and the forested buffers surrounding these caves. Protection of summer habitat is good management strategy, especially since it is not well understood how the bat uses the summer habitat. In addition, the Midwestern landscape has been fragmented for more than 200 years by agriculture, which means that they have survived in fragmented forests for several hundred years. This shows that the Indiana Bat is an edge species that uses open upland woodlots and riparian woodlots.

Also, recent research suggests there are only a few caves that provide suitable winter conditions for the Indiana Bat. History has shown that one major disturbance to one hibernation cave can kill several thousand bats. Indiana Bats are highly sensitive to temperature during
hibernation, and a change of a few degrees could be fatal to a large number of individuals. So, based on the above information, I contend that the winter Indiana Bat habitat is more critical than their summer habitat. Pressure from anthropogenic influences on caves over the past several decades probably the reason for the sharp decline in numbers since the 1960s. Therefore, it is my opinion that most of the research should continue to focus on the bat’s winter habitat.

There are several areas of research which have not been looked at when studying the winter bat habitat including climate change and unrecorded cave disturbance. Climate change, whether it is caused by humans or natural processes, may be impacting the Indiana Bat winter habitat. In future studies researchers should include the impacts that changes in temperature, precipitation and to the caves themselves are having upon the species. These factors can influence the temperature of the caves to which the Indiana Bat is extremely sensitive. In addition, climate change can cause differences in precipitation regimes. Snow fall can have an insulating capability and could influence survival. On the other hand, large precipitation events can cause flooding and sink holes which may compromise the safety of caves.

Caves are continually changing and any impact to caves could reduce their ability to hold constant temperatures. In addition to natural disturbance, anthropogenic disturbances in Karst regions are compounding these influences, which might reduce the diversity within these ecosystems. For example, pumping groundwater for human use can cause sink holes to develop in Karst regions, which could be disastrous to caves. In addition, increased surface runoff due to development might cause increased flooding within the caves. These types of impacts to a cave system could potentially decrease the habitat diversity and could over time influence the hibernation habitat. This in turn could have a disastrous effect on the bat.

In summary, the Indiana Bat is a species that has been in a constant decline since the 1960s. The USFWS is attempting to force developers to study the Indiana Bat’s summer habitat. They are doing so through the COE’s permitting process. While this management plan has placed attention upon the bat, so far developers have been able to avoid mist-net surveys by clearing sites during the winter months. Yet, the focus upon summer habitat of the Indiana Bat will likely increase in Ohio since if only due to the fact that there is no winter bat habitat in the state. I suspect that in the near future, mist-net surveys could become commonplace in Ohio as a step during the development process.
During my internship, I spend time researching the Indiana Bat. It is my responsibility to learn about the species so that I could complete my job more accurately. My consulting task has been to mark trees that are defined by the regulating agencies as Indiana Bat Habitat. This habitat is defined as trees with a Diameter at Base Height (DBH) of greater than 10 inches that also had exfoliating bark. It is well documented that the bat is not species specific and will inhabitant any species harboring good habitat. I find that hickory and dead trees provide the most habitats suitable to the species. Ironically, the trees I mark as habitat are cut down before the April 15 deadline, so that no bats are likely to be harmed when the area is cleared during the summer months.

I would have liked to perform mist-net surveys for the bat. This past summer two or three of EMH&T, Inc.’s permitting projects are required to complete mist-net surveys before clearing trees. However, this job is sub-contracted to people in the state qualified to tell the difference in bat species. The company has contemplated performing mist-net surveys but has decided that there was not enough work to justify it. If the bat surveys are required next summer, I may ask to help the sub-contractors so that I can learn more about this species.

EMH&T Wetland Basin

Over Labor Day weekend the EMH&T Inc. Corporate Headquarters moved from Gahanna, Ohio to New Albany, Ohio. Our department obtained funds to build a wetland as stormwater treatment for the drainage from the building and parking lot. The wetland was constructed as a series of three wetland cells with varying water depths that support a variety of wetland plants. The front cell was at a depth of approximately 6 inches to 2 feet, with a few deeper pools. The back two cells had water depths of approximately 2 to 6 inches.

In addition to providing stormwater treatment for our new building the wetland provides three services to the environmental department. First, since the company builds wetland shelves for companies that need both storm water treatment and onsite wetland mitigation, it is a showcase for our plantings. Secondly, it serves as a nursery for both cuttings and plants that may minimize the costs associated with this service. Thirdly, it allows our company to experiment with different plant species to identify those which will grow best and at what water depth. This will help us in our constant battle to combat invasive species, specifically reed canary grass and
cattails, which so often take over a newly planted wetland. Once, it becomes established our
department could also test water quality at different times of the year.

Rob Milligan has designed the wetland basin and has created the planting plan. Rob has put
a lot of effort and personal time into the project, to see that it becomes a success. It is important
to the Environmental Division that this wetland fulfills its potential. Several species of live
stakes including a variety of willow species, buttonbush, and dogwood have been planted in the
wetland. Large numbers of arrow-arum have been planted around the outside edge of the
wetland. Other species include swamp milkweed, polygonum, sedges, water plantain and ditch
stone crop. Many of these species have been started from transplant plugs brought back from the
Little Scioto Mitigation Bank. The wetland is also seeded using a wetland seed mix that is
available from a variety of nurseries. Bald cypress and pin oaks have been planted in and around
the wetland to provide shade in the future. Finally, the department has implemented an invasive
species management plan upon the wetland. The main problem with manmade wetland basins is
dealing with cattail invasion. Both the native and non-native can, without management, out
compete more desirable species.

At the outset of the project, there are a few construction and management issues. First, not
enough topsoil is used in the wetland construction, so more had to be trucked in to get an
acceptable topsoil depth. In another area of the wetland constant erosion has been seen occurring
after rain events. This erosion problem is solved by using rock protection in the problem area,
where there is an elevation difference between the lower two cells. The rocks are placed in such
a way to allow plants to grow in the soil beneath them. In addition, the mesh used at the outlet to
prevent soil particulates from polluting downstream portions of Sugar Run is becoming
constantly clogged, causing the water levels to rise. Water level issues are helped by cleaning
the mesh netting every few weeks; slowly the water levels were able to drop.

Freshly planted wetland shelves in central Ohio are subject to goose predation. Our
company has made it common practice to erect goose fence in order to keep this pest from
decimating the young plants. Geese prefer areas that are open with easy access to deep water.
The fence deters the geese from having this easy access to young plants and deters them from
landing in the wetland. A wooded stream buffer and a steep bank leave little protection for geese
from predators. Geese prefer to have deep open water as well as a clear line of site to use for
safely.
As of September, 2005, the wetland has shown much success and a few failures. The planted herbaceous vegetation in the three cells has taken off and completely covered most of the open water. The front cell has deeper water levels and supports a slightly different mix of vegetation than is found in the other two cells. Most of the live stakes have survived despite drought and flooding caused by water level issues previously discussed. However, most have been overtaken by herbaceous vegetation have not done as well as expected. The pin oak and bald cypress do show signs of stress caused by drought, but this is not surprising considering dry summer conditions in Central Ohio. The largest failure is not controlling an influx of cattails and rice cutgrass from an unknown source. The seeds have not been planted and must have been present in the top soil used for wetland construction.

I have specifically helped with the planting in this wetland. I have helped dig and bring back a few species from the Little Scioto Mitigation Bank. I have worked to weed out small cattails when they are emerging from the seed bank present in the soils. I have made trips to the wetland in order to monitor the establishment of many wetland species. More than anything, I have observed the work that must go into constructing and planting a wetland basin. It has given me a chance to see that some species flourish in these areas while others fail. I have no doubt that this learning will come into play as I design mitigation shelves for my own permit applications.

This fall a cattail management plan has been implemented within the wetland. Our division has attempted to wand Round-up onto the plants. The method is effective in distributing the herbicide to only the cattails. Hopefully, the cattails have stored it in their tubers over the winter and the effects of the herbicide combined with a spring cattail pulling may allow other vegetation a chance to outcompete them. In any case, the wetland has already been successful for its primary purpose as a water treatment. I am optimistic that our firm can perform research in order to provide a better functioning and more diverse wetland product to the clients.

**GPS**

Over the past ten years new technologies, like GPS, have been used in the field of environmental science. Our Environmental Division uses the company’s GPS unit, a GEOXT with Pathfinder 3.0 software, on projects where surveying would be expensive and/or unnecessary. I have personally used the unit to identify wetland locations, wetland boundaries,
stream centerlines and archeological sites. This information can be post-processed and used to create an accurate and useful map to show to developers and/or regulators. In this section I will first explain how the GPS is used by our department. I will also explain what I have done with the unit.

The GPS unit can collect points as either generic points or as features using a wetland dictionary. The dictionary connects points as they are taken, for example at the border of a wetland or a centerline of a stream. These connected points can be linked into a feature during post-processing and pulled into AutoCAD, where a comprehensive map overlay can be created. The resulting map is both accurate and useful for delineations and permit applications. While the GPS technology is not new, it is only beginning to be used in the field by environmental professionals.

The data recorded by the machine is accurate, but each point takes a significant amount of time. This tool can take points with an accuracy of 1 foot to 3 feet depending upon the number of readings recorded at each point. I must take readings at a point for at minimum sixty seconds in order to get an accurate reading. This may seem like a small amount of time, but when you are taking a hundred points, these minutes can add up quickly. Another problem encountered in the field is obtaining the necessary satellites in an area. A minimum of five satellites are needed for accurate readings. Trees and debris can block satellites and cause delays and frustration. Based on my observations, this interference is compounded if there is moisture in the leaves and being transpired into the atmosphere. The solution to this problem is planning to use the unit during times when many satellites are overhead. This is especially true when taking the unit into forested or shrub/scrub areas where satellite readings can be blocked.

In addition, problems can occur when attempting to process the data into a useable map. Once the field data is obtained a usable map requires several other people to manipulate the data in order to reduce error and put the data into a usable map. A lack of experience with the AutoCAD drawing program can hinder the ability to create mapping. However, if a routine with qualified individuals who can help with the post-processing can be established, the entire process can become more comfortable.

The GPS is useful to identify a few points along a stream or wetland. For example, since the start of my internship several projects with a minor amount of impacts needed between ten and twenty points located. In such situations, it becomes less efficient to send a survey crew out
to pick up these points. In addition, the survey crews must have the areas flagged by the environmental department before they can go to a site. This is the area in which the GPS unit is used most often within our company. I can accurately obtain the information that our department needs in a much faster time frame and without flagging any areas. I have used the GPS in these situations to find stream centerlines and wetland boundaries. I have also completed full delineations on several sites using the GPS units. Again, this is cheaper than sending a three man survey crew to a site to pick up the points.

One example of a successful GPS project is a land management project near Easton Mall. This is a project that I was assigned about midway through the internship. The client owns developable land surrounding the mall and intends to slowly sell off land parcels in the future. Because this land needs to be permitted before it can be developed, it makes sense for our client to manage the wetlands on these land parcels. Basically, they want to prevent agricultural fields and disturbed land from developing wetland conditions and current wetlands from expanding in jurisdictional size.

I am sent out on a parcel of approximately 100 acres to identify any areas of concern and use the GPS unit to accurately mark the areas. I take between 1 and 5 points around the edge of each wetland and/or problem area I find within the site. The beauty of the GPS is that it is very easy to use. Once you know how the filing system works in the hand held computer, you can collect information with ease. It took me a few site visits to understand how to take usable data. At this site, I use the GPS to mark the boundaries while a co-worker takes notes on the areas. The points taken in the field are stored in the machine. I take one check point for every ten points in order to determine how much error can be attributed to the user in the field. Finally, I take several boundary points at items that show up on mapping or aerials, so that I can visually check to make sure the points are in the correct place.

While this system works well, I do encounter problems in some areas under canopy and in dense brush, where I have trouble getting enough satellites. I believe the moisture in the leaves is the main problem with the canopy. This hypothesis is based on the fact that I had more trouble getting enough satellites during the wet spring months as opposed to the dry summer months. I also have trouble on days were there is less than optimal satellite coverage. I have learned that planning ahead, especially during spring and early summer, makes using the GPS less frustrating.
Back at the office, I first give the unit to Adam Long in our IT department. He is able to download the information from the GPS and correct for some of the error. Base stations collect information from the satellites at the exact same time that you are collecting data with the unit. Therefore, the company that sold the GPS unit knows how much error is present at any one time and is able to correct for some of it using the readings from these base stations. Adam then puts these points into a GIS aerial photograph which gives me a graphic to view the points. I then give this aerial to a person in the department who is well versed in the AutoCAD program. The CAD designer uses the points to create a useful map of the land parcels. Over the course of the internship, I have become better at using AutoCAD myself and can sometimes create my own maps.

I have used the GPS on many projects throughout the summer. The process has evolved into one very similar to the one above. Each project presents its own unique challenges and the GPS offers another way to deal with a few of them. At one point this summer, I use the GPS to delineate an approximately 150 acre farm, on my own. This particular site takes me two solid days in the field in order to flag and GPS the many streams and wetlands. At the other extreme, I recently complete a delineation at a site for a single wetland pocket. I take a point at every flag around the wetland boundary and the total field work takes only two hours.

After the map has been created, my co-workers in the department use the information to offer land management advice to the client. Some areas mapped upon disturbed soils may be filled to prevent wetland vegetation and soils from developing. Agricultural fields may be mowed and managed to prevent wetland vegetation from forming or spreading from existing regions. While this type of work may not be environmentally friendly, it can create a positive relationship with developers and land holders. This may make them more willing to work with environmental professionals on more controversial projects in the future. Our firm has just recently been rewarded contracts to delineate some of these parcels. I have been assigned these projects and intend to get the fieldwork finished in November.

Not every project that we complete uses the GPS to replace traditional surveyors. An inefficient use of the GPS unit would occur in a large, complicated delineation. Survey crews have GPS units which can pick up these same points instantaneously while preserving the same accuracy. So when it becomes necessary to pick up large numbers of points, it suddenly becomes more appropriate to send out a team of surveyors. For example, a survey crew has been
used to pick up the points for our delineation at the Little Scioto Mitigation Bank this past summer.

While the GPS is a new and valuable tool available to environmental scientist, it will not entirely replace the need for skilled surveyors. They will always be needed to do some surveying for environmental work. In addition to delineations, the GPS can pick up a few points around a wetland boundary or on a stream, to give a consultant quick information on a site. In some situations, it is to a scientist’s advantage to have a quick and accurate assessment of the amount of Waters of the U.S. upon a property in order to talk to a client or regulator. In situations such as these, the GPS can compliment surveying of wetlands and streams. This can save time and money to everyone involved in the process.

**Ohio Rapid Assessment Methodology**

In order to permit wetland impacts, there needs to be a numerical value assigned to the wetland community. This value is used to tell regulators what protection or mitigation standards the wetland deserves. In order to obtain these values, a form is normally completed during the delineation site visit and presented to regulators along with a permit application. In Ohio, environmental scientists use the Ohio Rapid Assessment Method (ORAM) for Wetlands to rate wetland communities. Currently Ohio is using the 5.0 version, which is the most recent of several versions produced since 1996. This is the third generation of the ORAM to be used in the field by environmental consultants. In order to use the tool, environmental scientists should attend an ORAM training seminar given by the Ohio Environmental Protection Agency’s (OEPA) John Mack. Mr. Mack is the lead creator of the ORAM x 5.0 and he is therefore qualified to teach professionals about its applications and limitations.

On May 8, 1998, Ohio adopted the wetland antidegradation rule which protects jurisdictional wetlands (Mack, 2000). With this rule the State of Ohio prioritized wetlands and streams as habitat types that need protection from human influences. In order to provide protection to these influences, Ohio must create rapid assessment methodologies that are general enough to cover Ohio’s diverse ecosystems and specific enough to provide the necessary protection. The tool also needs to be simple so that the broad group of users could assess wetlands in a fair manner.

The OEPA has adapted the ORAM from a similar methodology, the Washington State Wetland Rating System. The major assumption that has been made by the professionals who
adapted the ORAM is that a wetland’s characteristics are a measure of its functionality to the environment (Mack, 2000). In other words, wetlands with healthy characteristics provide more of a service to the community than do wetlands with less healthy characteristics. The ORAM scores are calibrated against other more intensive measures of wetland quality, principally the Vegetation Indices of Biotic Integrity (VIBI). The ORAM scores correlate very strongly with VIBI scores in both emergent and forested wetlands. The ORAM may underscore shrub-scrub wetlands, but the method is still the best robust method for quantifying wetland categories (Mack, 2001).

The original ORAM was developed along with the rule in the late 1990s in order to provide a tool for professionals to easily rate wetland quality. These professionals often have broad educational backgrounds sufficient for a general study upon a wetland community. It is understood that many environmental professionals using the ORAM in the field do not have specialized educations in all areas of wetland science. The ORAM forms are written so that only a general education and limited experience in wetland science is needed. The antidegradation rule says that wetlands must be evaluated based on: functions, sensitivity to disturbance, rarity and irreplaceability, minimization, and mitigation (Mack, 2000).

In Ohio, human influence during the past two hundred years has altered the historical ecological communities into the current state. Most environmental scientists agree that Ohio’s ecosystems are “degraded” when compared to the historical state of the region. Clearing the forests and draining most historical wetlands for Ohio’s agriculture occurred during the late 1700s and the early 1800s. During the 1900s, pollution and growth from industry again caused changes to Ohio’s landscape. Today, urban growth is causing rapid changes to Ohio’s landscape, which includes both upland and wetland areas. With this growth it is becoming more difficult to maintain the biological integrity of the region. Biological integrity is defined as maintaining a community of organisms that have the species composition, diversity and functional organization comparable to the historical habitat of the region (Mack, 2000).

In the 1970s, the Clean Water Act is created to “maintain and restore the physical, chemical and biological integrity of the waters of the United States (Mack, 2000).” There are four classes of factors that can be degraded by anthropogenic influences: biogeochemistry, habitat, hydrology and biotic interactions (Figure 13). The health of these classes can be used to access the degree of human influence upon an ecosystem, which is what the ORAM was designed for.
The biogeochemistry of a region can be defined as the manner through which nutrients and energy are cycled through communities. Similarly, the hydrology refers to the manner through which water is cycled through a region’s communities. Habitat includes the structure provided by the geography and fauna of a community. Finally, biotic interactions refer the patterns of interaction between organisms, such as competition, predation and symbiotic relationships. (Mack, 2000)

The United States’ current environmental policy attempts to manage wetlands by preventing further loss from occurring. The ORAM breaks wetlands into three major categories which can be managed based on their current state, shown in Figure 14. First Category 1 wetlands correspond to the lowest quality areas in the State of Ohio. These wetlands “are often hydrologically isolated and have some or all of the following characteristics: low species diversity, no significant habitat or wildlife use, limited potential to achieve beneficial wetland functions and/or a predominance of non-native species (Mack, 2001).” Most Category 1 wetlands are either found upon disturbed substrates, such as mined lands, or invasive species monocultures. These wetlands are seriously degraded by human influences and deserve little protection from the State of Ohio. These wetlands are rare in central Ohio, except perhaps for isolated pockets of farmed wetlands.

At the other extreme, Category 3 wetlands are those wetlands that “contain habitat for threatened or endangered species, are high quality mature forested wetlands, vernal pools, bogs,
fens, or which are scarce regionally and/or statewide (Mack, 2001).” Category 3 wetlands only need to exhibit one of the above characteristics to fall within this category. These wetlands deserve the highest level of protection given by the State of Ohio. These wetlands can not be impacted unless by a project for which there is an economically justified “public need”, which generally means an interstate highway, airport, or another large, necessary project. According to Mack, the definition of “public need” is “an activity or project that provides important tangible or intangible gains to society that satisfies the expressed or observed needs of the public where accrued benefits significantly outweigh reasonably foreseeable detriments (2001).” Residential and commercial development is not an economically justified reason to build upon a Category 3 wetland. Again, Category 3 wetlands are rare in central Ohio since most of the region has been drained for agriculture and development before any measures for protection were in place.

Finally, Category 2 wetlands are wetlands that are “dominated by native species but generally without the presence of habitat for threatened or endangered species; and wetlands which are degraded but have a reasonable potential for reestablishing lost wetland functions (Mack, 2001).” In central Ohio, most wetlands are within the Category 2 range. Under the antidegradation rule, compensatory mitigation for such a wetland is only appropriate when impacts can not be avoided, can not be further minimized, and are economically justified (Mack, 2001). In reality, if a developer can minimize impacts to wetlands and is willing to pay for mitigation, they can impact most Category 2 wetlands in the State of Ohio.

<table>
<thead>
<tr>
<th>Category</th>
<th>ORAM v. 5.0 Score</th>
<th>VIBI Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 - 29.9</td>
<td>0 - 21</td>
</tr>
<tr>
<td>1 or 2 gray zone</td>
<td>30 - 34.9</td>
<td>----</td>
</tr>
<tr>
<td>modified 2</td>
<td>35 - 44.9</td>
<td>22 - 44</td>
</tr>
<tr>
<td>2</td>
<td>45 - 59.9</td>
<td>45 - 66</td>
</tr>
<tr>
<td>2 or 3</td>
<td>60 - 64.9</td>
<td>----</td>
</tr>
<tr>
<td>3</td>
<td>65 - 100</td>
<td>67 - 100</td>
</tr>
</tbody>
</table>

Figure 14: Scoring breakpoints for ORAM and VIBI wetland categories (Mack, 2000).

Using an ORAM form is not difficult as long as the user is taught correctly. The ORAM form is made up of eleven questions that fall within six metrics including wetland size,
surrounding upland buffer and land use, hydrology, habitat quality, special wetland communities, and vegetation, interspersion, and microtopography (Mack, 2001). On every question, the wetland falls within one of several categories. On a number of the questions, for example microtopography, the user must assign a 0-3 ranking of a listed characteristic. Most of the characteristics can easily be identified by individuals with a limited knowledge of wetland science or by more experienced professionals. The forms should always be filled out on site, so that characteristics are not forgotten.

An ORAM user should never assume a characteristic is present unless there is direct evidence. For example, an ORAM user may know that a current wetland has once been a farm field because of old aerial photographs. He or she may suspect that the field has drain tile, which would be a human influence upon the landscape. However, unless the user sees broken drain tiles or drain tile outlets into a stream or ditch, the wetland must be scored as if no drain tiles are present. If evidence of drain tiles can be found, the wetland can be scored lower. In short, a user should always give the wetland the benefit of the doubt unless direct evidence of disturbance can be found in the field.

To further separate personal opinion and interests of the users from affecting ORAM scores, plant species found in bogs, fens and oak openings in Ohio are listed in the ORAM manual. These lists should be used in order to identify a Special Wetland on the ORAM listed under Metric 5. In addition, a list of Ohio’s most detrimental invasive species has been developed. Only the invasive species upon this list should be used when assessing the invasive species section of the ORAM under Metric 6. These plant lists have been included as Figure 15.

The ORAM is a powerful and useful assessment tool that can be valuable to the state’s wetland resources. When it becomes necessary in the interest of economical gain to impact wetlands, the ORAM can provide valuable information to state agencies who can then require a suitable amount of wetland mitigation. However, it is important to remember that the ORAM is a tool and can be misused. Only responsible and well trained environmental professionals should assess wetlands using the ORAM methodology.

When used correctly the ORAM forms can be a valuable tool for environmental consultants to assess these valuable resources. Like any tool, the forms can contain error if misused or used without the proper training. An environmental scientist should also double check the final score with his or her overall assessment of the wetland. If a wetland’s quality warrants, it can be
pushed into a higher category even if the area scores lower on the ORAM form. Any wetland scientist should be careful to not let clients, engineers, or one’s own thoughts lower an ORAM score to make development easier. It is important to have high ethical standards when using assessment tools because regulatory agencies often complete site visits to check a scientist’s wetland assessment. An example of the ORAM short form, used in most rapid assessment field work is included as Figure 16.

I have used the ORAM on several projects this summer. It is advisable as consultants to take the extra time in the field to fill out an ORAM form for wetlands during a delineation in Ohio. The CORPS usually asks for these forms on almost every permitting project, because this is the mechanism on which the amount of necessary mitigation is based upon. Basically, the ORAM methodology is to take a data form into the field and fill out the form for every wetland pocket. I have found both Category 1 and Category 2 wetlands during my internship. In my experience, no forested wetland in Ohio will score below a Category 2. The only Category 1 wetland that I encountered was an impounded herbaceous wetland caused by a human development which had been mowed approximately 1 month before I visited the site.
Figure 15: Lists of special wetland plants and invasive plants used to assess certain characteristics on the ORAM form.
Figure 16(a): ORAM x 5.0 short form developed to assess Ohio wetlands (Mack, 2001).
Figure 16(b): ORAM x 5.0 short form developed to assess Ohio wetlands (Mack, 2001).
Conclusion:

My internship at EMH&T, Inc. has been an important learning experience. I hope that this report shows that over the past few months I have been able to work on a variety of interesting projects. It has given me the opportunity to complete fieldwork, write technical reports, learn to use new tools, research environmental problems, problem solve and communicate with clients and regulators. I should add that most of the communication with clients and regulators has been done with more experienced consultants in our department.

At EMH&T, Inc. I am able to work on a wide variety of environmental issues. Everything from permitting impacts to waters of the United States to mitigating these impacts both onsite and off. I believe that I have performed well when completing the fieldwork and the technical writing on my projects. I have worked on delineations, monitoring, planting, Indiana bat tree surveys, GPS field work and communication with regulators. In addition, I have sat in on many conversations between experienced consultants, clients and regulators. I have enjoyed the freedom to research the necessary information and organize how to apply this information in the field. As you can tell by this report, my internship has had a vast scope and has provided an excellent learning opportunity.

While my problem solving and communication skills are improving, I have some learning to do before I can call myself a professional. This consists of mastering communication between clients, engineers and regulators in order to oversee an environmental project. I must continue to establish working relationships in the environmental field, which will make my job much easier. Although college has provided me with the background to be an educated and capable scientist, only experience can hone those tools into a skilled professional. I believe that this hands-on learning is the only way I will learn how to manage difficult situations. I will make mistakes and encounter delays, but with time, effort and patience I will be successful.

While I have made some mistakes, overall I have contributed to the company. EMH&T, Inc.’s environmental department encourages people to take on responsibility and allows employees the freedom to make decisions. The professionalism and work ethic of my coworkers at the company has led to the department to grow rapidly over the past few years. Because of this, I am convinced that this job will offer plenty of opportunities to work on challenging and innovative projects in the future.
Now, my internship has led me to identify strengths and weaknesses in the IES program. First, IES takes the approach that most of the skills needed in the environmental field are learned outside the core classes. The first year of IES is learning to apply the skills you learned as an undergraduate in order to problem solve and communicate with people in the environmental field. Even the programs that IES sponsors outside of class work teach valuable networking skills.

Second, the team building attitude that IES teaches is both useful and detrimental to the graduates. For me, the non-competitive attitude taught me to deal with people on a level that I never learned in the undergraduate level at Miami. Miami University is an extremely competitive undergraduate campus, much like the business world. Miami has a well respected business school and for this reason it is only natural that many students pick up competitive skills important in this field. Back to IES, I can see that others in my class, especially those that are extremely self-motivated, have benefited from the team atmosphere at IES. However, other, more passive people in my class were may have benefited from a more competitive setting. I suggest that at least one or two of the core classes make students function in a competitive learning environment.

The classes that have prepared me most for my internship were the Public Service Project (PSP), Aerial Photograph Interpretation, Landscape Capability and Analysis, Plant Taxonomy, Technical Writing and Methods. Most of these classes I did take at the graduate level but a few I took as an undergraduate.

Obviously every IES grad compliments PSP as the best part of the IES program and I am no exception. This experience allows students to problem solve on a project which is outside the university. Basically this class is a prelude to an internship, giving the student an opportunity to develop many of the skills they need to be prepared for it. In order to improve this area, I believe that the research advisor needs to be more involved in the project. If our group had known more about the available assessment tools and methodologies available from the OEPA, we would have been able to do a much better job with the project. In addition, the students should be taught to pay more attention to the economic constraints placed upon the environmental field.

Dr. Green’s class Regional Landuse Capability and Analysis should be mandatory for anyone considering a career in consulting or at a regulatory agency. Nearly everyday I use the USGS topographic maps and the county soil surveys which are covered in depth by the class.
The class teaches the common mapping scales used in today’s world. Finally, the class teaches a special interest section, for my class we learned about Karst topography which prepared to better understand habitat for the Indiana Bat. Dr. Green’s class on Aerial Photography is also useful because I consult aerial photographs often to identify land use, streams, wetlands and drain tile systems.

Methodology is an important class for several reasons. One, it teaches students to attack a project and work within a limited timeframe. It also makes them accept that there are limitations in the world and sometimes the quality of my work may suffer. Finally, it forces them to realize that different personalities have different opinions on what is an acceptable product. Often times, for whatever reasons, one or two people in a group of three or four must do most of the work.

Plant Taxonomy class is very important in preparing for identifying wetland and upland vegetation. I wish that the Botany Department at Miami would emphasize the usefulness and applicability in this area, especially in environmental science. Plant Taxonomy has been one of my favorite classes, but in the past I felt that it was not a useful skill. Now, I know that it was the most useful botany class that I could take at Miami. I very much regret not taking the plant taxonomy class specializing in grasses because Poaceae and Cyperaceae make up two of the most important plant families. Grasses and sedges are often found abundantly in wetland areas.

One area that is missing from IES is a tie to the civil engineering field. I know Miami has a small engineering department, but the environmental department has no relationship with it. I wish that I had been able to learn the methods being used in today’s civil engineering. It would be simple to offer a class that explains the problems engineers deal with such as stormwater regulations, bank stabilization, site preparation, etc. It would also be interesting to study the new environmentally friendly engineering like stream relocation and new innovative bank stabilization techniques. Again, the classes should teach cost benefit analysis on traditional engineering solutions vs. environmentally friendly approaches. It also would be useful to take a course in computer drawing, centering on the AutoCAD program that is used so often by civil engineers.

I believe IES is a truly great academic program in environmental science. Most of the limitations of the program are based on the size of the department, although I should add that the department makes the most of what it has. This is a credit to the professors and staff that care so
much about the environment. I have used much of what I learned through IES during my internship and will continue to do so throughout my career. I will owe many of my future successes to the IES department.
References


Appendix A:
Preliminary Investigation Letter
April 20, 2005

Mr. John Smith
Developer
Street
Floor
City, State  Zip

RE: Preliminary Investigation – Stringtown/Buckeye Parkway - EMH&T Project Number 2005xxxx

Dear Mr. Smith,

At your request, EMH&T, Inc. conducted a Preliminary Investigation for Waters of the United States for the 46 acre Stringtown/ Buckeye Parkway parcel, located south of Stringtown Road and east of Buckeye Parkway in the City or Township, County, Ohio (Figure 1). The property is bordered by young woods to the east, by residential development to the north and northeast, by commercial development to the west and by agriculture to the south and southeast. This study was performed at the request of and is for the exclusive use of the client.

Literature Review

As shown on Figure 2, the subject property is at an elevation ranging from approximately 760 feet along the western property boundary to approximately 740 feet along the eastern property boundary (National Geodetic Vertical Datum) according to the USGS 7.5' Series Quad Name, Ohio (Photorevised 1988) and Quad name, Ohio (Revised 1995). One drainageway, a tributary to the Scioto River, was mapped through the southern portion of the site. No marsh symbols or open water symbols were mapped on the subject property.

According to the Soil Survey of xxx County, Ohio (USDA-SCS, 1969) as shown on Figure 3, the subject property contains Celina silt loam with 2-6% slopes (CeB), Crosby silt loam with 0-2% slopes (CrA), Crosby silt loam with 2-6% slopes (CrB) and Miamian silty clay loam with 6-12% slopes, eroded (MIC2). A drainageway was mapped through the northeastern portion of the site. A second drainageway was mapped through the north-central portion of the site. Two drainageways were mapped within the southeastern portion of the site before having a confluence near the center of the site. No marsh symbols or open water symbols were mapped on the subject property.

A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation (USDA-SCS, 1985). According to the USDA-SCS, no soils were listed as a hydric on the subject property. However, all the soils on the subject property were listed as non-hydric soils that may have hydric components (USDA-SCS, 5/93 & USDA-SCS, undated).

As shown in Figure 4, the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) was reviewed for the site (FEMA, 4/21/99). The entire subject property lies in Zone X (unshaded) which are areas determined to be outside the 500-year flood plain.
Onsite Findings

The subject property consisted of residential development along Stringtown Road, a young woods, scrub and active agriculture. The site was surrounded by young woods to the east, by residential development to the north and northeast, by commercial development to the west and by agriculture to the south and southeast.

A grass-covered drainage swale with several depressional areas and a mixture of mowed upland and wetland grasses was located on the northwestern portion of the subject property. The jurisdictional, drainageway began along the wood line to the east of the depressions and flowed east until exiting the property. Drainageway 1 flowed east for approximately 550 linear feet across the north-central portion of the subject property. There was evidence that the area was once part of a drain tile system that was abandoned and the stream has since been recovering (Figure 4).

Drainageway 2 flowed southeast for approximately 500 linear feet across the northeastern corner of the subject property. The stream emerged from a pipe approximately 50' south of Stringtown Road in the central portion of the subject property boundary. The stream flowed to the southeast and would be considered jurisdictional for its entire path through the subject property (Figure 4).

A drain tile system located on the southern portion of the subject property appeared to be the focal point of drainage for most of the land south of Stringtown Road and east of IR 71 (Figure 4). This drain tile system would likely be considered non-jurisdictional for the 1500 linear feet it flowed through the subject property. The tile became visible approximately 150 feet east of Buckeye Parkway in a disturbed area used for placing fill material. The drain tile formed a small, grass covered ditch for approximately 400 linear feet through the west-central portion of the subject property. The feature then became ponded behind an old farm road, where a large culvert brought in storm water from neighboring properties to the south. The drainageway was culverted under the farm road, flowed along a rock filled embankment for approximately 50 linear feet and once again entered into a tile drainage system. It flowed east in the drain tile for approximately 800 linear feet until reaching the boundary of the subject property. Approximately 50 feet east of the property line, the drain tile system became an intermittent stream channel and continued to the southeast (Figure 4).

Soils on the subject property are known to have high water tables and may contain inclusions of hydric soils. For this reason, the agricultural fields should be actively farmed until development occurs or more areas of jurisdictional wetland may develop on the site.

Potential Wetland A (Figure 4), a wooded, streamside wetland, was observed along the wood line near the beginning of Drainageway 1 in the north-central portion of the subject property. This area was in a depression along the drainageway and had noticeable hydrology.

Recommendations

The drainage feature that flowed across the southern portion of the subject property consists of a combination of a grass-covered ditch and poorly maintained drain tile. This feature likely would not be considered a jurisdictional stream upon review by the COE. Approximately 1050 linear feet of jurisdictional stream was located flowing through the northeastern portion of the subject property. In addition, one potential wetland area was found in the north-central
portion of the subject property. In order to determine the boundaries of these jurisdictional waters within the subject property a formal delineation is recommended.

Please feel free to contact me at (614) 470-9447 if you have any questions regarding the contents of this letter or wish us to prepare an official delineation report for the Corps.

Sincerely,

EVANS, MECHWART, HAMBLETON & TILTON, INC.

Eric T. Nagy
Environmental Scientist
Environmental Division
FIGURE 1
Area Location Map
1"=0.7 miles
(xxx County Engineering Department, 2003)
FIGURE 2
USGS Topographical Map
1"=1000'
Quad Name, Ohio (Photorevised 1988)
Quad Name, Ohio (Revised 1995)
FIGURE 3
xxx County Soil Survey Map
1"=1320'
(USDA-SCS, 2/80)

Non-hydric soils with hydric components
FIGURE 4
Flood Insurance Rate Map
1"=500'
(FEMA, 8/2/95)
FIGURE 5
National Wetlands Inventory Map
1"=2000'
Quad Names, Ohio (FWS, 1995)
Appendix B:
Delineation Report
The Woods at Indian Lake
Winona Drive
The City of xxx
xxx County, Indiana

Investigations of Waters of the United States

Prepared for:
Indiana Homebuilder, LP

May 03, 2005
2005-xxxx
Table of Contents

Introduction ............................................................................................................................................. 1
Site Description ....................................................................................................................................... 1
Investigative Methodology ....................................................................................................................... 1
Literature Review ..................................................................................................................................... 2
Topographic Features
Mapped Soils
Hydrologic Conditions
Delineation Investigation Results .............................................................................................................. 3
Potential Wetlands and Waters on Non-Agricultural Lands
Potential Wetlands and Waters on Agricultural Lands
Conclusions ............................................................................................................................................... 6
Citations .................................................................................................................................................. 8

List of Tables
  1  Extent of Potentially Jurisdictional Waters

List of Appendices
  A  Hydric Soils and Non-Hydric Soils with Hydric Components
  B  Data Forms

List of Figures
  1  Area Location Map
  2  USGS Topographical Map
  3  xxx County Soil Survey Map
  4  FEMA Flood Map
  5  Delineation Map

Exhibits
INTRODUCTION

A routine delineation of waters of the United States, including wetlands has been conducted and a report prepared by EMH&T, Inc. for an approximately 51 acre property located south of Indian Lake Road and east of Winona Drive, City of xxx, xxx County, Indiana. The investigated parcel consisted of pasture field, wooded property, open grassy lawn, and a few buildings. This study was performed at the request of and is for the exclusive use of Indiana Homebuilder, LP.

Potential wetlands located on non-agricultural lands are identified using the 1987 Wetland Delineation Manual (Environmental Laboratory, 1987) for confirmation by the U. S. Army Corps of Engineers (COE). Impacts to waters and wetlands are regulated by the COE and the U.S. Environmental Protection Agency (EPA) through Section 404 of the Clean Water Act (33 U.S.C. 1344). In addition, prior to federal authorization for impacts to waters or wetlands, certification must first be obtained from the State as defined in Section 401 of the Clean Water Act (33 U.S.C. 1341). Waters of the United States incorporates coastal waters, navigable inland waters such as lakes, rivers and streams, tributaries to navigable waters and associated adjacent wetlands, and isolated lakes, wetlands, and intermittent streams (Environmental Laboratory, 1987).

A review of public information and a field investigation were conducted for the property. The results of the review and the location and extent of potential jurisdictional waters are summarized in the following report. The boundaries identified by EMH&T, Inc. are potential as only the COE has the final authority to determine if a wetland or water is jurisdictional.

SITE DESCRIPTION

As shown on Figure 1, the subject property is located south of Indian Lake Road and east of Winona Drive, City of xxx, xxx County, Indiana. The site consists of pasture field, wooded property, open grassy lawn, and a few buildings. New residential property is located to the east and south; older, wooded residential property is located to the north and west.

INVESTIGATIVE METHODOLOGY

According to the Federal Register (1980; 1982), wetlands are defined as Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Under normal site conditions, all three indicators of jurisdictional wetlands including the presence of hydrophytic macrophytes, hydric soils and certain hydrologic indicators must be identified to meet the criteria for a jurisdictional wetland (Environmental Laboratory, 1987).

EMH&T, Inc. conducted field investigations of the property on March 31, 2005 and April 22, 2005 to determine the location and extent of potential waters of the United States, including wetlands. Areas identified as potential Waters of the U.S. and areas that exhibited all three indicators of potential jurisdictional wetlands were noted. Identification of potential jurisdictional wetlands required characterization of plant community types and identification of hydric soils and hydrologic indicators for each community type.
For all potential wetland areas, dominant species in the tree, sapling, shrub, woody vine and herb layers were determined for all potential jurisdictional areas, in accordance with the 1987 Wetlands Delineation Manual. Recorded vegetative data consisted of herbs with the greatest percentage of aerial cover within 5' of the plot center. Within a 30' radius of the plot center, saplings and shrubs with the greatest height, trees with the largest relative basal area and woody vines with the greatest number of stems were recorded. Species within each of these layers were listed on data forms in order of dominance.

Dominance was determined for each stratum individually and dominant species included those that consisted of 50 percent of the total dominance measure for a stratum, plus any additional species comprising 20 percent or more of the total dominance measure of a stratum. Hydrophytic vegetation was determined to be present when more than 50 percent of the dominants in a sample area were listed as facultative (FAC), facultative wetland (FACW) or obligate wetland (OBL) plants according to Reed (1988).

Soil data were collected using a 1" diameter soil sampling probe to a depth of 30" (where possible) to determine the soil series or phase. Soil matrix and mottle colors were identified using a Munsell Soil Color Chart (Macbeth, Revised 1992). Evidence of any other hydric soil characteristics and evidence of the presence of wetland hydrology were also recorded.

The boundaries of areas in which all three wetland criteria were met were identified and measured in the field. Points at which dominant vegetation species changed from wetland to upland, where soils changed from hydric to non-hydric, or where indicators of wetland hydrology were no longer observed were noted. The characteristics of each community type were recorded on data forms and sample points were chosen to represent both an identified potential wetland and its surrounding upland community.

**LITERATURE REVIEW**

A preliminary review was made of available topographic maps, soils maps, and floodplain maps. This information was used to determine site topography and soil types present. It was also used to determine if wetlands had previously been mapped for the site and whether any portions of the site were located within mapped floodways of drainage features.

**Topographic Features**

As shown on Figure 2, the subject property is at an approximate elevation ranging from 795' to 825' (National Geodetic Vertical Datum) according to the USGS 7.5' Series Quad Name, Indiana quadrangle (USGS, Photoinspected 1984). The elevation begins in the western panhandle of the property at approximately 840' (National Geodetic Vertical Datum) and slopes down to approximately 805' before rising to 835'. The elevation then slopes down to approximately 790' near a stream in the eastern portion of the property. Several areas on the property are shown to have steep topography (USGS, Photoinspected 1984). One stream is mapped for the site flowing across the southeast corner of the property. No open water or marsh symbols are mapped on the site.
Mapped Soils

According to the Soil Survey of xxx County, Indiana (USDA-SCS, 10/91) as shown on Figure 3, the subject property contains Crosby silt loam with 0-2% slopes (CrA), Hennepin loam with 25-50% slopes (HeF), Miami Silt loam with 2-6% slopes, eroded (MmB2), Miami silt loam with 6-12% slopes, eroded (MmC2), Miami complex with 12-18% slopes, eroded (MxD2), and Rensselaer clay loam on nearly level land (Re). Five drainageways are mapped on the subject property. No open water or marsh symbols are shown on the subject property.

A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation (USDA-SCS, 1985). According to the USDA, Rensselaer clay loam on nearly level land is listed as a hydric soil on the subject property (USDA-SCS, 5/92). Crosby silt loams with 0-2% slopes, Miami Silt loams with 2-6% slopes, eroded and Miami silt loams with 6-12% slopes, eroded are listed as non-hydric soils with hydric inclusions in xxx County, Indiana (USDA-SCS, 5/92). Hydric inclusions may be found in the Miami silt loams within depressions and along drainageways. Hydric inclusions may be found in Crosby silt loams within depressions and along drainageways. Copies of the soils lists for xxx County, Indiana are included in Appendix A.

Hydrologic Conditions

According to the xxx County Soil Survey (USDA-SCS, 2/80), the Crosby series is listed as somewhat poorly drained with an apparent high water table between 1’ and 3’ below the surface from January to April. The Rensselaer series is listed as very poorly drained with an apparent seasonal high water table from 0’ to 1.0’ below the surface from December to May.

The Monthly Water Resource Summary for Indiana reported that precipitation within Climatic Division 5 of Indiana was 2.08 inches for March which is 1.47 inches below the monthly average. According to the Standard Precipitation Index (SPI), the Climatic Region 5 was experiencing a Very Wet Spell for the six months prior to and including March, 2005 (IDNR, 4/5/05).

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) was reviewed for the site (FEMA, 1/5/01). As shown on Figure 4, the majority of the subject property lies within Zone X (unshaded) which are areas determined to be outside the 500-year flood plain. A portion of Zone X (shaded), which are areas within the 500-year flood plain; areas within the 100-year flood plain that have average depths of less than 1 foot or with drainage of less than 1 square mile; and areas protected by leaves within the 100-year flood plain, exists on the southeastern corner of the subject property along an unnamed stream. A portion of the subject property along a tributary to Indian Creek lies within Zone AE, which are special flood hazard areas inundated by the 100-year flood for which base flood elevations have been determined.
DELINEATION INVESTIGATION RESULTS

The location and extent of potential jurisdictional waters identified during the field investigation are shown on Figure 5. The locations of sample points are also shown on Figure 5. Table 1 shows the extent of potential jurisdictional waters.

### TABLE 1

**Extent of Potentially Jurisdictional Waters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Classification</th>
<th>Stream Length (linear feet)</th>
<th>Waters (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream 1</td>
<td>Ephemeral</td>
<td>260</td>
<td>0.01</td>
</tr>
<tr>
<td>Stream 2</td>
<td>Ephemeral</td>
<td>760</td>
<td>0.04</td>
</tr>
<tr>
<td>Stream 3</td>
<td>Perennial</td>
<td>1060</td>
<td>0.12</td>
</tr>
<tr>
<td>Stream 4</td>
<td>Ephemeral</td>
<td>521</td>
<td>0.02</td>
</tr>
<tr>
<td>Stream 5</td>
<td>Perennial</td>
<td>415</td>
<td>0.06</td>
</tr>
<tr>
<td>Stream 6</td>
<td>Intermittent</td>
<td>305</td>
<td>0.02</td>
</tr>
<tr>
<td>Stream 7</td>
<td>Ephemeral</td>
<td>415</td>
<td>0.03</td>
</tr>
<tr>
<td>Stream 8</td>
<td>Ephemeral</td>
<td>6</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Stream 9</td>
<td>Ephemeral</td>
<td>46</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Pond A</td>
<td>Jurisdictional</td>
<td>-</td>
<td>0.40</td>
</tr>
<tr>
<td>Pond B</td>
<td>Jurisdictional</td>
<td>-</td>
<td>0.13</td>
</tr>
<tr>
<td>Pond C</td>
<td>Jurisdictional</td>
<td>-</td>
<td>0.10*</td>
</tr>
<tr>
<td><strong>Site Total</strong></td>
<td></td>
<td><strong>3788</strong></td>
<td><strong>0.93</strong></td>
</tr>
</tbody>
</table>

* 0.67 acre of Pond C existed offsite.

Potential Wetlands and Waters on Non-Agricultural Lands

The dominant vegetation within the wetland areas and the hydric soil and wetland hydrologic indicators found within the areas are described below based on data forms located in Appendix B. Corresponding upland sample points are also located on data forms in Appendix B. Photographs of the wetlands and streams are included in the Exhibits.

**Upland A**

Upland A was found approximately 50 feet west of Stream 3 along the southern property boundary. The area consisted of an approximately 0.10 acre area of inundation adjacent to a sewer line (Exhibits 1-3). The area was dominated by *Acer negundo* (Box Elder), *Salix nigra* (Black Willow), and *Fraxinus pennsylvanica* (Green Ash) in the sapling layer and *Scirpus cyperinus* (Woolgrass), *Acer negundo* and *Phalaris arundinacea* (Reed-Canary...
Grass) in the herb layer. Soils were identified as non-hydric, well drained Miami complex, 12-18% slopes, eroded. Inundation, saturated soils and drainage patterns were observed as the primary and secondary indicators of wetland hydrologic conditions. The area of inundation continued offsite to the southwest. The inundation appeared to be caused by surface water being dammed behind a sewer line.

Stream 1
Stream 1 (Exhibit 4-5) was located within the western panhandle of the subject property, beginning on the site. The amount of channel on the subject property was 260 linear feet in length by approximately 1 to 2.5 feet in width. The channel would be considered ephemeral due to its small size and lack of a connection with groundwater within the watershed.

Stream 2
Stream 2 (Exhibits 6-7) was located on the central portion of the subject property. The channel was 760 linear feet in length and approximately 2 to 3 feet in width. The channel would be considered ephemeral due to its small size and lack of connection to groundwater.

Stream 3
Stream 3 (Exhibits 8-9) was located in the southeast and north-central portion of the subject property. The stream ran offsite and flowed through a manmade pond (Pond C), which existed mostly offsite. The on-site channel was 1060 linear feet in length and 5 feet in width. The channel would be considered perennial due to its large size and seasonal connection to groundwater through hydric soils within the watershed. In addition, the length of stream north of Pond C (described in more detail later in this document) was inundated by the 100 year floodplain.

Stream 4
Stream 4 (Exhibits 10-11) was located in the south-central portion of the subject property. The stream began onsite and flowed east before having a confluence with stream 3. The channel was 521 linear feet in length and approximately 1 to 2 feet wide. The channel would be considered ephemeral due to its small size and lack of a seasonal connection to the groundwater.

Stream 5
Stream 5 (Exhibits 12-14) was located in the southwestern portion of the subject property. The stream began offsite as an ephemeral channel and then became a perennial stream after a confluence with Stream 8 (described in more detail later in this document) along the southern boundary of the subject property. The stream flowed north through the subject property before feeding Pond A and Pond B (described in greater detail later in this document). The on-site channel was 415 linear feet in length and 5-7 feet in width. The channel would be considered perennial due to its large size and seasonal connection to groundwater within the watershed. In addition, the stream reemerged offsite to the north of Pond A as a perennial stream.
Stream 6

Stream 6 (Exhibits 15-16) was located in the west-central portion of the subject property. The stream began onsite as a non-jurisdictional, grassed-over ditch along a fence line. The stream then flowed under a driveway by way of a culvert and flowed southeast as a jurisdictional stream before having a confluence with Stream 5. The on-site channel was 305 linear feet in length and 2 to 5 feet in width. The stream would be considered intermittent due to its relatively large size and deep, defined channel.

Stream 7

Stream 7 (Exhibit 17) was located in the west-central portion of the subject property. The stream began onsite and flowed southwest as a jurisdictional stream before having a confluence with Stream 5. The on-site channel was 415 linear feet in length and 2 to 4 feet in width. The stream would be considered ephemeral due to its small size and a lack of connection to the groundwater in the watershed.

Stream 8

Stream 8 (Exhibit 18) began off-site and was located on the southwestern portion of the subject property for a small length. The stream existing on the subject property was 6 linear feet in length and approximately 1 to 2 feet in width. The channel would be considered ephemeral due to its small size and lack of connection to groundwater.

Stream 9

Stream 9 (Exhibit 19) was located on the southwestern portion of the subject property for a small length. The stream was a tributary to Stream 6 and was 46 linear feet in length and approximately 1 to 2 feet in width. The channel would be considered ephemeral due to its small size and lack of connection to groundwater.

Pond A

Two manmade ponds existed online with Stream 5, a perennial stream. Pond A existed within the reach of an offsite perennial stream and was therefore a jurisdictional water of the U.S. (Exhibits 20-21). Water from Pond B (discussed in more detail later in this document) drained into Pond A before discharging into Stream 5 to the north of the site. No length of Stream 5 was located on the subject property north of Pond A. The pond was 0.40 acres in size and was located in the northern portion of the western panhandle on the subject property adjacent to Winona Drive.

Pond B

A manmade pond existed within the reach of an offsite perennial stream and was therefore a jurisdictional water of the U.S. (Exhibit 22). Stream 5, a perennial stream, fed into Pond B and flowed north out of Pond A. The pond was 0.13 acre in size and was located in the southern portion of the western panhandle of the subject property adjacent to Winona Drive.
Pond C

A manmade pond was located within the reach of perennial Stream 3 and was therefore a jurisdictional water of the U.S. (Exhibit 23). The pond was located mostly offsite; however a small portion, including the dam, was within the subject property. The portion existing within the subject property was 0.10 acre in size and was located in the north central portion of the subject property.

CONCLUSIONS

A routine delineation of waters of the United States, including wetlands has been conducted and a report prepared by EMH&T, Inc. for an approximately 51 acre property located south of Indian Lake Road and east of Winona Drive, City of xxx, xxx County, Indiana. The investigated parcel consisted of wooded property, open grassy areas and a few buildings (Exhibits 24-26). This study was performed at the request of and is for the exclusive use of Indiana Homebuilder, LP. One disturbed upland area, Upland A, contained wetland vegetation was observed along a sewer line in the southeastern corner of the property. Ephemeral Stream 1 with a length of 260 linear feet, ephemeral Stream 2 with a length of 760 linear feet, ephemeral Stream 4 with a length of 521 linear feet, ephemeral Stream 7 with a length of 415 linear feet, ephemeral Stream 8 with a length of 6 linear feet and ephemeral Stream 9 with a length of 46 linear feet were observed on the site. One intermittent stream, Stream 6, flowed through 305 linear feet of the subject property. Two perennial streams, Stream 3 and Stream 5, flowed across 1060 linear feet and 415 linear feet of the subject property respectively. In addition, three jurisdictional ponds, Ponds A-C, with areas of 0.40 acre, 0.13 acre and 0.10 acre respectively were observed on the site. No other jurisdictional waters existed within the subject property.
CITATIONS


FEMA.  Flood Emergency Management Agency.  1/5/01.  Flood Insurance Rate Map County of Marion County, Indiana.  Panel 88 of 290.  Map number 18097C0088 E.  Available from the FEMA Map Store.

Marion County Map.  1999.  Marion County Surveyor’s Department.


USDA-SCS.  United States Department of Agriculture - (Soil Conservation Service) Natural Resources Conservation Service.  10/91.  Soil Survey of Marion County, Indiana.  Available from the Natural Resources Conservation Service (NRCS), 6013 Lakeside Boulevard Indianapolis, Indiana 46278-2933

---------.  5/92.  List of Hydric Soils for Marion County, Indiana.  Available from the NRCS, 6013 Lakeside Boulevard, Indianapolis, Indiana 46278-2933


Appendix C:  
Nationwide Permit Application
Table of Contents

Introduction .................................................................................................................................................. 1
Site Description .......................................................................................................................................... 1
Wetland Delineation .................................................................................................................................. 2
Wetland Habitat Assessment .......................................................................................................................... 6
Proposed Project .......................................................................................................................................... 6
Required Authorization ................................................................................................................................. 7
Avoidance and Minimization Strategies ....................................................................................................... 9
Proposed Mitigation Plan .............................................................................................................................. 9
Conclusions .................................................................................................................................................. 10
Citations ...................................................................................................................................................... 12

List of Tables

1 Extent of Potentially Jurisdictional Waters .............................................................................................. 4
2 Ohio Wetland Rapid Assessment Method Results ...................................................................................... 6
3 Proposed Impacts to Jurisdictional Waters ............................................................................................... 7

List of Appendices

A Wetland Data Forms
B Historical Aerial Photographs – Franklin and Pickaway County FSA
C Ohio Wetland Rapid Assessment Method Data Sheets
D EMH&T Archaeological Literature Review
E Natural Heritage Database Correspondence
F Mitigation Agreement between Romanelli & Hughes Building Company Homes of Central Ohio, LLC. & Wetlands Resource Center LLC.

List of Figures

1 Area Location Map
2 USGS Topographical Map
3 Franklin County Soil Survey Map
4 Flood Insurance Rate Map
5 Delineation Map and Proposed Development Plan with Impacts

Exhibits
INTRODUCTION

An application for Clean Water Act Section 404 authorization under Nationwide Permit #39 has been prepared by EMH&T, Inc for an approximate 23.9 acre property located south of Hayden Run Road and east of Leppert Road in xxx Township, xxx County, Ohio. The proposed residential development project for this site is referred to as Hayden’s Trace. This study was performed at the request of and is for the exclusive use of an Ohio Building Company. A wetland delineation was conducted by EMH&T, Inc. on March 9, 2005 and is included in the body of this document.

Included in this document is information detailing a request for impacts to wetlands and streams on the property. Avoidance and minimization strategies, a delineation and evaluation of wetland habitats and streams, and a proposed mitigation plan are present in this document. Ohio Building Company has entered into an agreement with Wetlands Resource Center LLC (WRC) to purchase acreage at the Little Scioto wetland mitigation bank site.

SITE DESCRIPTION

As shown on Figure 1, the investigated property is approximately 23.9 acres located south of Hayden Run Road and east of Leppert Road in xxx Township, xxx County, Ohio (Figure 1). Agricultural land exists to the north, residential and wooded areas exist to the east, pasture land exists to the south, and residential, agricultural, and pasture lands exist to the west.

As shown on Figure 2, most of the site is at an approximate elevation of 940' (National Geodetic Vertical Datum), sloping down to 920' along Hayden Run, according to the USGS 7.5’ Series Hilliard, Ohio quadrangle (USGS, Photorevised 1973). One perennial drainageway, Hayden Run, is shown to flow through the property along the southern property boundary. In addition, one small open water area is indicated in close proximity to the Hayden Run channel. No marsh symbols are indicated.

According to the Soil Survey of xxx County, Ohio (USDA-SCS, 2/80) as shown on Figure 3, the subject property contains Celina silt loam on 2 to 6 percent slopes (CeB), Crosby silt loam on 0 to 2 percent slopes (CrA), Miamian silt loam on 6 to 12 percent slopes, eroded (MIC2), and Shoals silt loam on nearly level surfaces (Sh). Two streams, Hayden Run and an associated tributary, are indicated on the southern portion of the subject property.

Hydrologic Conditions

A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation (USDA-SCS, 1985). According to the Natural Resources Conservation Service (NRCS) no soils were listed as hydric on the subject property. All of the soils on the subject property were listed as non-hydric soils with hydric components (USDA-SCS, 1/91 & USDA-SCS, 6/91). Hydric inclusions within the Celina soil unit may be found along drainageways. Within the Crosby soils unit, hydric inclusions may be found within depressions. Hydric inclusions may be found along drainageways within the Miamian soils unit. Hydric inclusions may be found within the Shoals unit in depressions and along high water channels.
According to the xxx County Soil Survey (USDA-SCS, 2/80), the Crosby soil unit is listed as somewhat poorly drained with an apparent seasonal high water table from 1' to 3' below the surface, from January to April. The Shoals soil unit is listed as somewhat poorly drained with an apparent seasonal high water table from 1' to 3' from January to April.

The Monthly Water Inventory Report for Ohio reported that precipitation within the Central Region of Ohio was 7.40 inches above normal for the six months prior to and including February 2005, the most recent report available at the time. According to the Palmer Drought Severity Index, the Central Region was experiencing a Extreme Moist Spell (Cashell, 2/05).

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) was reviewed for the site (FEMA, 8/2/95). As shown on Figure 4, the majority of the subject property lies within Zone X (unshaded), which are areas determined to be outside the 500-year flood plain. The following zones are present along Hayden Run within the property: Zone X (shaded), which are areas of 500-year flood, areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood; Zone AE, which are special flood hazard areas inundated by the 100-year flood for which base flood elevations have been determined; and the floodway area in Zone AE, which are areas determined to be within the active floodway of the 100-year flood.

WETLAND DELINEATION

Potential wetlands located on non-agricultural lands are identified using the 1987 Wetland Delineation Manual (Environmental Laboratory, 1987) for confirmation by the U. S. Army Corps of Engineers (COE). Potential wetlands located on agricultural lands are identified using the National Food Security Act Manual, 3rd Edition (USDA-SCS, 3/94), for confirmation by the Natural Resources Conservation Service (NRCS) at the county level.

Impacts to waters and wetlands are regulated by the COE and the U.S. Environmental Protection Agency (EPA) through Section 404 of the Clean Water Act (33 U.S.C. 1344). In addition, prior to federal authorization for impacts to waters or wetlands, certification must first be obtained from the State as defined in Section 401 of the Clean Water Act (33 U.S.C. 1341). Waters of the United States incorporates coastal waters, navigable inland waters such as lakes, rivers and streams, tributaries to navigable waters and associated adjacent wetlands, and isolated lakes, wetlands, and intermittent streams (Environmental Laboratory, 1987).

A review of public information and a field investigation were conducted for the property. The results of the review and the location and extent of potential jurisdictional waters are summarized in the following report. The boundaries identified by EMH&T, Inc. are potential as only the COE has the final authority to determine if a wetland or water is jurisdictional.

Investigative Methodology

According to the Federal Register (1980; 1982), wetlands are defined as Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation
typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Under normal site conditions, all three indicators of jurisdictional wetlands including the presence of hydrophytic macrophytes, hydric soils and certain hydrologic indicators, must be identified to meet the criteria for a jurisdictional wetland (Environmental Laboratory, 1987).

EMH&T, Inc. conducted a field investigation of the property on March 9, 2005 to determine the location and extent of potential waters of the United States, including wetlands. Areas identified as potential waters and areas that exhibited all three indicators of potential jurisdictional wetlands were noted. Identification of potential jurisdictional wetlands required characterization of plant community types and identification of hydric soils and hydrologic indicators for each community type.

For all potential wetland areas, dominant species in the tree, sapling, shrub, woody vine and herb layers were determined for all potential jurisdictional areas, in accordance with the 1987 Wetlands Delineation Manual. Recorded vegetative data consisted of herbs with the greatest percentage of aerial cover within 5' of the plot center. Within a 30' radius of the plot center, saplings and shrubs with the greatest height, trees with the largest relative basal area and woody vines with the greatest number of stems were recorded. Species within each of these layers were listed on data forms in order of dominance.

Dominance was determined for each stratum individually and dominant species included those that consisted of 50 percent of the total dominance measure for a stratum, plus any additional species comprising 20 percent or more of the total dominance measure of a stratum. Hydrophytic vegetation was determined to be present when more than 50 percent of the dominants in a sample area were listed as facultative (FAC), facultative wetland (FACW) or obligate wetland (OBL) plants according to Reed (1988).

Soil data were collected using a 1" diameter soil sampling probe to a depth of 30" (where possible) to determine the soil series or phase. Soil matrix and mottle colors were identified using a Munsell Soil Color Chart (Macbeth, Revised 1992). Evidence of any other hydric soil characteristics and evidence of the presence of wetland hydrology were also recorded.

The boundaries of areas in which all three wetland criteria were met were identified and measured in the field. Points at which dominant vegetation species changed from wetland to upland, where soils changed from hydric to non-hydric, or where indicators of wetland hydrology were no longer observed were noted. The characteristics of each community type were recorded on data forms and sample points were chosen to represent both an identified potential wetland and its surrounding upland community.

Potential Waters and Wetlands on Non-Agricultural Lands

The dominant vegetation within the wetland area and the hydric soil and wetland hydrologic indicators found within the area are described below as based on data forms located in Appendix A. Figure 5 is a delineation map of the property. Table 1 shows the extent of potential jurisdictional waters observed on the site.
TABLE 1
Extent of Potentially Jurisdictional Waters

<table>
<thead>
<tr>
<th>Name</th>
<th>Classification</th>
<th>Wetland Area (acres)</th>
<th>Stream Length (linear feet)</th>
<th>Water Area (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetland A</td>
<td>Non-agricultural</td>
<td>0.20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wetland B</td>
<td>Non-agricultural</td>
<td>0.05</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hayden Run</td>
<td>Perennial</td>
<td>-</td>
<td>1050</td>
<td>0.19</td>
</tr>
<tr>
<td>Stream 2</td>
<td>Intermittent</td>
<td>-</td>
<td>150</td>
<td>0.01</td>
</tr>
<tr>
<td>Stream 3</td>
<td>Ephemeral</td>
<td>-</td>
<td>600</td>
<td>0.03</td>
</tr>
<tr>
<td>Site Total</td>
<td>-</td>
<td>0.25</td>
<td>1800</td>
<td>0.23</td>
</tr>
</tbody>
</table>

WETLAND A

Wetland A consists of a herbaceous, stream-side wetland adjacent to the Hayden Run stream channel (Exhibit 1). Approximately 0.20 acre of the wetland exists on the subject property. The herbaceous layer is dominated by *Scirpus atrovirens* (green bulrush), *Carex festucacea* (fescue sedge), *Phalaris arundinacea* (reed-canary grass), *Verbena hastata* (blue vervain), and *Festuca pratensis* (meadow fescue). Soils were identified as very poorly drained Kokomo silty clay loam. Saturated soils and drainage patterns were observed as the primary and secondary indicators of wetland hydrologic conditions.

The adjacent herbaceous upland has been continuously farmed since at least 1979 (Appendix B). The surrounding upland consists of recently active agricultural cropland, pasture field, and mowed lawn. Soils are identified as nonhydric, somewhat poorly drained Shoals silt loam and nonhydric, very well drained Miamian silt loam. No evidence of wetland hydrologic indicators was observed.

WETLAND B

Wetland B consists of a 0.05 acre of herbaceous wetland (Exhibits 2-3). *Scirpus atrovirens*, *Carex festucacea*, *Epiobium coloratum* (purpleleaf willowweed), *Verbena hastata*, and *Festuca pratensis* are dominant in the herbaceous layer. Soils were identified as very poorly drained Kokomo silty clay loam. Saturated soils and drainage patterns were observed as the primary and secondary indicators of wetland hydrologic conditions.

The adjacent herbaceous upland has been continuously farmed at least since 1979 (Appendix B). The surrounding upland consists of recently active agricultural cropland, pasture field, and mowed lawn. Soils are identified as nonhydric, somewhat poorly drained Celina silt loam and nonhydric, moderately well drained Crosby silt loam. No evidence of wetland hydrologic indicators was observed.
HAYDEN RUN

Hayden Run, a tributary to the Scioto River, flows for approximately 1050 linear feet across the southern portion of the property (Exhibits 4-5). The stream has an average width of approximately 8 feet. The stream would likely be characterized as having perennial flow due to its substantial size, its well developed bed and bank structure and channel morphology. Small emergent streamside wetland areas are present along Hayden Run within the subject property and are described collectively as Wetland A further in this document.

STREAM 2

Stream 2, a tributary to Hayden Run, enters the property from the south and flows for approximately 150 linear feet before it enters Hayden Run (Exhibit 6). The stream has an average width of approximately 3 feet. The stream would likely be characterized as having intermittent flow due to its developed bed and bank structure and channel morphology.

STREAM 3

Stream 3 is a tributary to Hayden Run (Exhibits 7-8). The stream emerges from a pipe on the northern portion of the property, approximately 120 feet south of Hayden Run Road and flows for approximately 600 linear feet before entering Hayden Run. The stream has an average width of approximately 2 feet. It would likely be characterized as having ephemeral flow due to its poorly defined, very narrow channel, lack of significant channel morphology and small watershed. A small amount of wetland was found near the upstream end of Stream 3 and is described as Wetland B further in this document.

Potential Waters and Wetlands on Agricultural Lands

The property consisted of both agricultural and non-agricultural land. Wetlands located on agricultural lands are subject to regulation under the National Food Security Act (NFSA) and are determined using the procedures outlined in the National Food Security Act Manual (NFSAM). During the site investigation, no potential agricultural wetlands were observed.

In order to make an agricultural land determination for the subject property, EMH&T used the procedures outlined in the guide "Making Agricultural Land Determination: Prior Converted, Farmed Wetland, Farmed Wetland Pasture", developed by the Natural Resources Conservation Service (NRCS) and provided to EMH&T by the COE. These procedures were developed to conform to NFSAM requirements.

To determine the pre-1985 land use conditions, historical aerial photographs maintained by the xxx and xxx County Farm Service Agency (FSA) were reviewed for the years 1979 through 1984. The 1984 aerial was the closest year to 1985 on record at the FSA. The aerial photographs indicated that the agricultural portion of the site was in continuous agricultural production for all years reviewed. No agricultural wetland areas are evident. A copy of the aerial photographs is included in Appendix B.

To determine the more recent cropping history of the site, historical aerial photographs maintained at the Franklin and Pickaway County FSA office were reviewed for the years
1999 through 2003. The aerial photographs indicated that the agricultural portion of the site was in continuous agricultural production for all years reviewed. No agricultural wetland areas are evident. A copy of the aerial photographs is included in Appendix B.

Based on the site investigation and review of historical aerial photographs, all areas of non-hydric soils with hydric components located on the agricultural portions of the site meet the Prior Converted Cropland (PC) criteria that are listed in the "Making Agricultural Determinations" guide: (1) Has been manipulated making agricultural production possible prior to 12/23/85, (2) Has had an agricultural commodity produced prior to 12/23/85, (3) Has not met Farmed Wetland, Farmed Wetland Pasture, or Wetland criteria as of 12/3/85, (4) Has not supported woody vegetation as of 12/23/85, and (4) Still remains in agricultural use. No evidence of any agricultural wetlands were present on the aerial photographs for the subject property. No evidence of any agricultural wetlands were observed during the on-site investigation.

**Wetland Habitat Assessment**

A wetland rapid assessment method (RAM) has been developed by the State of Ohio for use in determining wetland quality and the following assessment is based upon that method. The RAM seeks to determine whether wetlands are rated as Category 1, 2 or 3 based on the State of Ohio Wetland Water Quality Standards adopted in 1998. Category 1 represents the lowest quality wetland, Category 2 is a moderate quality wetland and Category 3 is the highest quality wetland. The RAM asks a series of questions regarding wetland functions and characteristics and scores each wetland based on the answers provided. Table 2 provides scoring breakdowns for each wetland based on the Ohio RAM. Copies of the RAM data forms are included in Appendix C.

**TABLE 2**

Ohio Wetland Rapid Assessment Method Results

<table>
<thead>
<tr>
<th>Wetland</th>
<th>Score</th>
<th>Category</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>29</td>
<td>1</td>
<td>Scored in low range due to relatively small size, lack of a buffer, high intensity of surrounding upland land use, presence of sediment and habitat alteration, poor habitat development, absence of horizontal interspersion and microtopography, and presence of invasive species (reed-canary grass).</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>1</td>
<td>Scored in low range due to the lack of a buffer, high intensity of surrounding upland land use, presence of sedimentation, poor habitat development, poor horizontal interspersion, absence of invasive species, and lack of microtopography.</td>
</tr>
</tbody>
</table>

**Proposed Project**

The project will include the development of 22 multifamily residential buildings containing 84 units, a clubhouse and the associated infrastructure for pedestrian and vehicular access. The site development plans were designed to minimize impacts to waters of the United
States to the maximum extent practicable. As such, 1500 linear feet of perennial, intermittent, and ephemeral streams and 0.20 acre of wetland will be preserved in perpetuity on the site. No road crossings will be necessary in order to develop the site, since filling of Stream 3 will provide suitable access to the proposed housing. Figure 5 indicates the planned land use distribution for the site. Impacts to jurisdictional waters are summarized in Table 3 and are shown in Figure 5.

<table>
<thead>
<tr>
<th>Name</th>
<th>Existing Stream (feet)</th>
<th>Existing Wetland (acres)</th>
<th>Stream Impact (feet)</th>
<th>Wetland Impact (acres)</th>
<th>Preserved Stream (feet)</th>
<th>Preserved Wetland (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetland A</td>
<td>-</td>
<td>0.20</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>0.20</td>
</tr>
<tr>
<td>Wetland B</td>
<td>-</td>
<td>0.05</td>
<td>-</td>
<td>0.05</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Hayden Run</td>
<td>1050</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>1050</td>
<td>-</td>
</tr>
<tr>
<td>Stream 2</td>
<td>150</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>150</td>
<td>-</td>
</tr>
<tr>
<td>Stream 3</td>
<td>600</td>
<td>-</td>
<td>300</td>
<td>-</td>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>Site Total</td>
<td>1800</td>
<td>0.25</td>
<td>300</td>
<td>0.05</td>
<td>1500</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Wetland B and 300 linear feet of ephemeral Stream 3 will be filled for grading associated with two internal subdivision roads, grading for a lot and excavation for an area of open water. The remaining 1050 linear feet of Hayden Run, 150 linear feet of Stream 2, 300 linear feet of Stream 3, and Wetland A will be entirely preserved. Details regarding preservation and mitigation for stream 3 and wetland B are provided later in this document.

REQUIRED AUTHORIZATION

The U. S. Army Corps of Engineers administers the Nationwide Permit program for the state of Ohio. On March 18, 2002, the COE published the final rule for the administration of its Nationwide permit program regulations under the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. The rule became effective on March 18, 2002 (COE, 3/18/02). The COE permit authorizes the discharge of dredged or fill material under Section 404 of the Clean Water Act and are not valid until the state of Ohio certifies that the proposed discharge is not in violation of the state’s water quality standards (COE, 3/18/02).

An archaeological literature review was performed and is included in Appendix D.

The FWS-published list of endangered and threatened species in Ohio (12/01/00) was reviewed. According to the list, four endangered species are found distributed within Franklin County, including *Myotis sodalis* (Indiana bat), *Haliaeetus leucocephalus* (Bald Eagle), *Noturus trautmani* (Scioto madtom), *Pleurobema clava* (clubshell mussel), and *Epioblasma torulosa rangiana* (northern riffleshell). *Sistrurus catenatus* (Eastern massasauga) and *Villosa fabalis* (rayed bean mussel) are listed as candidate species.

According to Clark, B. K., et. al., *Myotis sodalis* is found in Ohio during summer months through September. Preferred habitat includes large *living or dead trees with large cavities, cracks or exfoliated bark* (1987). Tree species including *Ulmus americana* (American elm), *U. rubra* (slippery elm), *Quercus stellata* (post oak), *Q. rubra* (red oak), *Carya ovata*
(shagbark hickory), _C. cordiformis_ (bitternut hickory), _Populus deltoides_ (Eastern cottonwood), _Acer saccharinum_ (silver maple) and _Fraxinus pennsylvanica_ (green ash) have been documented as used by reproductively active females in Michigan (Kurta, et. al., 1993). The entirety of the site’s developable land consists of agricultural fields and related structures-only the trees located in the vicinity of a few structures could have the possibility of providing suitable roost habitat within the site.

The known occurrences of _Epioblasma torulosa rangiana_, _Noturus trautmani_ and _Pleurobema clava_ within xxx County have only been from the Big Darby Creek of the Scioto River basin. In addition, _Noturus trautmani_ has only been collected from the lower Big Darby Creek, and has not been recorded in over 30 years (Fazio, 1993). The known occurrences as stated by Fazio imply that these species are unlikely to be found within the project site.

According to the ODNR - Division of Wildlife, _Sistrurus catenatus_ have been recorded in 17 Ohio Counties, including xxx County. Known habitat includes wet prairies, bogs and swamps. In summer these snakes can be found in nearby drier areas like early successional fields in search of small rodents (ODNR, 2005). The species avoids open water and woody-vegetated areas. The subject property does not contain habitat that would likely be suitable for this species. _Villosa fabalis_ “occurs in small, shallow rivers, in and near riffles,” and is also found “in slow flowing rivers, and along the shallow, wave-swept shores of lakes,” (Carman, 2001). The subject property does not contain habitat that would likely be suitable for this species.

According to the ODNR – Division of Wildlife, _Haliaeetus leucocephalus_ has been recorded in 57 of Ohio’s 88 counties. The latest count puts the Bald Eagle number at 4 for xxx County, Ohio. The ideal habitat for the bird is a secluded site within two miles of water so that the bird has access to a good food source of fish. The bird will also feed on groundhogs, rabbits, squirrels, hawks, owls, ducks, gulls, and other small mammals or birds, in addition to carrion (ODNR, 1/20/04). The subject property does not contain habitat that would likely be suitable for this species.

The Ohio Department of Natural Resources (ODNR) was contacted for any information available concerning the presence of state listed endangered, threatened and proposed species or their habitat for the project site. ODNR was requested to provide information through a formal search of the ODNR Natural Heritage Database. According to Mr. Butch Grieszmer, Ecologist Analyst, there are no records of rare or endangered species within a 1 mile radius of the proposed Hayden’s Trace development site. Therefore, it is unlikely that construction of the proposed development would have a negative impact on communities important to rare or endangered species as they are well out of the project area, and Best Management Practices for sediment and erosion control will be implemented. There are no existing or proposed state nature preserves at this site. ODNR was also unaware of any unique ecological sites, geologic features, breeding or non-breeding animal concentrations, champion trees, state parks, state forests, scenic rivers, or wildlife areas within the project area. A copy of Mr. Grieszmer’s response is included in Appendix E.

**Avoidance and Minimization Strategies**

Care was taken in the layout of the development to avoid jurisdictional features to the extent possible. Impacts were minimized by arranging road paths and lot pads around
jurisdictional waters where possible and by implementing large Preservation Zones, Reserves, and Open Space Areas around the majority of the jurisdictional features present. These goals were accomplished while still meeting the required road locations and achieving maximum lot layout. Approximately 11.40 acres of total Open Space is provided within the development (approximately 42.5% of the site), including a 150’ setback from Haden Run that will encompass 7.7 acres of stream buffer planted in natural woody vegetation and/or grasses. Of this, 2.7 acres is within the floodway for Hayden Run. In addition, 3.7 acres of open space will be provided for road setbacks and community green space (Figure 5).

Fill of 300 linear feet of Ephemeral Stream 3 and 0.05 acre of Wetland B is requested. All impacts can be covered under Nationwide Permit #39, as 401 certification has been granted for these amounts of fill. The areas proposed for fill are indicated on the development plan for the site, included as Figure 5.

PROPOSED MITIGATION PLAN

In an effort to mitigate impacts to wetlands on the site, an Ohio Building Company of Central Ohio, LLC has entered into an agreement with the Wetlands Resource Center to purchase acreage at the Little Scioto mitigation bank site (Appendix F). An Ohio Building Company will purchase credit for 0.10 acre to mitigate the 0.05 acre of Category 1 emergent wetland impacts involved with the proposed project. In addition, all of Wetland A (0.20 acre) will be preserved through deed-restriction within approximately 11.4 acres of Dedicated Open Space (labeled as Open Space) that runs through the development. Mitigation for impacts to Hayden Run is proposed through onsite preservation of the remainder of Hayden as well as Stream 2 through deed-restriction within the Dedicated Open Space area. The Dedicated Open Space area, Preservation Zone, and deed restrictions will be included on the Final Plat and filed with Franklin County. Approximately 1050 linear feet of perennial stream, 150 linear feet of intermittent stream, 300 linear feet of ephemeral stream and 0.20 acres of Category 1 wetland will be preserved in this manner. In addition, this 7.7 acres of open space surrounding Hayden Run will be dedicated to City of xxx Recreation and Parks. The areas preserved are shown on Figure 5.

The Dedicated Open Space areas and Preservation Zone indicated on Figure 5 will run with the land in perpetuity so that these areas shall forever be restricted from development with buildings, structures, and uses. It is also the intent and purpose of the Dedicated Open Space and Preservation Zone to restrict and forbid any activity or use which would as a natural consequence of such, impede or make more difficult the accomplishment of the purpose of which these areas were created.

Additional restrictions include:

- No dumping or burning of refuse
- No hunting or trapping
- Natural resources of the Preservation Zone shall remain undisturbed and no topsoil, sand, gravel or rock shall be excavated or removed
- Nothing shall be permitted to occur on the premises which would contribute to the erosion of the land and no trees shall be cut or removed, except for removal of such dead, diseased, noxious, or decayed trees or vegetation which may be required for conservation or scenic purposes, or for reasons of public safety.
• No private encroachment shall be permitted, such as, but not limited to, planting of flowers, shrubs, garden material, etc., dumping of trash or debris, or the installation of any type of recreation or other facility or convenience.
• No roadway or any facility of any public utility other than existing roadways and public utility facilities or those outlined in the original plan shall be permitted to be constructed or installed in the premises; however, developer reserves the right to construct pedestrian bridges and pathways and to have vehicular access within these areas, providing that these items will not create impacts within the preserved streams, open waters, wetlands, or cemetery.

Dedicated Open Space and Preservation Zone language is included on the Development Plan and will be inserted onto the Final Plat. The Final Plat with the above language will be filed with Franklin County.

Best management practices for sediment and erosion control will be implemented. Stormwater permits and Stormwater Pollution Prevention Plans for construction activities will be prepared as needed for site development, following the requirements of the National Pollutant Discharge Elimination Systems program (USEPA, 9/92) and Notices of Intent (NOI’s) will be submitted to the Ohio EPA. Appropriate, site specific Best Management Practices (BMP’s) will be included in construction plans to decrease erosion and sedimentation during and after construction of the project site, including the placement of sediment fence inside impact areas. All sediment controls that are utilized will be kept in place during construction activities and until the site has been stabilized. All areas disturbed during construction will be seeded to encourage the establishment of a vegetative cover and decrease erosion potential. No area for which grading has been completed shall be left unseeded or unmulched for longer than 14 days.

CONCLUSIONS

An application for Clean Water Act Section 404 authorization under Nationwide Permit #39 has been prepared by EMH&T, Inc. for an approximately 23.9 acre property located south of Hayden Run Road and east of Leppert Road in xxx Township, xxx County, Ohio. The proposed residential development project for this site is referred to as Hayden’s Trace. This study was performed at the request of and is for the exclusive use of an Ohio Building Company of Central Ohio, LLC.

Authorization to fill 300 linear feet of ephemeral drainageway as well as 0.05 acre of wetland, is requested. Compensation for the loss of stream channel is proposed to occur by on-site preservation of approximately 1200 linear feet of perennial stream, 150 linear feet of intermittent stream, and 300 linear feet of ephemeral stream through deed restriction. Best management practices for sediment and erosion control will be implemented. In addition, compensation for the loss of wetland will be made through onsite preservation of 0.20 acres of Category 1 wetland through deed restriction, in addition to the purchase of credit for 0.10 acres at the Little Scioto wetland mitigation bank operated by the Wetlands Resource Center. The 7.7 acres of Open Space located on the southern portion of the property will also be preserved through deed restriction and dedicated to the City of xxx Recreation and Parks.
CITATIONS


Cashell, David H. 2/05. Monthly Water Inventory Report for Ohio. Published by the Ohio Department of Natural Resources, Division of Water, 1939 Fountain Square, Columbus, Ohio 43224.


FEMA. Flood Emergency Management Agency. 8/2/95. Flood Insurance Rate Map of
Franklin County, Ohio. Panel 116 OF 387. Map number 39049C0116 G. Available from
the Ohio Department of Natural Resources, Division of Water.

Franklin County Engineering Department. 2003. Road Map and Street Locator of Franklin
County, Ohio. Franklin County Engineer, 970 Dublin Road, Columbus, OH 43215.

Roosts of the endangered Indiana Bat (Myotis sodalis) on the northern edge of its range.

Mack, John J. Ohio Rapid Assessment Method for Wetlands v. 5.0, User's Manual and
Agency, Division of Surface Water, 401/Wetland Ecology Unit, Columbus, Ohio.

Instruments Corp., P.O. Box 230, Newburgh, New York 12551-0230.


ODNR, Division of Wildlife. 2004. Record Number of Bald Eagles Observed During the
State's Mid-Winter Survey. Retrieved March 2, 2005 from the World Wide Web:
http://www.ohiodnr.com/wildlife/Feature/ResourcesF/eagleresults04.htm


Smith, Mark. 1/28/05. Personal communication with Mr. Mark Smith, Ohio EPA. Ohio
Environmental Protection Agency.

USDA-SCS. United States Department of Agriculture – (Soil Conservation Service) Natural
Resources Conservation Service. 2/80. Soil Survey of Franklin County, Ohio. Available
from the Natural Resources Conservation Service (NRCS), 200 North High Street,
Columbus, Ohio 43215.


--------. 1/91. List of Hydric Soils for Franklin County, Ohio. Available from the NRCS, 200 North High Street, Columbus, Ohio 43215.

--------. 6/91. List of Non-Hydric Soils with Hydric Components for Franklin County, Ohio. Available from the NRCS, 200 High Street, Columbus, Ohio 43215.

Appendix D:
Wetland Monitoring Report
# Year 1 Monitoring Report for the Project

## Table of Contents

- **Introduction** ............................................................................................................................. 1
- **Project Background** ................................................................................................................ 1
- **Stream Mitigation Plan Details** .............................................................................................. 1
- **Stream Monitoring** .................................................................................................................. 2
  - Performance Standards
  - Methodology
  - General Stream Data
- **Stream Development Assessment** ............................................................................................. 4
- **Mitigation Wetland Plan Details** .............................................................................................. 5
- **Mitigation Wetland Monitoring** ............................................................................................... 6
- **Mitigation Wetland Development Assessment** .......................................................................... 6
- **Management Activities** ............................................................................................................. 7
- **Conclusions** ............................................................................................................................. 7
- **Citations** ................................................................................................................................... 8

## List of Tables

1. Channel Width Measurements for UN Trib ................................................................................. 3
2. Channel Width Measurements for Drylick Run ........................................................................... 4

## List of Appendices

- A  
  - 2004 Data forms for Individual Stream Sample Transects
- B  
  - QHEI Data
- C  
  - 2004 Data forms for Wetland Shelf
- D  
  - 2004ORAM Form for Wetland Shelf

## List of Figures

1. Area Location Map
2. USGS Topographic Map
3. Sample Transect Location Map

## Exhibits
INTRODUCTION

Properties Inc. developed approximately 38 acres located off Brandt Pike, south of Interstate 70 in Huber Heights, Montgomery County, Ohio beginning in 2003. Development included a retail center and several other retail stores. In association with the development, RG Properties received authorization from the U. S. Army Corps of Engineers and Ohio Environmental Protection Agency to relocate a portion of Drylick Run and an unnamed tributary to Drylick Run as well as fill 0.29 acre of wetland. The Ohio Environmental Protection Agency (OEPA) issued 401 Water Quality Certification on May 6, 2003 and the U.S. Army Corps of Engineers, Huntington District (COE), issued the Section 404 permit on June 30, 2003 (RG Properties-200101406-mdh). Mitigation for the project included the creation of 0.72 acre forested wetland off-site but within the Drylick Run watershed. This wetland will be located south of the Bellefontaine and Artz Road intersection near the city of Huber Heights, Montgomery County, Ohio.

The stream relocation and mitigation wetland are to be monitored for five years. Annual reports are to be submitted to the U.S. Army Corps of Engineers and Ohio Environmental Protection Agency. The purpose of the monitoring report is to discuss stream and wetland development, maintenance and/or remedial activities, plant community development and whether the stream and wetlands are meeting set performance standards. This document provides the results of Year 1 monitoring activities.

PROJECT BACKGROUND

The subject property is located east of Brandt Pike and south of Interstate 70 in Huber Heights, Montgomery County, Ohio as approximately shown in Figure 1. The site is bordered by forested property to the north and east; a church and residential property to the south; and commercial and residential property to the west.

Per the development plans for the site and the issued permits, stream relocation was required to take place in accordance with natural channel design parameters outlined in the 401 certification. 417 linear feet of Drylick Run was restored and 917 linear feet of the same stream was preserved. In addition, Stream 2 was relocated for 650 linear feet between the Wal-Mart parking area and the outlots. The restored Drylick Run and the relocated Stream 2 and associated riparian and floodway corridors will be preserved by the property owner.

Wetland mitigation included the implementation of a permanently wet, vegetated wetland to be developed on property owned by the City of Huber Heights approximately 1.5 miles northeast of the subject property. This wetland is approximately 0.72 acre in size and is being built adjacent to an existing 0.17 acre wetland. Construction of the wetland and stream relocation occurred during the summer of 2004.

STREAM MITIGATION PLAN DETAILS

The relocation site is located in the City of Huber Heights, Montgomery County, Ohio, as shown on Figure 1. Figure 2 shows the original location of the unnamed tributary to Drylick Run flowing northeast through the subject property. Drylick Run is shown flowing along the northern property boundary.

The intermittent tributary was relocated in 2003 and involved the construction of a meandering low-flow channel through a wider floodplain valley. Pools and riffles were installed per design and riparian vegetation was planted both streamside and along the slopes. Floodplain and streambank plantings included Cornus sp. (dogwood), Salix sp.
Properties Inc.
Year 1 Monitoring Report for the Project

(willow) and *Viburnum* sp. (viburnum). Approximately 560 plants were dispersed across the floodplain area. Approximately 1400 trees and 410 shrubs were planted along the streambank. Slope plantings included *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Gleditsia triacanthos* (honey locust), *Quercus alba* (white oak), *Quercus rubra* (red oak), *Betula nigra* (river birch), *Cercis canadensis* (redbud) and *Cratategus phaenopyrum* (Washington hawthorn).

Drylick Run was restored in 2003 and involved the construction of a meandering channel through a wider floodplain valley. Pools and riffles were installed per design and riparian vegetation was planted both streamside and along the slopes. Floodplain and streambank plantings included *Cornus* sp. (dogwood), *Salix* sp. (willow) and *Viburnum* sp. (viburnum). Slope plantings included *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Gleditsia triacanthos* (honey locust), *Quercus alba* (white oak), *Quercus rubra* (red oak), *Betula nigra* (river birch), *Cercis canadensis* (redbud) and *Cratategus phaenopyrum* (Washington hawthorn).

**STREAM MONITORING**

Per the Ohio EPA water quality certification for the site, the relocated streams were required to incorporate the following features:

- Establishment of deep pools
- Woody canopy cover along the bankfull channel
- Logs and woody debris placement
- Boulders
- Sand/ gravel bars and riffles
- Extensive instream and riparian plantings

The streams were constructed in 2003 to include all of the features listed above.

**Performance Standards**

The objective of the stream monitoring plan is to survey the site on an annual basis to determine whether the goals set forth in the mitigation plan have been obtained or are progressing in the appropriate direction. Accepted performance standards for both Drylick Run and an unnamed tributary to Drylick Run were as follows:

- Drylick Run QHEI Scores should achieve a minimum score of approximately 60.
- The unnamed tributary to Drylick Run should achieve a minimum score of approximately 45.
- A C4-type stable channel should be established in both streams.
- Vegetative success of plantings should be evident within five years in both streams.

**Methodology**
Monitoring began in 2004 with two site visits to review Drylick Run and the relocated stream. The remaining monitoring years will continue to require one site visit per year. Four transects were established along the relocated channel of the unnamed tributary to Drylick Run. In addition, four transects were established along the restored section of Drylick Run. Each transect was marked with two wooden stakes, located opposite one another on the upper banks of the corridor. Locations of the transects are shown on Figure 3. Data collected includes morphological measurements at each transect. A Qualitative Habitat Evaluation Index (QHEI) was also performed. Photographs of all transect locations were taken for yearly comparisons.

**General Stream Data**

Morphological measurements taken along the transects indicate that the channel was constructed per design standards. Sinuosity of both channels was 1.3 and substrate in the channel was observed to be a mix of predominantly cobble and gravel with occasional boulders placed to encourage fish habitat. Table 1 presents the bankfull and floodplain widths for the unnamed tributary to Drylick Run at each of the three transects. Table 2 presents the bankfull and floodplain widths for Drylick Run at each of the four transects. The individual data forms for each transect of both streams are presented in Appendix A.

**TABLE 1**

Channel Width Measurements for an unnamed tributary to Drylick Run

<table>
<thead>
<tr>
<th>Transect No.</th>
<th>Floodplain Width (Ft)</th>
<th>Bankfull Width (Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>41</td>
<td>8</td>
</tr>
</tbody>
</table>
TABLE 2
Channel Width Measurements for Drylick Run

<table>
<thead>
<tr>
<th>Transect No.</th>
<th>Floodplain Width (Ft)</th>
<th>Bankfull Width (Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>62</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>72</td>
<td>16</td>
</tr>
</tbody>
</table>

QHEI data was taken at each stream during the site visit. A QHEI score of 51 was achieved along an unnamed tributary to Drylick Run during the first year of monitoring. A QHEI score of 65 was achieved along Drylick Run during the first year of monitoring. The QHEI score sheets are included as Appendix B.

STREAM DEVELOPMENT ASSESSMENT

2004 represented the first year in which the streams were stable. Overall, the streams have met the required conditions and are progressing towards functional habitat. The majority of the bareroot streamside vegetation installed survived and has begun to mature.

The intermittent stream, Stream 2, is subject to high flows during the wetter months and dry conditions in the summer. During high precipitation events, the stream was observed to be flowing at bankfull width, and occasionally above bankfull width into its floodplain. Pools and riffles were observed during these times to be fully functional. Dry summer conditions, observed during monitoring are consistent with the small watershed area and the intermittent nature of the stream.

The perennial stream, Drylick Run, is subject to high flows during the wetter months and drier conditions in the summer. During high precipitation events, the stream was observed to be flowing at bankfull width, and at times above bankfull width into its floodplain. Pools and riffles were observed during these times to be fully functional. The perennial stream has a large watershed area and therefore has flowing water even during dry spells.

A fair amount of silt exists in the upstream reach of the relocated channel which can be attributed runoff within an urban watershed. An evaluation of the condition has not resulted in the need for remedial action at this point. Conditions in late 2004 showed that the silt is dispersing.

Exhibits of the relocated stream are provided in the Exhibits section of this report.
MITIGATION WETLAND PLAN DETAILS

A 0.72 acre vegetated wetland was installed and planted next to an existing 0.17 acre wetland and north of an existing stream in the summer of 2003. The wetland is located 1.5 miles north of the development site which is approximately indicated on Figure 4.

The goal of the wetland was to establish hydrologic conditions such that the wetland would have seasonally inundated or saturated conditions that will prevail for 12.5% to 25% of the growing season. Water will be provided to the mitigation wetland through precipitation, overland flow and a small intermittent stream. The wetland drains approximately 146 acres. Approximately 15 acres flows into the wetland from adjacent ground to the west and east, with the remaining 131 acres from ground north of Artz Road. A drainageway brings the water north of Artz Road into the wetland.

The mitigation wetland consists of two components: a shallow wet pool and a sloped shelf. The pool was created through excavation of subsoils. Water levels within the pool were designed to be 4 to 6 inches.

The wetland was fully planted in 2003 with herbs, shrubs and trees in order to establish a forested wetland. Additional trees were planted around the perimeter of the wetland within the 50 foot buffer zone. Species selected for planting are native to the region and are cold hardy. Value to wildlife was also considered when preparing the plant species list.

Seeding of bare soils using a rapidly gemmating cover mixture took place prior to planting. Plants installed in the basins include the following:

- **Alisma plantago-aquatica**: common waterplantain
- **Asclepias incarnata**: swamp milkweed
- **Carex spp.**: sedge
- **Eleocharis obtusa**: blunt spikerush
- **Juncus effusus**: soft rush
- **Lobelia siphilitica**: great blue lobelia
- **Ludwigia alternifolia**: seedbox
- **Sagittaria latifolia**: broad-leafed arrowhead
- **Scirpus atrovirens**: green bulrush
- **Scirpus cyperinus**: wool-grass
- **Scirpus validus**: soft-stemmed bulrush

Shrubs installed in the basins include the following:

- **Cephalanthus occidentalis**: buttonbush
- **Cornus amomum**: silky dogwood
- **Hibiscus moscheutos**: swamp mallow
- **Rosa palustris**: swamp rose
- **Sambucus canadensis**: elderberry
- **Viburnum trilobum**: American cranberrybush
Trees installed in the basins include the following:

- Acer spp. maple
- Carya spp. hickory
- Fagus grandifolia beech
- Prunus serotina black cherry
- Quercus bicolor swamp white oak
- Quercus macrocarpa bur oak
- Quercus palustris pin oak
- Salix nigra black willow

Seed was installed at a rate of 10-15 pounds per acre and herbaceous plugs were installed on 3x3 foot centers. Finally, 4-foot tall plastic fence was installed around the perimeter of the wetland. This fence helps keep geese from landing in and using the wetland for resting and feeding.

**MITIGATION WETLAND MONITORING**

Per the Ohio EPA water quality certification, the mitigation wetland was to have met design plan standards including installation of emergent vegetation and permanent wet pools. The wetland was completed according to design in 2003.

The objective of a wetland monitoring program is to determine if the mitigation site is attaining or is successfully developing wetland characteristics and jurisdictional status. Monitoring began in the 2004 growing season following construction with at least two site visits per year. The first visit took place in May of 2004 and a second visit took place in August of 2004.

Monitoring for the wetland includes providing an as-built drawing of the wetland, listing the hydrology, soils, and dominant vegetation, provide a visual observation of the planting conditions, and providing photodocumentation of the wetland condition. In addition, an Ohio Rapid Assessment (ORAM) form was completed for the wetland, which scored it at 55. Year 1 monitoring of the wetland took place on May 7, 2004 and August 18, 2004. Data forms for the wetland are located in Appendix C and the ORAM form is located in Appendix D.

**MITIGATION WETLAND DEVELOPMENT ASSESSMENT**

The wetland exists as a depression that was designed and constructed to be completely covered in wetland vegetation. During the monitoring visits, the wetland was dominated by *Alisma plantago-aquatica* (common waterplantain), *Carex vulpinoida* (fox sedge), and *Eleocharis obtusa* (blunt spikerush). Additional species present included *Cephalanthus occidentalis* (buttonbush), *Quercus bicolor* (swamp white oak), *Cornus spp.* (dogwood), (*Scirpus atrovirens* (green bulrush) *Typha angustifolia* (narrow-leaved cattail), *Asclepias incarnata*, *Juncus effusus* (soft rush), *Leersia oryzoides* (rice cutgrass), and *Alisma subcordatum*. The basin contains a diverse assortment of wetland vegetation.
MANAGEMENT ACTIVITIES

The August 2004 monitoring event showed an increase in cattail density within the wetland. Cattails make up a high percentage of the seed bank and can invade a disturbed area quickly. This condition will be monitored closely in year 2005 to see if management is necessary.

CONCLUSIONS

A Year 1 monitoring report has been prepared by EMH&T for Properties in association with Permit Number 200101406-mdh. The purpose of the monitoring report is to review the development and progress of a relocated intermittent tributary to Drylick Run, a restored portion of Drylick Run, and the vegetated wetland basin. Monitoring data collected for the stream indicates that the construction achieved design standards and is meeting performance goals set by Ohio EPA. Vegetation development in the first year was excellent with the majority of individuals surviving. The wetland mitigation site was planted in 2003. The planted basin developed a complete cover of wetland vegetation during the first year of monitoring.
CITATIONS


USDA-SCS. United States Department of Agriculture-Natural Resources Conservation Service. 6/76. Soil Survey of Montgomery County, Ohio. Available from the Natural Resources Conservation Service (NRCS), 200 North High Street, Columbus, Ohio 43215.