SOIL AND WATER CONSERVATION WITH AN EMPHASIS ON STORMWATER MANAGEMENT, PUBLIC INVOLVEMENT, EROSION AND SEDIMENT CONTROL, AND GEOGRPAHIC INFORMATION SYSTEMS: AN INTERNSHIP WITH WARREN COUNTY SOIL AND WATER CONSERVATION DISTRICT

By Caitlin Jean Botschner

The purpose of this report is to demonstrate the duties and achievements of my internship with Warren County Soil and Water Conservation District from January 2008 to June 2008. This internship focused on soil and water conservation through sediment and erosion control, stormwater management, public involvement, and Geographic Information Systems mapping. Ohio and Warren County’s sediment and erosion control regulations are discussed along with the regulation and implementation of best management practices (BMPs) on construction sites. Stormwater management methods such as rain gardens and stormwater basins are described. Public involvement is detailed in outreach and education activities. Applications for using Geographic Information Systems to map stormwater structures and streams are described.
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Adolph Greenberg
Sandra Woy-Hazleton
George Esber
IES Faculty, Staff, and Students
Warren County Soil and Water Conservation District Board of Supervisors and Staff
Warren County Engineer’s Office
DEDICATION

This report is dedicated to my grandparents, George and Jean Perbix. You continually open my eyes to see the beauty of the world around me, and the role that my hands can play in it.
INTRODUCTION

To fulfill the professional experience requirement for a Masters of Environmental Science degree from Miami University’s Institute of Environmental Sciences, a six-month internship in the field of environmental science is required. A final report must be written then successfully defended at a public presentation. This internship should expose the student to interdisciplinary environmental problem solving and professional undertakings. I chose to complete my internship with the Warren County Soil and Water Conservation District in Lebanon, Ohio.

Warren County’s Soil and Water Conservation District (SWCD) is a legal subdivision of Ohio’s state government and is charged with conserving natural resources in Warren County, Ohio. Our mission emphasizes conserving soil and water by helping local landowners plan and apply conservation practices on their property. SWCD employees serve as advocates to farmers and landowners by offering them advice and technical assistance with drainage and erosion problems. Employees also promote conservation of natural resources through education and public involvement.

My internship with Warren County SWCD began January 7, 2008. I chose this internship because it offered me the opportunity to broaden my understanding of natural resource conservation and to expand my fieldwork experience as well as to improve my Geographic Information System skills. The regulatory aspect of government work and dealing with development and construction also intrigued me. The small office of eight employees also offered me the opportunity to work closely with a variety of professionals with different day-to-day duties. Another factor in my choosing this internship was the public involvement and multi-agency collaboration that is a foundation of this agency. A board of local residents runs Warren County SWCD and it works closely with other county agencies, the Natural Resource Conservation Service, the Ohio Environmental Protection Agency, and involves the public through stream clean-ups, educational outreach in schools, and a variety of special events. These factors, along with the important mission of conserving soil and water while involving the public and local landowners all appealed to my career goal of attaining a position in environmental public involvement.
The internship opportunity came about as a result of an on-going relationship between the Institute of Environmental Sciences (IES) and Warren County SWCD. IES has worked with Warren County and Butler County SWCDs on three different Public Service Projects in the past. As a result, a lasting repertoire has been established between the two offices and when in need of an intern Warren County SWCD approached the faculty at IES for possible candidates.

DEFINING THE PROBLEM

Warren County is one of the fastest developing counties in Ohio, yet there is a strong desire from many local residents to maintain the county’s rural character. This dichotomy between preservation and growth and development influenced much of our daily work. Increasing by an average of 26% since 2000, Warren County’s population is estimated at 200,000 people (Warren County Office of Economic Development).

The mission of conserving soil and water in a county with a mixture of agriculture and urban development is a challenge. Warren County possesses valuable natural resources including the Great Miami River and the Little Miami River and economic resources such as Interstates 71 and 75 as well as many large tracts of undeveloped farmland. Warren County’s soils are another important factor. Large areas of deep, nearly level or gently sloping soils make the county very suitable for farming. The six general soil associations in Warren County are Clermont Avonburg, Rossmoyne-Hickory-Fairmount, Russell-Miamian-Xenia-Wynn, Fincastle-Brookston, Genesee-Fox, and Patton-Henshaw. A map displaying the general soil associations in the county can be found in Appendix 1 along with descriptions of the drainage patterns of each soil association (Garner et al., 1973).

Warren County faces the challenge of promoting economic development while maintaining and improving environmental quality as well as rural character. Similarly, there is a great challenge associated with protecting water quality in the midst of major construction projects and new developments. Soil expert John Peterson describes an ideal by which we should look at development and erosion control as one in which no development occurs that causes irreversible environmental damage because in the long run such a project does not improve nor maintain quality of life (Peterson, 2002). This
goal in the face of environmental challenges makes up the majority of the workload of the Warren County SWCD office.

**HISTORY OF SOIL AND WATER CONSERVATION DISTRICTS**

Historically, the Soil and Erosion Service (SES) was created in the U.S. Department of Interior in 1933 as a response to the Dust Bowl Era. The dust bowl was a series of severe dust storms in the 1930’s that caused expansive ecological and agricultural damage (Figure 1). The cause of these dust storms was a combination of severe drought and decades of extensive farming without erosion control or crop rotation (Peterson, 2002). The amount of soil lost from the nation’s croplands during the dust bowl reached millions of tons a year, which is devastating when considering that it took thousands of years for that soil to form (Peterson, 2002).

![Figure 1: Dust Bowl Storm on Coble Ranch in Cimarron County, Oklahoma](image)

The SES was moved to the U.S. Department of Agriculture and became the Soil Conservation Service when President Franklin D. Roosevelt signed the Soil Conservation Act of 1935. The Soil Conservation Service (SCS) was since renamed the Natural Resource Conservation Service (NRCS) in 1994. The SCS was thus the first permanent erosion and flood control agency of the federal government. Following the establishment
of the SCS, it was realized that farmers and local landowners were hesitant to work
directly with the federal government. As a result, Congress passed a resolution allowing
states to establish local soil and water conservation districts to serve as conduits for
federal assistance to local landowners. Governor John W. Bricker signed Ohio’s Soil
Conservation District Enabling Act on June 5, 1941. This act established the procedures
for forming local soil conservation districts and defined the election process for the
boards of supervisors and detailed their authorities and responsibilities (Lucas County,
Ohio).

The next major milestone for soil conservation, especially in urbanized areas,
occurred during the 1970’s as erosion from construction sites became more prevalent
during rapid development. Along with this displaced sediment came issues of degraded
water quality. The Clean Water Act, Public Law 92-500, which was enacted in 1972,
influenced many states to pass stormwater management and sediment control legislation
for the first time. Protection against soil loss and water degradation in the two arenas of
agriculture and development continue to be the basis for soil and water conservation
districts across the country.

WARREN COUNTY SWCD

Following a few years after Ohio’s Soil Conservation District Enabling Act,
Warren County’s Soil and Water Conservation District was organized in 1944 by a
special election held in February. These beginnings make SWCDs some of the longer
continually operating agencies in local government.

Warren County’s Soil and Water Conservation District is charged with
stormwater runoff control in the unincorporated portions of Warren County, Ohio. The
county is divided into eleven townships: Clearcreek, Deerfield, Franklin, Hamilton,
Harlan, Massie, Salem, Turtlecreek, Union, Washington, and Wayne. Of the eleven, only
five are unincorporated and thus under the jurisdiction of Warren County for zoning,
while all eleven of them follow Warren County’s erosion and sediment control
regulations.

Warren County’s total area is 399 square miles (U.S. Census Bureau). With an
office staff of eight full-time positions and one intern the workload to cover the entire
county is quite large. As a result the Warren County SWCD office staff frequently finds itself coming together to reach goals and carry out duties and often collaborates with other agencies to complete projects and to implement programs.

**BOARD**

Warren County Soil and Water Conservation District is under the direction of a board made up of five people who serve three-year terms on a voluntary basis. The members of the board are elected at an Annual Meeting, which is open to the public. These supervisors develop the local program, set priorities, obtain and disburse funds and meet once a month with the employees of Soil and Water to carry out business.

Warren County’s board is made up of five individuals who go above and beyond their required duties by lobbying and making other efforts to promote soil and water conservation in their county. The statewide SWCD Board of Supervisors has continually refused compensation because they want their dedication to be shown to be to the cause and not the dollar. Also, in their own words, their ability to lobby would be weakened if they were financially compensated for their efforts. The current members of our board are Bruce Goodwin, Tom Spellmire, Mark Steiner, Shirley Lutmer, and Vince Uetrecht. The locally elected board is an impressive and important aspect of SWCDs as it emphasizes local people solving local problems.

Soil and Water Conservation District employees have many bosses. Our regulations are usually created at the level of Federal government, which are then delegated to the State, who asks us to carry them out; yet we answer to a local board that actually sets our agenda and approves our actions. In addition, we work for the county in which we are located because of our funding structure described below.

Each SWCD office has a district administrator, Dave McElroy for Warren County, who manages the office. The organizational chart below displays how our office is set up (Figure 2).
FUNDING AND STRUCTURE

Warren County Soil and Water Conservation District is funded by the Warren County Commissioners and matched by the state of Ohio at about 80 percent, the match varies from year to year based on the state budget. As a result of the county funding and the state match we are obligated to implement the regulations passed by the county that are based upon those of the state. These regulations as they apply to our office are described below.

REGULATIONS AND PRACTICES

Before detailing the duties of my internship it is important to describe the impetus behind what we do. In Ohio the responsibility for regulating stormwater is held by both local and state authorities (Rainwater and Land Development, 2006). According to Resolution number 90-491, Warren County’s Board of Commissioners authorized Warren County’s Soil and Water Conservation District to administer the Warren County erosion and sediment control regulations authorized by Section 307.79 of the Ohio Revised Code (Warren County Board of Commissioners). These regulations are in compliance with the provisions of the National Pollutant Discharge Elimination System that follow the federal Water Pollution Control Act and the Ohio Water Pollution Control Act (Rainwater and Land Development, 2006). The primary regulations that impact our office and directed my duties were the National Pollutant Discharge Elimination System Phase II permit and the Warren County Erosion and Sediment Control Regulations.
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the federal Water Pollution Control Act and the Ohio Water Pollution Control Act, dischargers of stormwater from construction sites are required by the Ohio Environmental Protection Agency (OhioEPA) to meet permit requirements under the National Pollutant Discharge Elimination System (NPDES), (Ohio EPA Permit No.: OHC000003). As a result, stormwater discharges that enter surface waters of the state or a storm drain leading to surface waters of the state as a result of construction activities are covered under the NPDES permit. Construction sites were first included in this permit in 1992 when NPDES was expanded into Phase II, which includes small construction sites and municipal separate storm sewer systems (MS4s), (Rainwater and Land Development, 2006).

The NPDES permit requires that a Notice of Intent (NOI) be filed and the appropriate fee be paid at least 21 days prior to the start of construction activity. The next requirement for sites under this permit is that a Storm Water Pollution Prevention Plan be developed. Finally, permittees wishing to end their coverage under the NPDES permit must submit a Notice of Termination (NOT) within 45 days of completing permitted land disturbances. The NOT requires that final stabilization be achieved on the site, or that another operator or homeowner has assumed control of the site (Ohio EPA Permit No.: OHC000003).

Our role in implementing NPDES is to review Stormwater Pollution Prevention Plans and inspect sites for compliance, which are both described in the job duties section of this report. Before describing my duties it is important to review the local side of these regulations and to explain the value of erosion and sediment control.

WARREN COUNTY EROSION AND SEDIMENT CONTROL REGULATIONS

As a result of the regulations described above, and the value of maintaining soil and water quality, the goal of our work from day to day in an SWCD office is erosion and sediment control. Warren County’s Erosion and Sediment Control Regulations follow closely the requirements of NPDES and also detail the specific requirements for development in Warren County. In Warren County, if a proposed development consists
of one or more acres, then the owner must submit an Erosion and Sediment Control Plan (Warren County Board of Commissioners). The review and components of these plans are detailed in the Stormwater Pollution Prevention Plans section of this report. Ultimately Warren County’s regulations require that developers reduce erosion and control sediment during construction.

The differences between erosion and sediment control are often overlooked or misunderstood. Erosion control methods minimize the negative effects of wind, rain, and flowing water on the disturbance on soil by stabilizing the soil. The best method of erosion control is a permanent vegetative cover, but this is difficult to achieve at sites being disturbed by construction, therefore stabilization is often achieved through temporary seeding (Figure 3) or mulching.
In comparison to erosion control, sediment control follows erosion control and allows sediment-laden water to pond, reducing suspended particles, before leaving the site. Sediment control practices include sediment ponds, silt fences, and rock barriers (Figures 4 and 5). These sediment control practices should be the second choice because it is more effective to stop erosion from occurring than it is to keep sediment from leaving the site once it has eroded.
A document called Rainwater and Land Development is our manual for meeting these regulations. The manual includes planning considerations, design criteria, images, problems and concerns to beware, and specifications for each BMP (Rainwater and Land Development, 2006).
JOB DUTIES AND RESPONSIBILITIES

My job duties and responsibilities as an intern for Warren County SWCD ranged from office work such as Geographic Information Systems mapping projects, letter writing, and database work to various types of fieldwork including construction site inspections, stormwater basin inspections, and drainage calls. Beyond these regular duties I was also involved with a number of special projects which are described in the Public Involvement / Education section of this report.

GEOGRAPHIC INFORMATION SYSTEMS

As part of my job I assisted Warren County SWCD with Geographic Information Systems (GIS) mapping projects. One of the first tasks I took on in this realm was to create base maps of each township in the county (Figure 6).

FIGURE 6: FRANKLIN TOWNSHIP BASE MAP
Creating the base maps involved splitting the Warren County data into separate sections based on township. Most of the data had already been provided to our office by the county GIS department. I did request some additional data for our mapping projects including watershed boundaries and county facility locations. The goal of this project was to make the map data more manageable by breaking it into smaller sections. For example, if field technicians have a territory of only one or two townships they can use that dataset rather than the entire Warren County map, which is much larger and more time consuming to use. These separate maps of each township are also useful because Warren County has only five unincorporated townships over which the county has jurisdiction. Thus it can be important to separate out those townships from the county for some visual displays. For example, the proposed stream setbacks discussed below would only apply to the unincorporated counties. In addition to making individual township maps, I also created a base map of Warren County and demonstrated how to do basic tasks in GIS to many employees in the office.

Another major focus of my mapping projects was to visually display a proposed revision to Warren County’s Zoning Code that implements riparian setbacks on the county’s streams and rivers. Currently there are both proponents and opponents to the proposed revision. The maps show the size of the setbacks and demonstrate the impact they will have on the surrounding land use, for example how they impact existing property lines. The maps provide visual displays for local residents and stakeholders that have questions about the riparian setbacks proposed in the zoning code (see Appendix 2 for the Warren County setback map).

Our office’s goal is to deal with questions and concerns with the proposed revision now rather than later in the process and to prepare for possible questions and objections. One particular focus of my efforts in promoting stream setbacks was in Turtletcreek Township. I worked with Turtletcreek Township to promote the acceptance of streamside setbacks into their zoning if they elect to do their own zoning rather than following Warren County’s zoning regulations. I met the township trustee for Turtletcreek who requested a map of the proposed stream set backs for his township. In response to his request I created maps of the proposed stream setbacks to visually display the effect it would have on Turtletcreek Township (Figure 7).
I attended a meeting with their zoning board along with my supervisor Dave McElroy to explain and to take questions about the proposed streamside setbacks and to give them a map of their township with the proposed stream setbacks. This meeting went well and there was definite positive interest from some of the board members. To date, no townships have adopted the streamside setbacks and it is proving difficult to find a township that is willing to go first.

I also participated in two projects that were new to our office by contributing GIS analysis and mapping for two local waterways in Warren County. The first project, for Lick Run, is in preparation for a grant application that our stream specialist is applying for this year. The second project, for Simpson’s Creek, was for a stream clean-up that occurred on April 27th and is discussed in the Education / Public Involvement section of
this report. My work in both projects was quite similar, my goal was to determine the names and addresses of the residents who live along each stream in order to be able to mail letters to them. I was able to map the streams and the parcels that are within a given distance of them, and based on the parcel numbers was able to find the names and addresses of the residents. The letters being sent to the residents inform them about the projects, and offer information about putting their land in trust for those residents who live along Lick Run (Figure 8), or gave them notice about the stream clean-up happening in their backyards along Simpson’s Creek (Figure 15). I found each of these projects particularly interesting because they are attempts to involve local residents in protecting their waterways and resources.

**Figure 8: Lick Run Parcel Map**
**URBAN TECHNICIAN**

Another facet of my duties was that of an urban technician. As a general guideline I was given the territory of Turtlecreek Township which is in the central part of Warren County and surrounds Lebanon. Within this township I had three sets of duties, one was to deal with new construction in the township by reviewing Stormwater Pollution Prevention Plans and inspecting the sites under construction. The second was to take calls from local residents and respond by going on site visits or drainage calls. The third duty was to inspect all the existing stormwater basins in the township and to add them to the database and maps that I created. This territory assignment was not a constraint in terms of where I could go, but rather a focus for my attention and for organizational purposes in the office. As a result of my shadowing various field agents in our office, I was frequently outside of Turtlecreek Township during my initial training and fieldwork. But by the end of my internship I generally stayed within the boundaries of the township.

**STORMWATER POLLUTION PREVENTION PLANS**

A Storm Water Pollution Prevention Plan (SWP3) must be developed for every construction side covered by the NPDES permit. An SWP3 must identify potential sources of pollution that would affect the quality of stormwater leaving a site. The document is meant to demonstrate and guarantee the implementation of BMPs that reduce stormwater pollutants related to construction and post-construction activities. (Ohio EPA Permit No.: OHC000003). The SWP3 is referred to in Warren County regulations as a Stormwater Management Plan (Warren County Board of Commissioners). They are reviewed by the Regional Planning Commission or by Warren County’s authorized agencies such as Warren County’s Engineer’s Office or a representative from our office (Stormwater Runoff in the Unincorporated Portions of Warren County, Ohio).

Reviewing these plans involves looking at the topography and layout of the design and checking for sufficient soil and erosion control measures such as silt fences, sediment basins, and inlet protection. Plan review also includes checking that structures are to be built an adequate distance from streams. Following review of the plans our
office sends a letter asking the developer for fees based on the number of lots to be
developed and for bond monies based on the cost of the erosion and sediment control
measures necessary for the site (see Appendix 3 for an example of a letter to a
developer). According to the 2006 regulations the fees are $50/lot for single-family
homes, $15/unit for multi-family, apartments and condos and $100/disturbed acre for
commercial/industrial (Warren County Board of Commissioners). The bond amount is
based on the cost of erosion and sediment control regulations for the site. This bond is
held to ensure that the county has sufficient funds to install erosion and sediment control
BMPs if the developer fails to do so. The bonds also serve as an incentive for developers
to install these practices correctly so that they get the money back when the project is
completed.

SWP3s are the initial form of communication between developers and technicians
in our office. Following the approval of the plans and receipt of the fees and bonds it is
the duty of our employees to inspect the construction site.

SITE INSPECTIONS

Once construction has begun on a site, members of Warren County SWCD are to
inspect the development for compliance with the regulations (Warren County Board of
Commissioners). Site inspection includes driving through developments to check for
functioning BMPs as well as walking the sites to inspect BMPs. These inspections reveal
a variety of failing BMPs ranging from missing risers on sediment ponds, to silt fencing
that has been run over by equipment. Below are depictions of failing BMPs that would
require follow-up with the developer to ask them to repair the overloaded inlet protection
(Figure 9) and to grass the eroding basin bottom (Figure 10). Developers have two weeks
from the receipt of a letter to repair failing or install missing BMPs.
I inspected construction sites for erosion and sediment control in Deerfield Township, Turtlecreek Township, and Mason throughout my internship and eventually fully took on the inspections of sites in the western half of Turtlecreek Township.
Throughout my internship I came to find that drainage calls are a regular part of work in an SWCD office. Local residents call our office frequently with questions about sinkholes, erosion, wet septic fields, drainage from neighbors, springs, as well as creek and stream concerns. Part of my duties was to respond to these concerns by scheduling visits to meet with the local landowner and look at the area of concern. I prepared for these drainage calls by looking up soil compositions, aerial photographs, elevation maps, and development grading plans prior to meeting with the residents.

By making site visits we are able to assess drainage situations and offer advice to the residents such as, but not limited to, calling the health department for failing leech fields, adjusting the grade of their land to provide better drainage, or adding a sump pump or drainage tile to protect structures from excess water. Following a site visit we provide a letter or a packet of information to the resident with our findings and recommendations (See Appendix 4 for a packet of information sent to a resident).

During March 2008 we had a large amount of rainfall that led to increased drainage calls and individual assistance calls dealing with flooded basements and failing leech fields. The photo below depicts a flooded road, which was not an uncommon sight during the rainfall events (Figure 11).
STORMWATER BASIN INSPECTIONS

The other project in which I participated was creating a system for storing data about the county’s stormwater basins. Our county engineer is required under NPDES Phase II agreements to maintain stormwater infrastructure. As a result, our district is charged with assessing all the basins in the county every other year for functionality. Upon my arrival at the district these inspections were recorded and filed on paper. As a result, analysis was difficult. As a response to these challenges, I helped create a digital database for documenting this information. I began by creating a digital form for entering inspection data in an Adobe format that all the field technicians can use (see Appendix 5 for the digital form). Then, I helped enter the data that had been collected thus far and exported this data into Excel for storage and analysis as it comes in (see Appendix 6 for the inspection form). Finally, I imported the data from Excel into Geographic Information Systems for mapping the basins and further analysis (see Appendix 7 for the Excel database). I worked closely with the Warren County Engineer, Charles Petty, on this aspect of the project in order to share mapping abilities with him and his office. The goal is to be able to provide the Engineer’s office with the locations of basins plotted on maps while they provide us with links to the basin plans and drawings on the map (see Appendix 8 for the stormwater basins map). This system is meant to facilitate future basin inspections by giving inspectors all the information in one place. For example, by clicking on the basin on the digital map an inspector will find the design for the basin, the owner, previous inspection data and comments, and will be able to locate it on an aerial photo.

In addition to the mapping project for the county engineer, I also created a map book of the basins in Deerfield Township. The map book serves a purpose much like an Atlas, with the front page showing the entire township with a grid over it (Figure 12). Each grid box then corresponds to a page in the book that zooms in on a specific section on of the map (see Appendix 9 for the Deerfield Township map book).
FIGURE 12: DEERFIELD STORMWATER BASINS GUIDE MAP
Following the data input and mapping of about 175 basins, I worked to create a system for mailing letters to basin owners regarding the condition of their stormwater basins. The purposes of inspecting the basins were first to document their location, second to determine if they were built according to plan, and thirdly to identify problem areas in order to contact owners with maintenance recommendations. Unfortunately the sheer number of basins made contacting owners a tremendous task. As a result we decided to code the comments about the basins as we entered the data into the form. For this coding we chose the following categories: Earth dam, Erosion, Not built to design, Sediment, Structure: pipe and outlet, Trash or debris, and Vegetation. These items cover all the frequent maintenance issues we came across during inspections. The categories appear in a series of drop-down boxes on the digital form allowing the inspectors to report problem areas in a consistent way. The coding also allows for analysis of the data, for example, determining how many basins have erosion problems or how many had more than two problems at the time of inspection. The coding also makes it easier to inform basin owners about the condition of their basins. Two other categories designate those that need immediate attention and those that will require future maintenance. These categories give basin owners further information about the urgency of repairing their basin and allow us to send letters in a timely manner. During my internship I sent out about 175 letters along with each basin’s inspection report (see appendix 10 for the letter to basin owners). We had about twenty residents call our office after receiving a letter with questions about how to maintain their basin and how to repair the problems we identified. We also noticed some of the repairs being made when we checked on the basins.

In addition to creating this database and inputting it into GIS, I also inspected over twenty basins in Turtlecreek Township. These inspections included surveying the elevations of the basin outlet structures to determine if they were storing adequate quantities of water and making recommendations about how to maintain or repair the stormwater basins. One basin in Turtlecreek that required maintenance is shown below, with an orifice clogged with vegetative debris (Figure 13) and large debris surrounding the outlet structure (Figure 14).
The clogged orifice would fit in the “immediate attention” category because the basin could potentially overtop during a large rainfall. Our recommendation would simply be to unplug the outlet to allow for stormwater release. The large debris surrounding the outlet structure fits into the future maintenance category. We would make recommendations to maintain the vegetation to reduce the amount of debris and to
install a trash rack to allow for more convenient maintenance when debris does reach the structure.
PUBLIC INVOLVEMENT / EDUCATION

In addition to GIS and Urban Technician work I was also able to participate in a wide variety of public involvement efforts carried out by Warren County SWCD.

BROCHURES

One of my public involvement and education activities was to create a brochure for the public, listing suitable native plant species for Ohio Rain Gardens. The brochure includes basic information about what rain gardens are, where to site them, and a list of plants along with their characteristics such as bloom color, sun preference, and moisture preference. The reason for promoting rain gardens is that they are a practical and attractive small-scale solution to stormwater runoff. Rain gardens are a major trend in stormwater management and promoting the installation of such gardens in Warren County is a priority.

Further use for the brochure is that our office recently received grant monies to install a rain garden on the premises for public education and for water quality purposes. The brochure I created will serve as further public education for local residents interested in installing their own rain gardens by providing a list and pictures of native Ohio wildflowers, shrubs, and grasses appropriate for a rain garden. I also updated this brochure with plants that are sold locally at Marvin’s Organic Gardens. The purpose of this addition was to provide local and organic purchasing opportunities to people using the brochure (see Appendix 11 for the rain garden plants brochure).

I also created an additional brochure on Emergent Plants to identify suitable plants for the edges of ponds and wetlands. Emergent plants are extremely relevant to visitors to our office because many of them come in with questions about ponds. We hold two pond clinics each year where these brochures could be used as supplemental materials (see Appendix 12 for the emergent plants brochure).
SIMPSON’S CREEK STREAM CLEAN UP

In April, I participated in what was a new event for the area, a stream clean-up was conducted in Simpson’s Creek in partnership with Deerfield Township Parks and Deerfield Stormwater District. My mapping efforts were described above in the GIS section. This was the event for which I created a GIS map of the stream and then informed the residents along the stream of our efforts. I sent letters to these residents inviting them to help in the clean-up and letting them know we would be cleaning the stream and possibly walking through their yards (Figure 15).
The stream clean up had a small turnout of about fifteen residents, probably due to the newness of the event and the fact that it was a campout weekend for boy scouts who are usually big participants in these types of events. Despite the small turnout it was a quality event in which we met all the participants and were able to learn their names and hopefully engage them enough so that they will return again next year. Also, the participants who attended were very ambitious and excited about protecting Simpson’s Creek, which was very encouraging (Figure 16).

![Figure 16: Simpson's Creek Clean Up Volunteers](image)

The event included a kick-off gathering where we provided supplies such as gloves and trash bags and instructions at a local park. We then divided up into smaller groups of two or three and went to three different sections of the stream to collect trash (Figure 17). The amount of trash removed from the stream was remarkable despite a small number of participants in comparison to other local stream clean ups. Following the clean up we had a cookout to thank participants for their efforts and to facilitate conversations.
TREE SALE

The Warren County SWCD annual Tree Sale serves as a fundraiser for scholarships that our office gives to graduating seniors entering college for environmental degrees. The tree sale also serves as outreach and public involvement by inviting local residents to purchase trees and participate in local conservation efforts. The tree sale involves months of planning, sending out brochures, and pre-ordering followed by a week of packing the trees to keep their roots wet, putting together the orders for customers, and handing out the orders at the local fairground. This event serves as a great outreach to local residents by getting them interested in planting trees and bringing them into contact with our office and what we do. I took calls from residents placing orders, helped with mailings, and worked with our entire office staff throughout the week of the sale to get the trees ready and to hand them out. The event taught me to identify a variety of tree species and to learn their growth characteristics. We raised a comparable amount of money to what we raised the previous year and felt that the sale was a success.
ENVIROTHON

An exceptional education activity that SWCDs provide is the Envirothon. Envirothons are an environmental knowledge competition for high school students. This year Warren County SWCD hosted the Area IV Envirothon for 18 counties under the direction of our education specialist Amy Pond. We held the event at Camp Kern where over four-hundred high school students competed in five areas of environmental studies: wildlife, soils, aquatics, current environmental issues, and forestry. The top four teams at this competition went on the state Envirothon held in early July. My role in the event was primarily to help with behind-the-scenes planning and organization leading up to the event such as planning meetings, creating maps for the students, posters for the sponsors, and reviewing test materials. Our entire office staff came together to set the event in motion because it was held in our county. We joined together to set-up, run the event, and clean up the next day.

WELL/POND TESTING

I was also involved with a new outreach and education event that allowed residents to test their well and pond water. We held the event at Franklin High School and invited residents to bring samples of their well and or pond water for nitrate testing. A variety of organizations including Warren County Public Health and the Miami Conservancy District collaborated to plan the event and came together on the evening of the event to bring their displays and information for local residents. High school students also took part in the event by helping with the analysis of water for nitrates. The goal of the event was to get people in the door and to get them thinking about their water quality and the fact that anything they put on their lawn ends up in their wells and ponds. There was a good turnout of about forty residents and much interest was shown in water quality and in other programs we and the other organizations offer.

POND TESTING WITH OHIO STATE UNIVERSITY EXTENSION OFFICE

Another new project I was involved with was pond testing in conjunction with the Ohio State Extension office. This endeavor began in March 2008 and occurs every two months throughout the year. The purpose of the project is to collect data from about
twenty local ponds in order to provide pictures and information for presentations to local landowners about the health of local ponds and how to best manage their own ponds. I developed the two data sheets that have been used to record information gathered from the ponds. One sheet is an initial evaluation that was filled out once and kept on record with information including the type of pond, drainage area, slope, surrounding land use and other relevant information. (see Appendix 13 for the initial pond sampling sheet) The second sheet is used each time the pond is tested, and asks for information such as temperature, nitrate levels, phosphorous, and pH (see Appendix 14 for the pond sampling sheet).

During the initial evaluations of ponds and first round of sampling, I tested seven ponds and made a file to organize the photographs taken. The first round of sampling went well. Most of it was completed in a single day and a few ponds were sampled the following day. The photo below is an example showing the warmest pond we tested at 68 degrees, with what appears to be new algae growth, which was unexpected in March (Figure 18).
The second round of sampling was done in May. We had noticeable changes in temperature and phosphorous, and also increased amounts of algal growth and the success of other weeds. Figure 19 shows the same pond with increased algal growth in May. Following this sampling event I created a spreadsheet for storing and analyzing the data (see Appendix 15 for the pond sampling data). The sampling will continue through September or possibly November dependent upon the need for more data.

**Erosion and Sediment Control Field Day**

The Southwest Ohio Erosion and Sediment Control Field Day is an annual educational event hosted by Warren County SWCD, Butler County SWCD, Hamilton County SWCD, Clermont Stormwater District, and the Warren County Career Center. The event is held at the Warren County Career Center using both the indoor classrooms and the outdoor large machinery section of the school. The purpose of the event is to educate homebuilders, construction workers, and supervisors about erosion and sediment control in their jobs. The Field Day offers attendees exposure to new and innovative sediment and erosion control products. It also uses a six-lot mock subdivision to
demonstrate best management practices properly installed and in-action. This year silt fencing, rock checks, porous concrete, porous pavers, bio-retention, seeding, straw cover, and various turf reinforcement matting were all BMPs displayed. The picture below shows Warren County SWCD technician Guy Ashmore demonstrating the porous pavers by pouring water on them and describing their ability to soak up water rather than causing run-off (Figure 20).

![Figure 20: Porous Pavers Demonstration at Erosion and Sediment Control Field Day](image)

The event also has indoor sessions including special speakers and presentations. This year Rich Apuzzo, Chief Meteorologist of Skyeye Weather LLC spoke on tornados and Teresa Barnes of Butler County’s Engineer’s Office spoke on green stormwater infrastructure, namely rain gardens, and Ohio EPA’s Chris Cotton spoke on the new rules for the NPDES permit.

The one-day event requires extensive planning and collaboration between the hosting agencies and the sponsors. The sponsors include both local environmental organizations with interests in sediment and erosion control and vendors who sell products designed to control sediment and erosion. I was able to attend the planning
meetings for the event and compiled a mailing list of local construction and development companies to invite. I also participated in the set-up of the outdoor displays of BMPs and coordinated with the North America Green vendor who installed turf reinforcement matting. I also purchased plants for the bio-retention cell and created a PowerPoint to display the sponsors at the event.

This year held the sixth annual event and received positive feedback from participant surveys and from newspapers. An additional assurance that the event is successful is that other events across Ohio have been based on it.

**RAIN GARDEN PROJECT**

Our office, like much of the environmental field, is infatuated with the emerging trend of using rain gardens for stormwater management. Rain gardens are simply a new take on gardens where a depressed garden is formed rather than a raised bed. By placing the garden in the path of runoff and by planting deep rooted, native plants the garden serves as a filter and a brief storage place for the first flush of stormwater runoff. In our office, which deals so much with stormwater infrastructure, we have particular and concentrated interests in learning to install and utilize rain gardens. I had the privilege of being heavily involved with a Rain Garden grant project awarded to our district office. The funding for the project comes from a Source Reduction Grant through the USEPA. My participation in the project began just after the grant was awarded and allowed me to see the project from its beginning to its current state of installing the rain gardens.

I attended a meeting with Warren County’s Waste Water Reclamation Plant to set up a system whereby we will collaborate with them on the water sampling and monitoring that are requirements of the grant. Furthermore, I helped survey the three sites where the rain gardens will be built using total station to get the elevations and distances necessary for the plans to be drawn. I also attended meetings with the consulting firm, FTC&H, which was chosen to install the rain gardens. Following that groundwork was the initial stakeholders meeting with all the parties involved including: two representatives from FTC&H, Wes Duren of Marvin’s Organic Gardens, Donna McCullom, Greg Meyer of OSU Extension Office, Kathy Dorman an engineer with the City of Mason, myself, Marsha Rolph, and Dave McElroy of Warren County SWCD.
The meeting offered great input about how the rain gardens should be constructed. We reviewed the plans and talked about cell barriers, sediment bays, and other aspects of the designs. For example, cell barriers were discussed in terms of how they can actually block the roots from reaching their full potential. Also, the usefulness of a sediment bay to catch the first flush of sediment before it reaches the garden was mentioned as a helpful method to keep the garden functioning, and the practicality of various monitoring methods was discussed for the rain garden sites. This meeting was successful in terms of valuable input and definitely highlighted the importance to bringing experience to the table when working on a project such as this one. I also attended a rain garden plant training that Wes of Marvin’s Organic Gardens offered to members of our office and to the Master Gardeners who are involved with selecting the plants for the gardens and maintaining them after installation. At this current junction we are embarking on installing the first rain garden at the Warren County Engineer’s Office and the second one along the parking lot of our own office (see Appendix 16 for the Warren County SWCD rain garden plans). Following those installations will be one in Pine Hill Park in Mason (see Appendix 17 for the Pine Hill Lake rain garden plans). This project is especially exciting because it is innovative, collaborative, and ultimately provides valuable research, education, and stormwater management.
CONCLUSION

This report should demonstrate to both students and professionals the value of soil and water conservation as well as the variability with which one can carry it out. Soil and water conservation has been practiced for generations and continues to be a priority for Warren County SWCD and its partnering agencies. Warren County SWCD pursues soil and water conservation through regulation, education, and stormwater management. The practices described in this report are the current and most common practices carried out by Warren County SWCD. The positive impacts of these activities demonstrate the value of local initiatives and the benefits of collaborating with other agencies to achieve goals. Warren County SWCD is facing ever-increasing urbanization and development head-on with stronger water quality standards and improved sediment and erosion control regulations.

My six-month internship with Warren County Soil and Water Conservation District has been an invaluable experience. I have been exposed to a variety of professional experiences, including but not limited to, board meetings, training sessions, conferences, and dealing with a wide range of government and private employees. I have also been trained in fieldwork including drainage calls, surveys, construction site inspections and walk-throughs. I have also been further trained in and reminded of the value of collaboration and the importance of public involvement and education.

IES PREPARATION FOR THE INTERNSHIP EXPERIENCE

My experience at the Institute of Environmental Sciences gave me a sturdy foundation in collaboration, professional skills, GIS applications, problem solving and fieldwork all of which prepared me for the duties of my internship with Warren County SWCD.

IES’s emphasis on group work and collaboration trained me in working with people of diverse and varying backgrounds. It also prepared me for some of the challenges of maintaining communication with these often separated parties. The professional skills developed through IES’s public service projects and networking opportunities prepared me for professional situations and meetings. The Geographic Information Systems course was essential to me throughout my internship and should be
emphasized as an important course for all students. The problem solving skills I obtained while in IES, through the public service project and workshops, gave me the ability to envision projects and analyze their feasibility. These problem-solving skills were especially useful to my stormwater basin database and mapping project. IES also equipped me for the fieldwork involved with my internship through the Environmental Methods course and workshop experiences. I was also grateful for a solid background in policy and broader environmental topics provided by the Environmental Policy course and Environmental Principles and Applications. IES provided me with all of these valuable skills and also significantly improved my writing skills and interpersonal skills, which proved very useful throughout my internship.

**TRANSFERABLE SKILLS ATTAINED**

Throughout my time with Warren County SWCD I have refined many of the skills that IES gave me. I expanded the breadth of my interdisciplinary understanding of environmental problems, broadened my fieldwork and regulatory experience, and advanced my GIS skills as well as other professional capacities.

My internship exposed me to new disciplines and deepened my understanding and capacity to work with them in the environmental field. Extensive work with the Warren County Engineer’s Office as well as the building industry taught me new vocabulary as well as new skills such as reading construction plans and working with builders and developers. I was also exposed to the new and emerging field of rain gardens and learned along with other professionals in the environmental arena some of the techniques, challenges, and benefits of rain gardens in Ohio.

My fieldwork abilities and comfort level were greatly strengthened throughout my internship. I learned to do elevation surveys using a laser level and also participated in surveys using total station. I was trained in some our local soils during the digging of test holes and a soils training workshop. I also gained knowledge about pond building and maintenance through fieldwork experiences. In addition, I became proficient in inspecting stormwater basins for functionality and surveying them for adequate storage capacity.
Also, in another form of fieldwork I learned to assess drainage problems and make recommendations about installing swales, drainage tiles, and other drainage solutions. In this fieldwork experience I improved my ability to communicate with local landowners and to understand their struggles and needs.

Throughout my internship, I gained extensive sediment and erosion control regulatory skills by working with developers and by inspecting construction sites. I also gained experience in plan reviews and in writing letters requesting bonds, fees, and sediment and erosion control plans. I grew my understanding of stormwater regulations throughout my internship.

I also refined my GIS skills and found meaningful uses for them in mapping local stormwater basins, streams, and townships. In addition to these more concrete skill sets I was also able to polish my interpersonal and professional skills and to use and improve my problem solving skills.
REFERENCES


Ohio EPA Permit No.: OHC000003 “Authorization for Storm Water Discharges Associated with Construction Activity Under the National Pollutant Discharge Elimination System”


Stormwater Runoff Control in the Unincorporated Portions of Warren County, Ohio, Article 600.


Warren County Board of Commissioners. Adopted 2006. Warren County Erosion and Sediment Control Regulations.

APPENDIX
Appendix 1: Warren County General Soils Map
Appendix 2: Warren County Streamside Setback Map
Appendix 3: Letter to Developer

WARREN COUNTY SOIL AND WATER
CONSERVATION DISTRICT
320 East Silver Street, Lebanon, Ohio 45036
513.695.1337

May 1, 2008

Robert Ware
Warren Co. Regional Planning Commission
406 Justice Drive
Lebanon, Ohio 45036

RE: SHAKER RUN POD C, PHASE 1 (AKA SHAKER RUN GOLF CLUB, INC. PUD)

The sediment and erosion control plans received for Shaker Run Pod C Phase 1 located in Turtlecreek Township meet the requirements of the Warren County Erosion and Sediment Control Regulations. (Note: the sediment and erosion control plans received for this section are dated October 4, 2006 and call this section Pod 2 Phase 1A and 2A). Before a permit can be issued and earthmoving can begin, the following needs to be received by this office.

- The filing fee based on the preliminary plan will be $2650.00 (using the rate of $50/lot). This is a one-time fee covering review and inspections and is in addition to all other applicable fees. The fee is to be made payable to: Warren County Regional Planning Commission (W.C.R.P.C.).
- An erosion and sediment control bond with the Board of Warren County Commissioners must be received. The agreement form may be downloaded off the county web site at: www.co.warren.oh.us/commissioners.

Once the required fee and bond have been received by this office, a letter will be issued which will serve as notification that the plans are approved. It will also serve as the permit for this project or portion of the project covered in the above referenced plan.

Periodic site inspections will be made during project construction to determine continued compliance with Erosion and Sediment Control Regulations.

Sincerely,

Caitlin Botschner
cc: Developer
    Consultant
    File
To: Michael Schmidt, 4838 Eagle Ridge Court

From: Caitlin Kuzila, Jeff Thomas

Date: September 3, 2008

RE: Lot drainage / water in basement

I have enclosed a number of articles and sources of information that may be useful to you in working with your builder. They are all labeled with a letter that will correspond to the notes below.

A. Fact sheet on cracks in foundations from the National Ready Mix Concrete Association. It may be helpful to consult another company that pours foundations to see if your foundation appears to have a “normal” amount of cracking.

B. This is a copy of the grading plans we have on file for Shaker Run. While this may not be the final version, it does show your lot with drainage arrows along lot lines. The County does not have a process to verify or require that lot drainage is installed as designed. I was not able to find anything on our set of plans that indicates drainage easements along lot lines as we had discussed.

C. Based on our survey, the grading in your back yard appears to be sufficient to move water off your property. There is approximately 1.5' of fall from the heat pump to northwest lot corner.

D. Map D. is a general soil map for your site with the home site marked with a pink X. The soil type is Miamian-Russell (MrC2). This is approximate since the construction process generally upsets many of the soil properties and the break between soil types is not as finite as it appears on the map, but it will serve as a reference for the tables we have included.
E. This table shows limitations for different soils types in this area for Dwellings and Small Commercial Buildings. The primary limitation, and it is very minor, for your lot was slope. This was taken care of when they lowered your lot and installed the retaining wall.

F. The Physical Soil Properties information is generally provided to demonstrate your soils shrink-swell potential (linear extensibility). Since your house was not built from the natural soil surface downward, we have highlighted the rows (page 4 of 6) that are most applicable to your site. We estimated that an average of 5’ of soil was removed near the south property line to lower the lot. Based on this estimate, your shrink-swell potential is low or below 3 percent.

G. The Water Features information discusses soil permeability, or the likelihood that water will runoff rather than infiltrate. Since a large depth of soil was removed from your lot, you were left with primarily a heavier clay subsoil, rather than more permeable topsoil. I would expect your yard to behave more like a Group C – D soil, with an even greater amount of runoff than would normally be expected.
Appendix 5: Stormwater Basin Digital Form
Appendix 6: Stormwater Basin Inspection Form

**Warren County Storm Water Basin Inspection Form**

Inspector __________________ Date ______________ Twp./City ______________

Development __________________

Basin (location or designation if more than one) ______________

Parcel ID # ______________ Latitude ______________ Longitude ______________

Type of Basin: ______________ Is this a Water Quality Feature? ______________

If this is an “off-line” water quality feature, describe (i.e. grassy swale, bioretention with under drain, bio-infiltration, structural filter, oil/grit separator)

Ownership: ______________ Responsible Party for Maintenance: ______________

Name ______________

Company ______________

Address ______________

City ______________ State ______________ Zip Code ______________

Phone ______________

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Items needing immediate attention (these repair/replacement items need to be performed in order for the proper function of the feature. These items will need a follow-up inspection in ______ days)

Items to be watched or addressed to avoid future maintenance cost

Attachments: picture(s) □ parcel map □ Inspection Cycle: ______________
Appendix 7: Stormwater Basin Excel Database

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Appendix 8: Map of Warren County Stormwater Basins
Appendix 9: Deerfield Township Stormwater Basins Guide
Appendix 10: Letter to Stormwater Basin Owners

WARREN COUNTY SOIL AND WATER
CONSERVATION DISTRICT
320 East Silver Street, Lebanon, Ohio 45036
513.695.1337

September 3, 2008

«Name»
«Company»
«Development»
«Address»
«City», «State» «Zip»

Dear stormwater basin owner,

The Warren County Soil and Water Conservation District, in cooperation with the Warren County Engineer, has inspected the stormwater basin(s) serving your community. The inspections will be conducted on a biennial basis for stormwater retention and detention basins and yearly if the basin is designed to treat storm water quality. Stormwater basins and systems constructed after 2004 may have water quality components incorporated. Your basin is privately owned, but installed as a result of county stormwater requirements; and we are offering the free inspections as a courtesy to keep you informed of any deficiencies.

Our inspections will not address any aesthetic qualities. We will only be inspecting with regard to function and only cite those items in need of repair so that the basin may function properly in storm events.

Attached is the inspection report for your stormwater basin. On the second page of this letter there is a listing of items needing immediate attention, if nothing is listed in this section then your basin is functioning properly at this time. Below this is a listing of items to be watched. Items needing immediate attention should be addressed as soon as possible and we will conduct follow-up inspections until they are completed. Items to be watched are things that are not currently affecting the function of the basin, but they have the potential to affect function in the future, and addressing them now will help guard against more costly maintenance in the future. We will not have immediate follow-up inspections on these items.

We will provide assistance to you wherever possible, however, the responsibility for maintenance of the stormwater basin or water quality feature is yours. Please feel free to contact Dave McElroy or Jeff Thomas at our office if you have questions or concerns about your basin.

*If you feel you are not the party responsible for this basin please contact our office.
Items that require immediate attention:
«ImItem1»
«ImItem2»
«ImItem3»
«ImItem4»

Comments: «ImmediateComments»

Items that may require attention in the future:
«FutureItem1»
«FutureItem2»
«FutureItem3»
«FutureItem4»

Comments: «FutureComments»
Appendix 11: Rain Garden Plants Brochure

What are native plants?

Firstly, native plants are those that are naturally occurring in the area where you live. Plants that are native to your area have adapted to its climate and soil conditions, making them more resilient and adaptable than non-native plants. By using native plants, you can help support local ecosystems, improve soil health, and reduce the need for water and maintenance.

What is a Rain Garden?

Rain gardens are specially designed gardens that capture and filter stormwater runoff, reducing the amount of pollutants entering nearby waterways. They are typically low-maintenance and can be installed in yards and gardens. Rain gardens are an effective way to manage stormwater and improve water quality.

Where should a rain garden be?

Rain gardens are typically placed in areas that collect stormwater runoff, such as the edges of parking lots, near roads, or in yards. They should be located where rainfall will naturally occur, as this allows for optimal water collection and filtration.

Examples of a rain garden in action:

[Images of rain gardens in action]

What are the benefits of rain gardens?

Rain gardens provide numerous benefits, including:

- Reducing stormwater runoff and flooding
- Improving water quality by removing pollutants
- Creating habitat for wildlife
- Attracting pollinators
- Enhancing property appearance
- Providing shade and cooling effects

Rain gardens can be a beautiful and functional addition to any landscape, helping to improve the environment and water quality in your community.
Suggested Rain Garden Plants for Ohio

Common Name / Botanical Name

Yellow Flag Iris / Iris pseudacorus

Flowering Dogwood / Cornus Florida

Wild Ginger / Asarum canadense

Redbud / Cercis canadensis

Sweet Pepperbush / Clethra alnifolia

Sweetgale / Myrica pensylvanica

Sweet Pepperbush / Clethra alnifolia

Beech / Fagus grandifolia

Beach Sunflower / Helianthus petiolaris

Beach Sunflower / Helianthus petiolaris

Beech / Fagus grandifolia

Beech / Fagus grandifolia

Beech / Fagus grandifolia
Appendix 12: Emergent Plants Brochure

Emergent Plants: Photo Guide

- Broadleaf Arrowhead
- Horsetail
- Swamp Milkweed
- Tapered Rush
- Soft Rush
- Yellow Lotus
- Pickerel Plant
- Blue Flag
- Dudley's Rush
- Blunt Broom Sedge
- Blunt Spike Rush
- Lizard's Tail
- Black Willow
- Cardinal Flower
- Common Reed

Native Emergent Plant Species for Ohio

Warren County Soil and Water Conservation District
Warren County Soil and Water Conservation District
120 East River Street
Lebanon, Ohio 45036

Phone: 513.698.3187
Fax: 513.698.2923

Warren County, Ohio
Emergent Plants: A quick guide

Emergent plants can be defined as vertical rooted plants that can tolerate flooded and wet conditions but not extended periods of being completely submerged by water. These riparian plants are valuable for stabilizing banks, natural flood control, and beautification. They also provide important habitat and cover for fish and under water creatures. Emergent plants can also be defined as those that grow in water but pierce the surface or grow on the surface of the water as shown by the water lily above.

Example of a wetland with emergent plants on its edges and at its center.

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<thead>
<tr>
<th>Native Ohio Species List</th>
<th>Native Ohio Species List</th>
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<td><strong>Amurian Sk went BBQ</strong></td>
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<td>Broadleaf Cattail</td>
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<td>Cardinal Flower</td>
<td>* Lobelia cardinalis*</td>
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<td>Mild Water Pepper</td>
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<tr>
<td>Narrowleaf Cattail</td>
<td><em>Typha angustifolia</em></td>
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</table>

| Needle Spike Rush        | *Eriogonum parvulissimum*|
| Perennial                | annual / perennial / full sun, white flowers |
| Pickle Plant             | *Potamogeton obtusifolius* |
| River Bulrush            | *Carex aquatilis*        |
| Soft Rush                | *Juncus effusus*         |
| Swamp Milkweed           | *Arctium minus*          |
| Sweet Flag               | *Acorus calamus*         |
| Tafted Rush              | *Juncus arutatus*        |
| Typha Squa Botrydes      | *Typha latifolia*        |
| White Water Lily         | *Nymphoida odorata*      |
| Yellow Lotus             | *Nelumbo lutea*          |
| Yellow Nutsedge          | *Cyperus floridus*       |
| Yellow Pond Lily         | *Nuphar lutea*           |

Broadleaf Cattail Yellow Pond Lily
Appendix 13: Initial Evaluation Pond Sampling Sheet

**Pond Sampling: Initial Evaluation**

Pond Location ________________________________________________

Type of Pond:
- □ Farm
- □ Retention

Drainage Area (acres) __________________________________________

Size of Pond (acres) __________________________________________

Predominant surrounding land use in watershed, if more than 1 applies estimate percentages on blanks:
- □ Commercial ___  □ Industrial ___  □ Residential ___  □ Forest ___  
- □ Agricultural ___  □ Field/Pasture ___  □ Golf Course ___  □ Other ___

% Slope of Bank _____________________________

Describe area within 50 foot border of pond shoreline (vegetation, impervious surface, condition etc.) ___________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Weeds Present:
- □ Algae          □ Submerged Weeds (chara, milfoil, naiad)
- □ Duckweed/Water Meal          □ Emergent Weeds (cattails, rushes, sedges)

Describe location where sample will be taken:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(recommended ¼ of the way in from the inlet)

**Attach photo of site.**
Appendix 14: Pond Sampling Sheet

**Pond Sampling**

Location ___________________________________________ Date ______________

Inspector ___________________________________________ Time ______________

Weather conditions (temperature and recent precipitation)
_______________________________________________________________________
_______________________________________________________________________

Site observations _________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Weeds Present:
  □ Algae                      □ Submerged Weeds (chara, milfoil, naiad)
  □ Duckweed/Water Meal        □ Emergent Weeds (cattails, rushes, sedges)

Was this pond chemically treated for weeds in 2008? □ yes □ no

Description of treatment ____________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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Attach current photo of site.
# Appendix 15: Pond Sampling Data

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Appendix 16: SWCD Rain Garden Plans
Appendix 17: Pine Hill Lake Rain Garden Plans