ABSTRACT

URBAN STORMWATER QUALITY MANAGEMENT AND EDUCATION WITH AN EMPHASIS IN EROSION AND SEDIMENT CONTROL: AN INTERNSHIP WITH BUTLER SOIL AND WATER CONSERVATION DISTRICT

By Douglas Michael Dirksing

The purpose of this report is to describe the activities and accomplishments of my internship with the Butler Soil and Water Conservation District (Butler SWCD) from February to August 2006. This internship focused on natural resource conservation, primarily through erosion and sediment control, stormwater management, and water quality protection in urban and urbanizing areas of Butler County, Ohio. Applications of natural resource management in an urban setting are fully discussed as well as primary position responsibilities such as stormwater pollution prevention plan reviews and development site inspections to ensure compliance with local and state regulations. Strategies to enhance existing natural resource management, such as the revision of County erosion and sediment control regulations and the creation of a riparian setback ordinance, in addition to the implementation of best management practices (BMPs) of the Butler County Phase II Stormwater Management Plan are explained.
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EMPHASIS IN EROSION AND SEDIMENT CONTROL:
AN INTERNSHIP WITH BUTLER SOIL AND WATER CONSERVATION DISTRICT

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Butler County Planning Department
DEDICATION

This report is dedicated to my father.  
Your values, knowledge, and creativity inspire me every day.

“My father didn’t tell me how to live; he lived, and let me watch him do it”
– Clarence Budington Kelland
I. INTRODUCTION

To fulfill the research requirement for a Masters of Environmental Science (M.En.) from Miami University’s Institute of Environmental Sciences (IES), an internship of at least six months at an appropriate sponsoring agency that is actively involved in interdisciplinary environmental activities must be completed and successfully defended. This internship should accentuate the M.En. Degree Candidate’s understanding of and expertise in program curriculum objectives through real world applications of environmental problem solving related to their area of concentration. During my coursework, my primary interest became natural resource conservation through sound land use planning and best management practices. I opted to complete this internship with the Butler Soil and Water Conservation District (SWCD), a Butler County agency formed in 1942 by concerned resident landowners interested in protecting and improving the soil and water resources of the county.

The SWCD is an agency of the state of Ohio, and is financially assisted by the Butler County Commissioners, the Ohio Soil & Water Conservation Commission, and the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation. With the aid of U.S. Department of Agriculture’s (USDA) Natural Resource Conservation Service (NRCS) employees, the Butler SWCD provides free technical assistance for local conservation practices. Butler SWCD objectives include the reduction of soil erosion on agricultural and urban lands; the improvement of water quality through stormwater management and erosion control; increased community awareness of the value, need, and ways of conserving our natural resources; and environmental education programs for local schools and the general public.

My internship with the Butler SWCD began on February 13, 2006 as an Urban Technician. This full-time position was created through the Butler SWCD District Administrator and Board of Supervisors in order to develop a water quality program and resources to educate local agencies, communities, and residents. The Urban Technician and Urban Specialist administer this program in conjunction with several state and local agencies, the Ohio Department of Natural Resources, the Ohio Environmental Protection Agency, and the Butler County Stormwater District.
I chose this position with Butler SWCD for many reasons. First, it offered me the chance to further develop my skills in Geographic Information Systems, grant writing, program administration, environmental education, project management, and environmental problem solving. Second, the position was located in a rapidly urbanizing county in my home state of Ohio. As a lifelong resident of Hamilton County, Ohio, which is located immediately to the south of Butler County, I observed the effects of urbanization on already diminishing natural resources. This position provided me an opportunity to study the causes of urbanization and develop means to preserve sensitive areas and local natural resources. Third, this position made coordination between and among partnering organizations imperative. The ability to discuss and implement programs with other local, state, and federal agencies was very appealing. Finally, tasks of the position such as stream walks, storm drain labeling, and other activities to described further in this report allowed for frequent public participation and public involvement. Few other employment opportunities offer such diverse duties and responsibilities.

My internship with Butler SWCD quickly became challenging, as the Urban Specialist went on maternity leave two months into the position. This placed me in the position of Urban Technician and acting Urban Specialist with minimal training. My job duties were increased and I was also able to implement other special projects in lieu of the added work load. My ability to take on this challenge was noticed by my superiors; and, upon completion of my six-month internship, I was promoted to Urban Specialist.

Defining the Problem

Like many other areas in the United States, Butler County encounters great difficulty in water quality and watershed management due to non-point source pollution and sediment loading. In fact, several Butler County streams and rivers are categorized as “impaired” by the Ohio EPA as a result of these pollutant inputs. (Table 1 displays several types of non-point source pollutants and their corresponding sources.) Factors such as topography, geology, surface hydrology, and land use all contribute to the difficulty of managing soil and water resources; it is therefore crucial to have an understanding of these factors in order to make sound decisions and management goals.
Sediment
Nutrients (Fertilizers, Grease, Organic Matter)
Acids and Salts
Heavy Metals (Lead, Mercury, Zinc)
Toxic Chemicals (Pesticides, Organic, Inorganic Compounds)
Pathogens (Bacteria, Viruses)

- Construction Sites
- Mining Operations
  - Croplands
  - Logging Operations
  - Streambank Erosion
  - Shoreline Erosion
  - Grazed Woodland
- Croplands
- Nurseries
- Orchards
- Livestock Operations
- Gardens
- Lawns
- Forests
- Petroleum Storage Areas
- Landfills
- Irrigated Lands
- Mining Operations
- Urban Runoff
- Urban Roads, Parking Lots
- Landfills
- Mining Operations
- Vehicle Emissions
- Urban Runoff
- Urban Roads, Parking Lots
- Landfills
- Croplands, Nurseries, Orchards
- Building Sites
- Gardens, Lawns
- Landfills
- Domestic Sewage
- Livestock Waste
- Landfills

Table 1: Nonpoint source pollutants and major sources. (Leeds, et al, 2005)

The rolling hills and steep river valleys that characterize a large part of Butler County’s surface are due to Pleistocene ice sheet invasions which were preceded and followed by significant stream erosion (Lerch et al, 1980). Since it is located near the southern edge of all of the glaciers, Butler County did not experience intense leveling like the central and western parts of Ohio, and so these landforms remain. The soils of Butler County formed in several types of parent material including glacial drift, weathered shale and limestone bedrock, loess, lacustrine deposits, and, more recently, alluvium from these materials (Lerch et al, 1980). Deposits of till from glacial drifts of the Wisconsin Age consist of fine grain sediments and cover approximately 80% of Butler County’s land area. Butler County soils are characterized predominantly as silty-clay till, loamy outwash, and silty loess. These soils are, therefore, highly mobile and extremely susceptible to erosive forces. Combined with the topography, these soil properties lead to increased rates of natural erosion in the upland areas and extensive sediment deposition in the streams.

These natural resource management problems are exacerbated by the fairly recent trend of urbanization in many parts of Butler County, especially in Liberty, West Chester, and Ross Townships and in cities such as Oxford, Trenton, and Monroe. From 1990 to 2000, West Chester Township experienced an approximate 40% population increase from 39,703 to 54,895. More astonishingly, Liberty Township experienced a 150% population
increase from 9,249 in 1990 to 22,819 in 2000. With a 2005 population estimate of 26,447, Liberty Township has seen a nearly 200% increase in just 15 years (U.S. Census Bureau). As a result of urbanization, agricultural lands as well as wetlands and forested areas are rapidly converted to residential, commercial, and industrial land uses, thus significantly altering surface hydrology through increased impervious surface area. More impervious surfaces increase the volume and rate of stormwater runoff thereby causing higher flow velocities and increased frequency of bankfull flows in receiving streams (Konrad, 2002).

**History of Soil and Water Conservation Districts (SWCDs)**

Documentation throughout the early history of the United States demonstrates that soil erosion has been a consistent concern. The earliest settlers and scientists recognized human influence on erosion; however, little was done to correct land management practices. This neglect continued into the United States’ Civil War in which several texts and documents described streams and rivers choked with large amounts of sediment from poorly managed agricultural lands. Since resources seemed limitless in this period, it was common for land owners to move further west once their cropland productivity had diminished (Peterson 2002).

In the early twentieth century, a number of writers, such as Hugh H. Bennett, warned of the severe long-term problems confronting the nation because of the persistent erosion of croplands and advocated government programs to educate farmers and persuade them to change their methods. In 1928 Bennett’s work, “Soil Erosion, A National Menace” was published by the United States Department of Agriculture (USDA) and attracted the attention of several politicians including Representative James P. Buchanan of Texas (Patrick, 1961).

In 1929 the first recognition of soil erosion and its effects by the United States government occurred when Congress enacted the Buchanan Amendment to the Agricultural Appropriation Bill. This Bill appropriated $160,000 to the USDA for the investigation of erosion and its impacts to the soil of the United States (ODNR, 2001).

In May of 1934 the largest dust storm in United States’ recorded history “swept eastward from the Great Plains to the Atlantic Ocean, obscuring the sun and depositing obvious films of dust as it moved” (ODNR, 2001). This catastrophic storm and the
The subsequent Great Plains “Dust Bowl” period resulted in public upheaval that catalyzed congressional action for soil and water conservation. Faced with this calamity and the massive unemployment resulting from the United States’ Great Depression, the Roosevelt Administration established the federal Soil Erosion Service (SES) in the Department of Interior to create jobs and deal with a great natural resource problem (Peterson, 2002). In 1935 the SES became the Soil Conservation Service (SCS) within USDA with the enactment of the Soil Conservation Act of 1935, Public Law No. 46 (ODNR, 2001).

The establishment of the SCS marked the beginning of federal funding and natural resource education to landowners, especially farmers. However, inherent difficulties surfaced with the direct relationship of the federal government and local landowners. Federal policymakers recognized local landowner distrust for the federal government and the threat it posed to the longevity of the agency, so a resolution was passed to allow the states to establish state soil conservation agencies and procedures whereby local Soil and Water Conservation Districts could be formed (ODNR, 2001).

In Ohio on May 16, 1941 the 94th General Assembly passed House Bill 646, or the Ohio Soil Conservation District Enabling Act, which created the Ohio Soil Conservation Committee (OSCC) as an agency of the State of Ohio. The Act also established procedures for the formation of local Soil Conservation Districts and the election of local Boards of Supervisors and defined the authorities and responsibilities of local District Boards (ODNR, 2001).

The focus of the Soil Conservation Districts’ programs remained mainly agricultural for many years until many urbanizing counties began to recognize the impacts of residential and other urban and suburban development to soil erosion and started addressing issues such as water conservation, watershed management, and stream protection (ODNR, 2001).

Today SWCDs continue to serve as the community liaison and program administrators for agricultural resource conservation services outlined in the federally mandated Farm Bill (ODNR, 2001). They also provide technical assistance on urban drainage issues, assist in the regulation of local development ordinances, and assist in the
administration of the Six Minimum Control Measures (MCMs) outlined in the National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater program.

Butler SWCD

In the early 1940s residents of Butler County who were concerned about local soil and water resource protection petitioned to organize a local Soil and Water Conservation District and, in May of 1942, the Butler SWCD was established.

A subdivision of the state of Ohio, the district is funded in part by the Butler County Board of Commissioners with a state match from the Ohio Department of Natural Resources, Division of Soil and Water Conservation. The Butler SWCD office is located in Hamilton, OH, the Butler County seat, and employs a small staff of varying backgrounds and experience. The office also houses employees of the United States Department of Agriculture’s (USDA) Natural Resource Conservation Service (NRCS) and the Farm Services Agency (FSA). Together these agencies are able to administer federal funding and cost sharing to local farmers who are implementing conservation practices on their land.

The Butler SWCD staff is directed by an independently elected Board of Supervisors (Figure 1) and provides free urban and agricultural technical assistance and environmental education to approximately 150,000 residents.
Figure 1: Organizational Flow Chart of Butler SWCD

In 2006 the Butler SWCD’s Agriculture Program in conjunction with USDA NRCS, administered over $600,000 to Butler County farmers to implement conservation practices through programs authorized by the Farm Security and Rural Investment Act (Farm Bill). Fourteen Environmental Quality Incentives Program (EQIP) contracts were awarded to implement practices such as Waste Management Facilities, Comprehensive Nutrient Management Plans, Timber Stand Improvements, Livestock Roof Structures, and Compost Facilities. Through the Conservation Reserve Program (CRP) twenty landowners installed nearly 43,000 linear feet of grassed waterways. In addition, nine landowners were able to convert or preserve about 75 acres of quail border habitat (Butler SWCD, 2006).

With almost 80 active construction sites in Butler County in 2006, the Urban Program reviewed over 125 preliminary and final plats as members of the Butler County Subdivision Review Committee and on behalf of the Butler County Planning Commission. The Urban Program also reviewed 35 Stormwater Pollution Prevention Plans (SWPPPs) and conducted over 150 erosion and sediment control inspections to
determine compliance with the Butler County Earthmoving Permit and Ohio EPA NPDES General Permit for Stormwater Discharges Associated with Construction Activities. Furthermore, the Urban Program provided technical and educational assistance to over 70 landowners with drainage, erosion, stream management, and other natural resource issue, concerns, or problems on their land (Butler SWCD, 2006).

The Education Program held 277 environmental education programs for 6,500 children and 400 adults. Through the year seven water quality field trips, or Stream Walks, were held for 405 children and 49 adults as well as numerous outreach, education, and public involvement events such as WaterFest, Great Miami River Days, Envirothon, Clean Sweep of the Great Miami, and Storm Drain Labeling field trips. Several of the education programs were funded through grants from the Ohio EPA’s Office of Environmental Education as well as through Butler County Stormwater District funds (Butler SWCD, 2006).

Each year the Butler SWCD District Administrator drafts an Annual Plan of Operations to identify program goals, duties, and responsibilities. Pertinent goals, objectives, and action items relating to the Urban Technician position can be found in Appendix 1.
II. JOB DUTIES AND RESPONSIBILITIES

As stated earlier, my job duties and responsibilities became more extensive when the acting Urban Specialist left for five months of maternity leave. In this chapter I will discuss the duties and responsibilities of each position and shared positional duties as they applied to my internship.

**Urban Technician**

*Stormwater Pollution Prevention Plan Reviews*

When the preliminary plat of a commercial or residential subdivided parcel that is greater than one acre in size is approved by the Butler County Planning Commission, the subdivision developer has an engineer draw up construction plans to fulfill certain requirements of the Butler County Subdivision Regulations and the Ohio EPA’s General Permit for Stormwater Associated with Construction Activities Ohio EPA Permit (OHC000002). These construction drawings, which are submitted initially to the Butler County Department of Development Planning Division, include a demolition plan, a grading plan, a utilities plan, and a Stormwater Pollution Prevention Plan (SWP3), to name a few. The SWP3 Plan, also referred to as an Erosion and Sediment Control (ESC) Plan, contains many components including limits of clearing and grading, location of surface waters, existing and proposed contours, and location and method of erosion and sediment control devices (see Appendix 2 for complete list of requirements). The basic premise of the SWP3 is to precisely convey how silt- and sediment-laden stormwater runoff will be controlled and/or reduced both during and after construction activities.

Prior to 2005, the Butler SWCD only provided soil limitation input and basic erosion and sediment control advice to the Planning Commission via the Planning Division, and SWP3’s were not formally reviewed as part of the Butler County subdivision review process. In 2005 Butler County enacted the ‘Butler County Earthmoving Permit’ authorizing the Butler SWCD to review SWP3s and to inspect active construction sites. The Permit also bestowed upon the Butler SWCD enforcement power to delay non-compliant sites from plat approval through the Planning Division. Within the Butler SWCD these duties were assigned to the Urban Technician.
When the SWP3 for a development is submitted to the Butler SWCD, the developer also submits the ‘Butler County Earthmoving Permit Application’ (Appendix 3) which requires information such as project name and location, acreage disturbed, receiving waters, ESC Contractor, and site contact information. My job was to review the SWP3 to confirm that all necessary components are included and to verify that erosion and sediment control devices and Best Management Practices (BMPs) conform to the specifications of the Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Manual and are appropriately placed with regards to existing and proposed drainage patterns. Currently there is no fee assessed on the ‘Butler County Earthmoving Permit’; however, as described in Chapter V, Butler County is revising the Butler County Subdivision Regulations, and a fee schedule will be appended.

Erosion and sediment control device requirements differ with the type of stormwater drainage. Concentrated flows require sediment trapping and energy dissipation capabilities, typically through methods such as sediment/stormwater basins, check dams, or sediment traps; whereas, sheet flows require protection such as silt fence or mulch berms to serve a broader land area. Other erosion and sediment control requirements run standard with each site. For example, the construction drawings must show a suitable construction entrance (so that sediment is not transferred to the roadways via construction vehicles), a seeding stabilization plan (for completed construction areas or areas that will remain dormant for an extended period), and storm drain inlet protection location and description (to minimize sediment transfer to the storm sewer system).

If the SWP3 is deemed insufficient or further controls are required, I send a letter to all parties listed on the Earthmoving Permit explaining the revisions needed for approval. The developer may then resubmit the SWP3 for another review. Once the SWP3 complies with all requirements and an approval letter is sent, the developer must arrange a pre-construction meeting with the engineer, the ESC Contractor, and the Urban Technician. This meeting provides all project parties an opportunity to review all requirements of the SWP3 and to address any related questions. The pre-construction meeting also serves as an introduction of all project parties to determine whom I should...
notify when erosion and sediment control devices need maintenance or when additional controls are needed.

When the pre-construction meeting is completed, the Butler County Earthmoving Permit is issued and construction activities may commence. Construction activities cannot begin until all of these steps are fulfilled. An example of a plan review revision and approval letter can be found in Appendix 4 and 5.

Inspections

Once construction activities commence on an approved development site, the Urban Technician is responsible for inspecting the site once every two to three weeks to ensure compliance with the approved SWP3. Violations occur frequently and are usually caused by poor installation or total lack thereof, normal wear-and-tear of the controls, invasive destruction of controls (e.g. driving equipment over silt fence), or simply a general lack of knowledge of state and local regulations. Some infractions are slight maintenance concerns and can be solved by a quick phone call to the ESC contractor; however, more grievous issues require a Notice of Violation (NOV) report to be sent to all responsible parties. The NOV report clearly describes the nature of all infractions through written descriptions and photo documentation and suggests means to resume compliance. The NOV report also notifies the developer that Butler County can withhold final plat approval and/or building inspections until all violations are addressed. (An NOV report can be found in Appendix 6.)

Stormwater pollution education is the paramount aid in ensuring continued compliance on development sites. The development community likes to save money and finish a project under budget, as most industries do. This fiscal reality can often cause neglect of erosion and sediment pollution protection. By using the SWP3 review and site inspection processes as an opportunity to educate the local development community on soil erosion and water quality issues associated with construction, I found that most developers understand the good investment they are making. In most cases, developers and contractors want to achieve compliance, avoid hassles, and be good neighbors. It is my goal to educate them on how erosion and sediment control can be accomplished cheaply and effectively and can potentially raise the marketability of their development to future buyers. In addition to this, each year the Butler SWCD Urban Division recognizes
a developer, engineer, or ESC contractor who has exhibited outstanding compliance with erosion and sediment control requirements with the Urban Cooperator of the Year Award presented in October at the Butler SWCD Annual Meeting. The recipient of this award for 2006 was Mr. Rod Baker, Superintendent of all public general construction projects with Don S. Cisle Contractor, Inc. Mr. Baker has been involved on many construction sites in Butler County. Most recently he was responsible for the erosion and sediment controls at Southpointe Crossing, a residential community in Oxford Township.

During my internship there were approximately 90 active construction sites in the unincorporated areas of Butler County and I conducted approximately 150 inspections in that time. These sites were either residential or commercial and were in varying stages from active construction to entire site recorded. To aid in tracking developments and their respective stages, a geodatabase was developed. The resulting GIS layer (Figure 2) illustrates that most development is occurring in southeast Butler County in Liberty and West Chester Townships and predominantly in the Upper Mill Creek and Gregory Creek watersheds.
Urban Specialist

Plat Reviews

For many years the Butler SWCD Urban Specialist has provided technical assistance to the Planning Division on soil and water related issues during the plat review process. Each month the Urban Specialist meets with other members of the Butler County Subdivision Review Committee, which consists of representatives from the Engineer’s Office (BCEO), Department of Environmental Services (BCDES), Health Department, and Planning Division, to discuss any issues or concerns related with preliminary and final plats, replats, or other issues such as township zoning text amendments, submitted that month. Each county department makes comments based on requirements set forth in the Butler County Subdivision Regulations which are then compiled by the Planning Division and presented to the Butler County Planning Commission at their monthly meeting. The Planning Commission then approves the plat
outright, approves the plat with certain stipulations, or denies it based on Subdivision Review Committee comments.

The responsibility of the Urban Specialist at the preliminary plat stage is to first review the plan to determine location and any important characteristics that should be investigated further in the field, such as steep slopes, ponds, streams, potential wetlands, etc. Soil type plays an important role at this stage as it defines water table depth, bedrock depth, location of hydric soils (a good indicator of wetlands), and degree of erodibility. The next step is to perform an environmental field assessment of the site. During this assessment, which is often performed with a representative of the Planning Division, I could walk the proposed development, investigate any concerns, and further develop comments or recommendations to be submitted to the Planning Commission. The final step is to compile any comments concerning the plat and send them to the Planning Division.

When a final plat is submitted, it must again be reviewed by the Butler County Subdivision Review Committee to ensure that all requirements of the Subdivision Regulations are met. At this time the Urban Specialist verifies that all comments made at the preliminary plat stage have been addressed. For instance, if the developer has filled in a pond to be used as a home site, a soil compaction test must be approved by the Urban Specialist prior to final plat approval. Since the inception of the ‘Butler County Earthmoving Permit’, this has included compliance with all erosion and sediment control requirements. In essence, this stage has provided enforcement capabilities for the ‘Butler County Earthmoving Permit’ administration.

Zone Changes

When a property owner wants to change the zoning classification of their parcel, they must submit a proposed use plan to the Subdivision Committee via the Planning Division. During this process the Urban Specialist performs a somewhat perfunctory review of the site and plan to aid the Planning Commission in its decision to adopt or deny the zone change. Zone change reviews contain some of the same elements of the preliminary plat review, but do not yet spell out specific requirements for development. It is very rare that a zone change would be denied based on soil limitations; however, this
stage serves as an introduction to a potential subdivision and future concerns can be noted.

**Township Zoning Plat Reviews**

The Urban Specialist is also solicited each month by the West Chester Township Planning and Zoning Department to make comments on preliminary and final plats and zone changes. These plats can include developments also covered by the County Subdivision Regulations or developments not under the jurisdiction of the County Subdivision Regulations. Any comments made are then presented to the West Chester Township Zoning Commission at their monthly meeting.

**Urban Technician/Urban Specialist**

**Accela Automation**

In October of 2006 Butler County launched Accela Automation® as its new enterprise land management information system. This software application streamlines the plan review process by providing a centralized database of all comments made by the various county agencies and the Subdivision Review Committee, thereby eliminating the need for expansive paperwork and frequent facsimiles. With Accela a development project can be tracked from beginning to end, allowing county employees to reference past comments and requirements more efficiently, to submit comments more quickly and easily, and to view geographic representations of all land use information associated with a permit, plan, or inspection.

This software also tracks activities associated with the SWP3 and the Butler County Earthmoving Permit. SWP3 approval and revision letters can be generated as a report through Accela, and all of the information included on the ‘Butler County Earthmoving Permit’ can be stored for easy reference. Accela also allows the Urban Technician to enter construction site inspection information, which simplifies historical searches and allows other county agencies to view compliance status. This is very helpful when the Planning Division compiles staff comments at the final plat review stage.

Since Accela is such a broad program with seemingly endless capabilities and applications, implementation can take a long period of time due to behind the scenes programming, employee training, and the growing pains that accompany system changes.
In fact, Butler County purchased the software about a year before the start of my internship, in March 2005, yet did not actually “go-live” until October of 2006. Throughout my internship I received extensive training on this software as it was an important responsibility to understand its functions and general mechanics to prepare for implementation and training of future Butler SWCD employees.

**Drainage/Pond Calls**

A vital function of the Butler SWCD is to provide free technical and educational assistance on urban streambank erosion, drainage problems, and pond management to residents and landowners of Butler County. Each year the Urban Division receives about a hundred calls from residents with questions and concerns relating to these issues; and, nearly all of them necessitate further investigation through a scheduled visit to the property. Problems and concerns vary in stage and severity. Some problems have relatively easy, low cost solutions, while others require a large investment. During my internship I handled about forty of these cases.

Responding to these calls has been an effective means to publicize SWCD programs and has provided an excellent forum for environmental education and Low Impact Development (LID) Best Management Practices (BMPs). A persistent wet spot in the yard, for instance, can be abated by a rain barrel tied to the downspout of the gutter system or potentially eliminated through the installation of a rain garden. A rain barrel is essentially a cistern that collects stormwater runoff from impervious roofs. This rain water can then be reused on the lawn or in the garden in drier times (Figure 3). Gardens are often built above the surrounding landscape; whereas, rain gardens, sometimes referred to as bioretention cells, are constructed in depressions to capture stormwater, slowly filter out sediment and other pollutants, and recharge groundwater supplies (Figure 4).
Many residents don’t understand the nature and causes of streambank erosion and will toss just about anything against the stream bank to reduce soil loss. As a first measure people often use things at their disposal such as yard clippings, tree branches, and stones. These techniques might work temporarily, but the material is typically washed downstream with a larger storm event. In these situations we can educate on more permanent, more ecologically sound methods. For example, by planting or staking native willow trees along the streambank, the roots are able to bind the soil more firmly, supplying more resistance against stream flows. Also, by leaving a substantial vegetative buffer and not mowing the lawn up to the streambank, erosion could be slowed and the stream could have more space to naturally meander and utilize floodplain. Vegetative buffers can also naturally filter pollutants out of stormwater before it enters the stream system.
III. THE CLEAN WATER ACT AND THE FEDERAL PHASE II STORMWATER PROGRAM

In the 1960s public awareness and concern over water pollution grew rapidly; in part due to calamitous events such as the combustion of the chemical and industrial waste-filled Cuyahoga River in Ohio and a large oil spill of the coast of Santa Barbara, California. In response to public demand, the federal government enacted the Federal Water Pollution Control Act Amendments of 1972 in order to “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” and to make all U.S. waterways fishable and swimable by 1985 (CWA, 1973). The Clean Water Act, as this law eventually became known, set the discharge of pollutants into the United States’ waterways as a national priority and established a framework by which these pollutants could be regulated. The Act provided the United States EPA the authority to implement pollution control programs, continued requirements to set water quality standards for all contaminants in surface waters, and made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. Furthermore, the Clean Water Act funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution (USEPA, 2007). Another result of the Clean Water Act was the National Pollutant Discharge Elimination System (NPDES), a permitting program that made great strides in reducing point source pollution.

Although by the end of the seventies many U.S. waterways were significantly cleaner than earlier in the decade, the National Urban Runoff Program report, started in 1978 and submitted to Congress in 1983, concluded that the goals of the Clean Water Act would not be achievable without addressing stormwater runoff. In response to these findings, the federal government enacted the Water Quality Protection Act of 1987 in order to address pollution problems from diffuse sources such as agriculture, combined sewer overflows (CSOs), and urban runoff. The Water Quality Act used a phased approach and mandated that each state devise a program and approach to deal with nonpoint source and stormwater runoff pollution. Phase I began in 1990 and applied to
most industrial facilities, municipalities with populations greater than 100,000 people as
determined by the 1990 US Census, and construction sites with 5 acres or more disturbed
land (Ohio EPA, 2004). In March 2003 the Phase II stormwater program tightened
criteria for coverage and included municipal industrial dischargers, municipalities with a
population of 10,000 or greater, and construction activities down to one acre of disturbed
area. This program employed an holistic, watershed-based approach to urban and
agricultural stormwater runoff rather than simply regulating point source pollution from
pipes.

In the state of Ohio, the Ohio EPA has been delegated authority to permit,
monitor, and oversee the three main components of the federal Phase II program. These
components, all of which require permits to discharge stormwater from their site or
jurisdictional boundary to Ohio waterways, are the industrial stormwater program, the
construction stormwater program, and the municipal separate storm sewer system (MS4)
program. The industrial and construction general permits regulate individual landowners
and/or developers, while the MS4 permit applies to communities, townships, cities, or
villages that discharge surface water runoff to Ohio waterways via separate storm sewer
systems. Table 2 highlights some key differences of the Phase I and II programs.

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Table 2: Differences between Phase I and II of the NPDES Stormwater Program

**Butler County Phase II MS4 Stormwater Program**

In 1999 the US EPA required municipalities deemed as “Urban Areas” by the
2000 U.S. Census to obtain a National Pollution Discharge Elimination System (NPDES)
General permit in order to authorize communities with municipal separate storm sewer
systems to discharge stormwater to Waters of the State. In Butler County, 16 units of
government had all or parts of their communities fall under Phase II mandates. Those
municipalities with separate storm sewer systems were required to develop or join a
Phase II stormwater management program by March 2003. The affected municipalities, as determined by the 2000 U.S. Census Bureau can be found in Figure 6. The Phase II stormwater management programs had to include a plan to control stormwater runoff pollution through six minimum control measures. These control measures are:

1) Public education and Outreach
2) Public involvement and participation
3) Elimination of Illicit Discharges
4) Construction site runoff control
5) Post Construction runoff control
6) Pollution Prevention/ Good Housekeeping

Figure 6: NPDES Phase II Areas as determined by the 2000 U.S. Census (Butler County Stormwater District, 2003).
Butler County formed a countywide stormwater utility, the Butler County Storm Water District which is housed in the County Engineer’s Office, and offered coverage to all affected townships and cities. In response to this, all of the affected townships, as well as the City of Trenton, opted to obtain coverage under the Butler County MS4 NPDES General Permit (No. 1GQ00051*AG). Other cities in the County that fell under Phase II MS4 requirements, such as Fairfield, Hamilton, Middletown, and Monroe, chose to form their own stormwater management programs. As a result, funds provided by the Butler County Storm Water District can only be used on Minimum Control Measure projects within the District.

**Butler County Storm Water Management Plan**

To fulfill NPDES Phase II requirements the Butler County Commissioners appointed the Butler County Engineer’s Office (BCEO) as the lead agency to develop and implement a stormwater management plan under Ohio Revised Code (ORC) Section 6117. In 2002 the BCEO hired consultants, Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) and Environmental Rate Consultants (ERC), to assist in the formation of a Stormwater District and Stormwater Management Plan. The BCEO also formed a steering committee comprised of representatives from local governments, local development organizations, watershed groups, Chambers of Commerce, conservation organizations, and other interested stakeholders to evaluate Phase II requirements, choose Best Management Practices (BMPs), and develop a regional Storm Water Management Plan. The committee chose as a means to finance the Storm Water District and District Programs a property tax based on the amount of impervious surface area per tax parcel. Also, the committee chose the BMPs that would most effectively address each Minimum Control Measure, prevent nonpoint source runoff pollution, and restore “Impaired Waters” of Butler County (Butler County Storm Water District, 2003). According to the 303(d) list in the Federal Register, “Impaired Waters” in Butler County include Four Mile Creek, the Great Miami River, Mill Creek, Sevenmile Creek, Indian Creek, and the Whitewater River. The causes of impairment are typically sediments and nutrients. Please see Appendix 7 for more information on the BMPs selected for each Minimum Control Measure including the party responsible for completing the goals and the time frame within which completion is necessary.
In order to increase the efficacy of the Storm Water Management Plan and execute the elected BMPs, job duties for the Minimum Control Measures were allotted amongst the County agencies. The Butler SWCD was given the majority of the Phase II duties including all of the duties pertaining to the Education and Outreach MCM and the Public Involvement and Participation MCM. In addition, the Butler SWCD is responsible for almost all of construction site runoff control and often assists on post-construction runoff control and Pollution Prevention. The Butler SWCD and the Butler County Storm Water District maintain a Memorandum of Understanding (MOU) that clarifies the determined job duties, expectations, funding, and time accounting and reporting responsibilities.
IV. APPLICATIONS OF STORMWATER MANAGEMENT AND EDUCATION

My involvement with the Butler County Phase II program has been a vast learning experience on how to interact with and educate the general public (both adults and children), policymakers, county agencies, and the private sector on effective stormwater management. I assisted the Butler SWCD Education Specialist as an instructor on Water Quality Field Trips, demonstrating to local school children the effects of pollution and habitat loss on stream ecosystems. I helped organize and implement Storm Drain Labeling volunteer programs. Furthermore, I was able to educate the general public and county employees on Post-Construction BMPs such as water quality, or wetland, detention basins. Through Public Outreach and Public Involvement communities begin to understand watershed management concepts and can learn stormwater management good stewardship practices.

Water Quality Field Trips

The Butler SWCD Education program serves as a resource for educators, students, scout leaders and parents who are interested in activities, resources, and lessons regarding earth science and natural resources and assists the Butler County Stormwater District with Public Education and Public Involvement. As part of this program, the Education Specialist and SWCD staff organize Water Quality Field Trips for local students, educators, and general public. These Field Trips consist of hands-on educational modules, each designed to promote an understanding of the biological, chemical, and physical properties and processes of local streams. By using an interdisciplinary approach, the students gain a vital understanding of the many components of stream systems and the causes of water quality degradation.

Students are introduced to several different chemical testing methods such as Test Strips for pH levels, Color Wheel Kits for Nitrogen and Phosphorus levels, and Drop-Count Titration Kits for Dissolved Oxygen levels. Other activities include evaluating
stream flow, testing turbidity using the Secchi disk method, assessing habitat quality, and kick seining for macroinvertebrates as an indicator of pollution levels. Students are also introduced to concepts such as the watershed and stream system components (i.e. floodplain, pools and riffles, stream terraces, etc.).

During my internship I conducted five Field Trips for students of varying age, education level, and socio-economic backgrounds. The Field Trips were performed at Indian Creek Preserve with students from Hamilton and Talawanda High Schools, at the Great Miami near the Fairfield Wastewater Treatment Plant with students from St. Julie Billiart and St Peter in Chains Schools, at Gregory Creek in Dudley Woods Metropark with students from Lakota Plains Jr. School, at Elk Creek in Sebald Park for the Metroparks Summer Education program, and at a stream adjacent to Camp Kern in Clinton County for 4-H Camp.

The Butler County Water Festival

The Butler County Water Festival is sponsored by The Hamilton to New Baltimore Groundwater Consortium and began in 1999 as a way to promote drinking water awareness and education to Butler County school children. Today the Water Festival incorporates several other environmental and natural science issues like solid waste management, air quality, and wildlife management.

The 8th Annual Water Festival was held in October 2006 at Miami University Hamilton. Nearly 1,000 area fourth, fifth, and sixth graders participated in the event which consisted of forty-five, thirty minute activity workshops. I was asked by Mr. Tim McClelland, Manager for the Groundwater Consortium, to conduct one of the activity workshops, essentially a Water Quality Field Trip focusing on Macroinvertebrate identification in the classroom. The workshop, which was to be presented four times throughout the day with approximately 25 students at each session, concentrated on the students’ ability to identify macroinvertebrates.
identify stream water quality as poor or good based upon certain indicators such as the presence or absence of tree canopy cover, riffle zones, habitat, pollutant-sensitive macroinvertebrates, and pollutant-tolerant macroinvertebrates.

**Storm Drain Labeling**

As a measurable goal for the Public Education and Outreach Minimum Control Measure, The Butler County Stormwater Management Plan proposed to “purchase and coordinate the installation of 300 [storm drain] labels per year until all basins in the [Storm Water] District are marked (Butler County Storm Water District, 2003). Each year the Butler SWCD implements this goal on behalf of the Storm Water District. With supplies such as glue, storm drain labels, and educational handouts provided by the Storm Water District, the Butler SWCD recruits local groups such as Girl Scouts, local high school FFAs, and environmental organizations and instructs them on proper label installation. During my internship I conducted three Storm Drain Labeling trips – one at a subdivision in Liberty Township with a Girl Scout Troop from VanGorden Elementary School and two at subdivisions in the City of Trenton with Edgewood Honor Students and Edgewood FFA members. While participating in the Labeling trips I, as well as chaperones and students, was stopped by numerous inquisitive homeowners wanting to learn more about the program and ways they could help out or volunteer. From this experience I learned that many Butler County residents do not understand the purpose of storm sewers as transmitters of storm water runoff to Butler County streams. It is extremely important to educate these residents on the adverse effects of chemical, animal, and yard waste disposal in these systems.

**Beckett Ridge Water Quality Basin**

In February of 2004 the Butler SWCD submitted an application for the Five Star Restoration Challenge Grant to restore 420 linear feet of riparian corridor in a rapidly developing suburban watershed by replacing the existing barren and concrete-lined stormwater detention facility with a fully functioning wetland to treat stormwater pollutants and provide habitat. The Five Star Restoration Program, which is administered by the National Association of Counties (NACo), the National Fish and Wildlife Foundation, and the Wildlife Habitat Council, in cooperation with the U.S. EPA, provides financial assistance on a competitive basis to support community-based wetland,
riparian, and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities. In addition, the Program provides an incentive for local participants, such as government agencies, elected officials, community groups, businesses, schools, and environmental organizations, to contribute matching funds and labor (NACo, 2001).

Prior to submitting the grant proposal, the Butler SWCD had to choose a suitable stormwater detention basin for the project based on a number of stipulations, i.e. the basin had to be located in the Upper Mill Creek watershed, the basin had to be privately maintained, and the adjacent residents and Homeowners’ Association had to approve of the project. Other criteria such as drainage area feeding the detention basin and actual basin size were also factored into the decision process. After careful consideration, weighing the pros and cons of about ten different basins, the Butler SWCD determined that a stormwater detention basin located in the Beckett Ridge subdivision in West Chester, Ohio most aptly satisfied all of the requirements. In 2005 The Butler SWCD’s “Upper Mill Creek Riparian Restoration and Stormwater Wetland Enhancement” project was awarded a sum of $12,000 and consisted of two primary phases.

First, the 1.1-acre detention basin was transformed and properly restored to a riparian wetland, principally to provide habitat and treat upland stormwater runoff before entering a substantial tributary of the Upper Mill Creek. Second, a monitoring program was enacted by project partners, Miami University’s Institute of Environmental Sciences and the Butler County Storm Water District, to evaluate the efficiency of the wetland in its assimilation of pollutants following storm events.
For the first phase, the Butler SWCD contracted JFNew, an ecological consulting firm, to design the wetland and perform most of the restoration work. JFNew’s design focused on separating the inputs of the three different sub-watersheds that drain into the detention basin and increasing the surface area of conveyance channels within the basin. Through a combination of earthen berms, selected concrete removal, open channel swales, and water treatment mechanisms such as sediment forebays, micro pools, grassy swales, and prairie buffers, the design proposed to not only detain stormwater, but also to filter pollutants (For the complete plans see Appendix 8).

In late May 2006 the plan was set into motion with the removal of existing vegetation and spot spraying of noxious weeds. The removal of this vegetation increased the survival rate of the introduced wetland vegetation through decreased competition with the existing species.

When preparation was completed, the earthwork began. This process, which involved the removal about 150 feet of concrete channel, the excavation of over 500 feet
of swales and three micro pools, and the creation of several earthen berms, was finished in mid-June. The next step of the project was to install Coconut Matting, a blanket woven from coconut fibers that provides bank stability, in all of the swales and plant about 2,000 wetland plugs. Installation of the matting was accomplished primarily by SWCD staff, and the planting was completed by the SWCD staff and numerous project partner volunteers.

Figure 12: Installing coconut matting.

Figure 13: Planting wetland species.

In addition to this, an Agri Drain Inlet Water Level Control Structure™ was installed by JFNew at the outlet of the wetland basin. This structure contains several panels which can be raised or lowered to control the rate at which stormwater is allowed to pass through the system. Determining how much and how long stormwater should be detained in the infant stages of this project was a sensitive balance. Inundating the basin for an extended period killed off most of the competitive noxious weeds and invasive species, yet it increased concerns of adjacent residents who were guaranteed that the basin would dry before mosquitoes reached the adult stage of their life cycle which is about seven to twelve days. Figure 15 shows me adjusting the panels of the control structure after a large rain event. The wooden stakes to the left of the structure show the water level pre- and post-rain event.
The final step of the first phase was to again remove any invasive vegetation that managed to grow in the basin and apply various seed mixes to their appropriate locations, e.g. prairie grasses on the upland slopes, submergent species in the micro pools, etc.

For the second phase, the Butler SWCD partnered with IES to develop a wetland basin water quality monitoring project. Sample sites were chosen at three locations – Sample Site C is located upstream from the outlet of the restored wetland, Site B is located at the outlet of the wetland, and Site A is located downstream of the wetland (See Figure 17). Samples were typically taken at two week intervals by SWCD staff and delivered to IES for analysis; however, due to wetland construction and occasional scheduling constraints, some weeks are missing data.
Figure 17: Sampling locations shown on aerial photo of pre-restoration basin.

Preliminary water quality parameters were based primarily on availability of chemical testing kits and consisted of Nitrates (NO$_3$), Phosphates (PO$_4$), and Total Dissolved Solids (TDS). The following data and subsequent discussion are based on these preliminary results. Data will continue to be collected and several other parameters will be included such as Conductivity, Turbidity, and Fecal Coliform. To date, not enough data is available to include these parameters in the results.

The following results are for each Sample Site. The data, including amount of daily precipitation, were plotted on a standard x-y axis. Values for TDS were divided by 100 for display purposes. The data from Sample Site C (Figure 18) indicate a slight overall decline in TDS, a slight overall increase in PO$_4$, and a significant increase in NO$_3$. This increase in NO$_3$ might be caused by the increase in precipitation experienced in mid-September.
Figure 18: Water Quality Data from Sample Site C.

The data from Sample Site B (Figure 19) indicate a large decrease in TDS, a decrease NO₃, and a slight decrease in PO₄. These decreases could be due to the biological and chemical functions of the wetland vegetation as well as the wetland hydrology which allows for increased settling time for the stormwater runoff.

Figure 19: Water Quality Data from Sample Site B.

The data from Sample Site A (Figure 20) indicate slight decreases in TDS and PO₄ and only a slight increase in NO₃. The decreases in TDS and PO₄ can be expected as there was a decrease in these parameters at Sample Sites C and B. The slight increase in NO₃ could be due to the mixing of water from Sites C and B. In other words, the sharp increase in NO₃ from Site C could have been abated by the NO₃ decrease at Site B.
In addition to water chemistry analysis, I also monitored wetland basin water quality periodically by means of benthic macroinvertebrate identification. Before the basin was restored to a wetland habitat, these animals were virtually non-existent. Within weeks of construction, though, we were able to identify several pollution-facultative benthic macroinvertebrates including Snails (*Class Gastropoda*), Whirligig Beetles (*Order Coleoptera*), Damsel and Dragonfly nymphs (*Order Odonata*), and Scuds (*Order Amphipoda*). We also identified a couple of somewhat-tolerant species including Aquatic Sowbugs (*Order Isopoda*) and Water Striders (*Order Hemiptera*).


Other animal species encountered included Snapping Turtle (*Chelydra serpentine*), Raccoon (*Procyon lotor*), White-tailed Deer (*Odocoileus virginianus*),

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**Figure 20: Water Quality Data from Sample Site A.**
Virginia Opossum (Didelphis virginiana), Eastern Gray Squirrel (Sciurus carolinensis), Striped Skunk (Mephitis mephitis), Eastern Cottontail (Sylvilagus floridanus), and Monarch Butterfly (Danaus plexippus).
V. SPECIAL PROJECTS

Butler County Subdivision Regulations, Article VII Revision

One of the most important projects in which I participated was the revision of Article VII, Soil Erosion and Sediment Control Standards, of the Butler County Subdivision Regulations. The Butler County Subdivision Regulations were adopted by the Butler County Board of Commissioners on November 24th, 1997 under authority granted by Chapter 711 of the Ohio Revised Code. Generally, these regulations secure and provide for proper arrangements of streets and highways, appropriate use of land, and standards to minimize degradation to the County’s natural resources. More specifically, the goals of Article VII are to promote development while keeping downstream flooding, erosion, and sedimentation at existing levels and to reduce damage to receiving streams and drainage systems caused by impairment of their capacity through increases in sedimentation.

At present Article VII contains very basic guidelines and standards for soil erosion and sediment control on construction sites and lacks information pertaining to the ‘Butler County Earthmoving Permit’, its application process, and any associated fees. Furthermore, the authority of the current Article VII regulations ends when the site is recorded. Individual lot erosion and sediment controls, which should be in place during the home building process, are currently inspected by Butler County Engineer’s Office (BCEO) staff.

The revised Article VII will more closely mirror requirements set forth in the Ohio EPA NPDES General Permit and contain many more specifications derived from the ODNR Rainwater and Land Development Manual. In addition to this, the Butler SWCD will have the authority to inspect erosion and sediment controls at the lot level for both residential and commercial developments. The revised Article VII will also describe in detail the ‘Butler County Earthmoving Permit’ and the new permit, the ‘Lot Erosion and Sediment Control Permit,’ and will assign fees for each. The fees involved for obtaining the proper permit will be paid to the Butler County Commissioners who will use some of the money to enhance the Urban program by hiring two full-time inspectors. One of the inspectors will focus on residential and commercial subdivisions.
prior to final record; and the other will inspect residential and commercial lot controls post final record.

Revising Article VII of the Subdivision Regulations has been a lengthy and challenging process. Since the regulations affect so many different parties of the development community (i.e. residential developers, commercial developers, civil engineers, contractors, and homebuilders), it has been difficult to please everyone. For revisions we first sent a draft of the regulations to representatives from the Ohio Valley Development Council (OVDC) and the Homebuilders’ Association to cover the residential side of the development community. The new regulations were met with little opposition and more constructive criticism. The reality of the Ohio EPA Phase II requirements is progressing, and members of the development community would typically rather answer to the local governing body than that of the state level. This was true on the commercial side as well. We sent a further revised draft to representatives from a large local commercial developer and a locally notable engineering firm. The comments received were again very helpful. By including the development community in the revision process we were able to get feedback from those being regulated. This instilled a sense of trust in the District as we were not trying to slide anything by the development community, rather make them aware of all intended changes. As far as the addition of fees, Butler County remains one of the few remaining Phase II communities not to have them for SWP3 reviews and erosion and sediment control inspections. This is again a growing reality in the field.

Article VII has not yet been adopted. Currently all revisions are complete, but several more steps must be accomplished before this can happen. The first step is to present and clarify the revisions to the Butler County Planning Commission at one of their monthly meetings. Comments made by the Commission will then be heard by the Butler County Commissioners. Another requirement for adoption is to present the revisions at two public meetings held by the Butler County Commissioners. The Commissioners will hear comments favoring, opposing, and neutral comments and will decide, based on all comments, whether to adopt the revisions or deny them. By mid-April 2007 all of these steps will be completed. An excerpt of a draft version of the revised Article VII can be found in Appendix 9.
Riparian Buffers

Each watershed and the component landforms of which it is comprised, performs important hydrologic functions of capturing, storing, and safely releasing water (Petersen, 1999). Well-vegetated floodplains, for example, allow for the dissipation of water energy and velocity when stream flow exceeds the bankfull and becomes a flood. This process in turn decreases erosion potential and facilitates sediment deposition and groundwater recharge. Furthermore, riparian vegetation increases the stability and functionality of a stream system. The roots of riparian vegetation bind soil on stream banks and prevent erosion, the above ground plant components dissipate water energy flow and filter sediment, and both parts buffer streams from upland activities often filtering pollutants before they enter the stream channel (Petersen, 1999). For these reasons, many local government agencies throughout the nation are recognizing the benefits of and necessity for riparian setbacks or buffers.

As a new employee, I decided early to work towards the implementation of a stream buffer ordinance in Butler County. The Butler County Subdivision Regulations define a stream as a “body of water running or flowing on the earth's surface or a channel in which such flow occurs,” this flow may be seasonally intermittent (Butler County, 1997).

The revision of Article VII of the Butler County Subdivision Regulations seemed like the perfect opportunity to promote the benefits of riparian buffers to other county agencies and to develop appropriate buffer widths. Initially, riparian setback regulations were to be included as part of Article VII of the Butler County Subdivision Regulations. After much discussion with top representatives of the Butler County Planning Department, the Butler County Engineer’s Office, and Butler County Building and Zoning, however, it was decided that the riparian setback regulations would be more suitably placed in the Butler County Floodplain Regulations. As the Floodplain Regulations are administered by the Building and Zoning Department, much of the responsibility for enacting these regulations would fall therein. The current Floodplain Regulations have setback provisions only for development adjacent to the Mill Creek. These provisions do not necessarily preserve the riparian buffer, rather mandate sufficient flood storage. The revised regulations would restrict certain activities such as building,
removing vegetation, etc. within the buffer, but appropriate widths would have to be determined.

I was soon given the task of developing a Riparian Setback section for the Floodplain Regulations by the Floodplain Regulation Revision Committee with the stipulation that it be easy to implement while remaining palatable to County decision-makers, the development community, and all County residents. I did extensive research into existing riparian setback ordinances, borrowing some aspects and developing others. The following paragraphs will describe the pros and cons of each of these methods.

Many jurisdictions in Ohio determine setback width by the amount of drainage area feeding a corresponding stream. Summit County, Ohio, for instance, requires a thirty foot buffer on both sides of all streams draining an area less than 0.05 square mile, a 50 foot buffer on each side of all streams draining an area greater than 0.05 square mile and up to 0.5 square mile, a 75 seventy-five foot buffer on each side of all streams draining an area greater than 0.5 square mile and up to 20 square miles, a 100 foot buffer on each side of all streams draining an area greater than 20 square miles and up to 300 square miles, and a 300 foot buffer on each side of all streams draining an area greater than 300 square miles (County of Summit, Ohio, 2002). This method is desirable in that all streams great and small receive an ample amount of protection; however, its extensiveness could incite great opposition as it restricts uses on nearly all parcels in Butler County. This method also requires that drainage area calculations for new developments be included with Preliminary Plat. These calculations would then have to be checked by the regulating authority to ensure accuracy. As stated earlier, a prime expectation from County agencies was ease of implementation and operation, and with minimal staff this could prove difficult.

Another method, which maintains extensiveness and eliminates drainage calculations, is to determine riparian setback width based on stream order. Stream order systems were proposed by Arthur Strahler in a 1952 Geological Society of America Bulletin article titled “Dynamic basis of geomorphology” and were essentially hierarchies of streams where a first-order stream has no tributaries, a second-order stream has two first-order tributaries, a third-order stream has two-second order tributaries, and so on (Strahler, 1952). Please see Figure 21 for a description of the Strahler stream order
system. Generally, a first-order stream has the smallest drainage area; and as the orders increase, so to does the drainage area.

![Figure 21: Schematic diagram of Strahler Stream Order](image)

Using existing ordinances, like the one described above, I decided on appropriate and comparable riparian buffer widths. For first order streams a 25 foot buffer would be required on both sides of the stream, for second order streams a 35 foot buffer, for third order streams a 50 foot buffer, and for fourth order streams and larger a 75 foot buffer. These buffers would then be augmented based on a number of criteria. For instance, streams that are adjacent to steep slopes will require larger buffer widths.

Using ArcView 9.1, I went through the existing Butler County streams shapefile and assigned the appropriate stream order to each stream segment as an attribute. This turned out to be a lengthy process with nearly 40,000 segments to account for. Once this was completed, however, I was able to develop a model using ArcView ModelBuilder (Figure 22) that would essentially separate the stream segments based on stream order, apply the appropriate buffer width, and then join the buffers into one feature class. When this layer was viewed over the Butler County parcel feature class, it was again apparent that the extensiveness would hinder implementation and regulation.
A third method was to simply apply a seventy-five foot buffer to both sides of all blue line streams. A blue line stream is any stream shown as a solid or broken blue line on the 7.5 Minute Series quadrangle maps prepared by the U.S. Department of the Interior Geological Survey (USGS). A seventy-five foot buffer was chosen based on the findings of the Ohio Floodplain Regulation Criteria for Floodplain Management Manual. This manual states that the Ohio EPA recommends a minimum seventy five foot setback for a healthy stream system (ODNR, 2006). This method is advantageous because it covers almost all significant streams in Butler County and it is more easily implemented and regulated.

To determine the extent of this method I again turned to ArcGIS. This process began by overlaying the Butler County streams layer onto scanned and georectified USGS 7.5 minute quadrangle topographic maps. Then the streams attribute table was updated to include blue line stream data, as this was not done before in the County. Once this task was completed, I was able to apply a seventy-five foot buffer to all of the blue line streams. In order to provide more information on the amount, the extent, and the spatial arrangement of parcels affected by the buffers within Butler County, I produced two categorical maps of all of the parcels in the unincorporated areas Butler County that intersected the stream buffers. The first map shows the parcels separated into ten classes and color-coded based on the total acreage of the buffer within each parcel (Figure 23).
Figure 23: Acreage of stream buffer per parcel in unincorporated Butler County.

This map shows a relatively homogeneous distribution of affected parcels within each township, with the exception of West Chester and Liberty Townships. This is likely caused by lower average parcel size in these townships from increased urbanization and subdivision development. This map also shows that most of the affected parcels will have less than five acres of riparian buffer. A histogram of this data (Figure 24) affirms this observation as over 90% of all affected parcels contain less than or equal to 4.2 acres of riparian buffer.
Figure 24: Frequency Distribution of Acreage of Riparian Buffer per Parcel.

The second map presents the parcels again in ten classes, but this time they are color-coded based on the percent of total acreage of each affected parcel occupied by the riparian buffer (Figure 25).
Figure 25: Percentage of Parcel to be Occupied by a Riparian Buffer.

This map again shows an even distribution with a large number of the affected parcels falling in the 0 to 10 percent class. In fact, a histogram of these data show that about 30% of the parcels fall within this class, and about 75% of the parcels have 40% or lower of their total acreage occupied by a riparian buffer (Figure 26).
The method by which riparian buffer width will be determined in Butler County has not yet been chosen; however, the above data will be utilized by the Floodplain Regulation Revision Committee in their decision-making process. The Butler County Floodplain Regulation Revisions are expected to be adopted in early 2008.

Fourth Annual SEC Field Day

The Southwest Ohio Sediment and Erosion Control (SEC) Field Day was developed by employees of Southwest Ohio SWCDs as a means to educate homebuilders, developers, contractors, engineers, public officials, and a myriad of other NPDES Phase II stakeholders about compliance with non-point source pollution regulations through new and improved Best Management Practices and innovative products in soil and erosion control. Since its start in 2002, this event has been tremendously successful in spreading the importance of erosion control, stormwater runoff management, and water quality protection though the expertise of various
speakers, the exhibition of hands-on demonstrations, and product vending. The event is held annually in early June at the Warren County Career Center in Lebanon, OH and boasts a record number of attendees each year. Funding for the Field Day is provided by vendors who wish to market products such as coconut fiber compost logs, pervious pavement, erosion control blankets, and mulching machines at the event.

In 2006 the event was attended by over 150 people and featured a representative from the development community to discuss and answer questions regarding the passage of House Bill 411 and its impacts on the construction industry, a representative from the Ohio Nonpoint Pollution Education Program (NEMO) to speak about water quality structures in detention basins, and employees from Butler County, Warren County, and Hamilton County SWCDs to educate stakeholders on the SWP3 review process (Appendix 10).

![Figure 27: Field Demonstration of pervious concrete at 2006 SEC Field Day](image)

I attended the first planning meeting for this event shortly after being hired in February 2006 and quickly learned that I would be playing an integral role as a speaker on the SWP3 review process. I took this job very seriously and worked with Dan Taphorn, Urban Conservationist at the Hamilton County SWCD, and Don Norman, District Technician at Warren County SWCD, to develop a presentation that would help developers and engineers create effective SWP3s. My portion of the presentation dealt specifically with the specifications and standards of erosion and sediment control BMPs such as proper installation and maintenance of temporary construction entrances, temporary stream crossings, silt fence perimeter controls and permanent and temporary vegetation establishment. As a speaker I was able to meet and answer the questions of
many important stakeholders and regulating authorities from the region, many of whom have become informative and helpful contacts.

Planning for the 5th Annual SEC Field Day is currently underway, and this year I have become more involved in the planning process. The Southwest Ohio Erosion and Sediment Control Field Day has become a model for similar events around the state as we have received many calls from other SWCD employees seeking advice on how to create such a successful event.

**Clean Sweep of the Great Miami River**

The Clean Sweep of the Great Miami River is a two-day event that brings together private citizens, businesses, conservation organizations, and government agencies in an effort to clean up the entire 160-mile river in one weekend. The event began in summer of 2005 with great success. Over 1,200 volunteers from the Great Miami River watershed collected an estimated 200 tons of trash as well as approximately 1,000 tires. In the summer of 2006 the numbers remained strong. In Butler County alone over 400 volunteers set out to ten different sites retrieving about 60 tons of trash and 200 tires. Among the more astounding finds in the river were a recliner, a golf cart, a child’s go-cart, and a four-wheel all terrain vehicle.

For this event I assisted Butler SWCD District Administrator, Kevin Fall, by locating and securing sponsors and participants. I also served as a trash collector and supervisor to a group of Boy Scouts and Edgewood High School FFA members at a pick-up site in Woodsdale Regional Park in Madison Township. The volunteers at my site carried out bag after bag of trash collected from within the park while learning about the environment and importance of our local resources.

Sponsors of this event included Butler SWCD, Cargill, Veolia Water, the Miami Conservancy District, the Hamilton to New Baltimore Groundwater Consortium, and the Butler County Storm Water District.

*Figure 28: Volunteers at Woodsdale Park*
Grants

Partnerships are an invaluable resource for the Butler SWCD and numerous other government and non-profit agencies. During my coursework at IES, I became interested in residential conservation designs as a sustainable development practice to conserve land and water resources. The Livable Landscapes Conservation Development Program was initiated in May 2003 by the Miami Valley Resource Conservation and Development Council (MVRC&D) in order to provide educational and technical assistance on sustainable development practices to local units of government, planners, developers, and the public in southwest Ohio. The program also promotes strong, economically vibrant communities by bringing together the essential elements of sound land use planning, innovative site design, and natural resource conservation. I learned of the Livable Landscapes program while doing research for the Public Service Project at IES and proceeded to meet, interview, and work with the program’s Board members in order to discover ways in which I could help. The Board members informed me that their top project priorities were a Conservation Development conference that would bring field experts to the area to educate local developers, planners, government agencies, and other interested parties and a Livable Landscapes website that would serve as a portal for Conservation Development information and as a place to share and link ideas, experiences, and technical issues. Insufficient funds were in place to begin these projects, so I volunteered to research grant opportunities and write a grant proposal to an appropriate funding agency.

After researching several funding opportunities, I decided that the Ohio Environmental Education Fund (OEEF), which is administered by the Ohio Environmental Protection Agency’s (OEPA) Office of Environmental Education, shared many similar goals with Livable Landscapes. I then researched the costs for conference locations and materials, well-known Conservation Development speakers, and website development contractors. Using the average costs I formulated a budget and determined that an OEEF Mini-grant of $5,000, coupled by matching funds and in-kind services from Livable Landscapes and local project partners, would be appropriate for this project.

I prepared a project narrative and solicited, with great success, local government agencies and non-profit agencies for letters of support and collaboration. The grant was
awarded the full amount, $1,000 of which would be used for website development and $4,000 for conference expenses.

The conference, titled “Putting Conservation Development on the Ground in SW Ohio,” was held on November 16, 2006 at the Der Dutchman Restaurant and Conference Center in Waynesville, OH. The conference featured lectures by successful Conservation Design developers from Ohio and Wisconsin, a former Zoning Administrator from a Township in Michigan with innovative Conservation Development zoning, and eminent landscape planner, site designer, author, and lecturer, Randall Arendt. The conference was very well attended and many key issues surrounding upfront costs, long-term maintenance, and overall economic and natural resource benefits of Conservation Development were discussed.

GIS Projects

Geographic Information Systems (GIS) are a powerful tool in the realm of environmental problem solving; and, during my internship I discovered many opportunities to utilize this software. GIS was a fairly new concept to the Butler SWCD employees when I began working in February 2006, as they had only purchased the software a few months prior. I immediately adopted their current day-to-day uses and was soon able to identify projects which could benefit from its many tools.

As a new employee I was shown the multitude of available shapefiles and layers that were produced through the Butler County GIS Department; layers such as two- and ten-foot contour lines, rivers and streams, main and secondary roads, soils, and a high resolution aerial photograph of the County taken in 2006. I determined early that these layers could be very useful in completing position tasks such as drainage calls, Preliminary Plat reviews, SWP3 reviews, and construction site inspections.

As described in Chapter II, drainage calls typically come from County residents with concerns or problems on their own land or in their subdivision. Problems ranged from persistent wet spots in low lying areas to severe streambank erosion. For wet spots and poor drainage problems, I was able to use GIS and identify the underlying soils in the problem location to determine depth to water table, soil slippage potential, and soil permeability. I also used contour lines to calculate the area of the watershed introducing stormwater runoff to the area. Often I would produce a map that displayed pertinent
layers draped over the high-resolution aerial photograph in order to educate the concerned resident about drainage patterns and soils properties and discuss possible solutions. For streambank erosion problems I could examine the stream network and stream morphology at multiple scales in order to determine the extent of the erosion problem. Maps of watersheds are an effective supplemental tool when educating homeowners on the hydrologic functions of the watershed components, e.g. floodplain, stream channels, stream terraces, etc.

For Preliminary Plat and SWP3 reviews I used GIS as a first step in identifying critical areas or development concerns. For example, the soils layer would provide information such as location of hydric soils for potential wetlands, depth to bedrock, water table depth, and soil erodibility. The streams layer and aerial photograph were used to determine and verify the location of potentially impacted streams. The two-foot contours layer was used to determine steepness of slope. Pertinent information gathered from these layers would then be included in the Butler County staff comments presented to the Butler County Planning Commission at the approval hearing.

Figure 29: Evaluating an SWP3 using ArcGIS
To more effectively administer stormwater management and Phase II Stormwater programs, the Butler SWCD created a personal geodatabase called ‘Stormwater’ that contained six feature datasets, each representing one of the six minimum control measures required of Phase II municipalities. For the duties of my position, the ‘Public Education’, ‘Public Outreach’, ‘Construction’, and ‘Post-construction’ feature datasets were used most frequently. In the ‘Public Education’ dataset there are feature classes representing Butler County streams, watersheds, wetlands, and floodprone soils; in the ‘Public Outreach’ dataset there is a feature class for storm drain label locations, the date and by whom they were applied; in the ‘Construction’ dataset there is a feature class representing all active construction sites in the County with information on site contact and their respective stages in the development process; and finally, in the ‘Post-Construction’ dataset there are feature classes for impervious services, storm sewers, catch basins, and known BMPs.

One of my biggest accomplishments with GIS was helping, in partnership with the ODNR Division of Soil and Water Conservation, create and implement a GIS Users Group and Forum for the Ohio Federation of Soil and Water Conservation Districts. This Group was created as a means for SWCD staff throughout the state to communicate on GIS technical issues, problems, and capabilities. The Forum allows GIS users to post questions in a web setting, have them viewed by all members, and receive a response. The Forum also contains an area where tricks or tips can be posted. In this section I was able to post instructions on how to use GIS as a project tool through the use of ModelBuilder, Editing tools, and Geoprocessing tools. The Group meets quarterly at different SWCDs throughout the state to discuss current issues and GIS uses in agricultural and urban programs. Through my involvement with the Users Group I have been able to publicize Butler County’s GIS program. In fact, I have been asked numerous times by the Division of Soil and Water to present to SWCD and ODNR staff, watershed coordinators, and watershed action groups on current projects in Butler County and how I used GIS as an analysis tool to accomplish project goals.

Although the Geographic Information System was initially developed for geographers, its uses and applications span a wide array of disciplines including transportation, business, forestry, social science, zoology, engineering, and, of course,
natural resource conservation. GIS software is developing a more user-friendly format so that the average user can more easily execute key functions such as querying, model building, and Geoprocessing without extensive training. As an SWCD employee I will continue to use GIS to better understand natural resource conservation problems, to build more comprehensive and insightful datasets, and to implement BMPs.
VI. CONCLUSION

The principles and applications detailed within this report should serve as a reference and guide to students and practitioners of natural resource conservation, specifically in the realm of stormwater management, erosion and sediment control, and soil and water resource protection. The strategies employed by the Butler SWCD and other County and partnering agencies serve to reduce nonpoint source pollution in Butler County waterways while concurrently disseminating environmental and natural resource education and awareness. Many outstanding accomplishments were achieved; however, more work remains and new challenges are always anticipated.

Increasingly, stormwater is being recognized as an invaluable resource by the academic, private, and public communities. Through proper stormwater management strategies and the implementation of Best Management Practices at the local and regional scale, the soil and water resources in Butler County and Ohio can be maintained and enhanced for generations to come. Local initiatives like those described in this report as well as continuing partnerships across political boundaries can only aid this goal as local watersheds become progressively more urbanized.

Concluding Thoughts and Remarks

My internship with the Butler SWCD has truly been the culmination of my lifelong curiosity with natural resources, my studies both at Xavier University and Miami University’s Institute of Environmental Sciences, and my sense of duty to promote good stewardship of the land. The diverse nature of the Butler SWCD provided me innumerable opportunities to educate and be educated on natural resource conservation. I was continuously in contact with members of private industry, public officials and decision makers, government staff and regulators, grassroots organizations, and the general public. I learned about policy change processes, innovative education strategies, successful communication tactics, and effective project management skills. When asked about the day-to-day duties of the position I often respond, “In the morning I could be in the stream teaching students about macroinvertebrates, by noon I could be meeting onsite with a developer regarding erosion and sediment control requirements, and by the afternoon I could be meeting with government officials to discuss policy changes.” True,
the work was at times very difficult and challenging, yet always equally rewarding, and I am ever grateful of the Board of Supervisors and District Administrator’s confidence in my ability to manage the Urban Program in the absence of the Urban Specialist.

One of the greatest lessons learned through this internship was the importance of local government and community involvement in natural resource conservation. Without such involvement most state mandates and federal regulations cannot succeed. Local units of government such as county, township, and city agencies coupled with the input and support of their respective constituents are most suited to make decisions about conservation and land development in their communities. As a public employee and conservationist I feel it is imperative to inform these entities of growing natural resource problems and provide them technical assistance on strategies and techniques to manage these resources so that environmentally sound decisions can be made.

The influence of the Butler SWCD as a government agency and natural resource program administrator continues to grow and flourish. It has been a great pleasure to work with the SWCD staff and Supervisors and to learn from SWCD partners and affiliates. I feel that my efforts have helped to sustain the great work done before I arrived and bolster the programs to new heights and expectations.

IES Preparation for the Internship Experience

Miami University’s Institute of Environmental Sciences’ core curriculum, Public Service Project, and Oral Examination, as well as the courses required of my ‘Environmental Management’ Area of Concentration, successfully prepared me for an internship in natural resource conservation. The courses of greatest utility for my daily activities were Regional Land Use Capability Analysis, Advanced Geographic Information Systems, Watershed Management, Land Use Law, Community-based Decisions in Environmental Management, and Environmental Policy Making and Administration. Other core curriculum courses such as Environmental Measurements, Environmental Analysis and Modeling, and Principles and Applications of Environmental Science were also extremely useful and provided me the framework by which to develop new projects and excel well beyond position requirements. In fact, I contribute a vast amount of credit for my promotion to Urban Specialist to the preparation I received at IES.
One aspect that I was least prepared for was the strong role played by environmental and civil engineers in soil and water conservation and nonpoint source pollution reduction. I have since gained the ability to review construction plans and stormwater pollution prevention plans effectively; however, this skill was accomplished through Ohio Department of Natural Resources training and colleague assistance. I believe that a course geared toward these disciplines would be beneficial for future students. Early in my internship I also felt inept at the land development process. In order to successfully communicate with the development community, it is crucial to understand the processes that govern their work. Just as I endeavor to educate them on the importance of natural resource conservation; I too needed to be open to their project struggles, methodology, and compliance responsibilities across varying governmental agencies and jurisdictions. This understanding, however, is best obtained through experience and an open-minded demeanor. In my experience communication and cooperation are typically the best means to achieve results.

Transferable Skills Attained

My internship with the Butler SWCD allowed me to fully utilize the skills which I developed at IES and, indeed, improve upon them. Successfully managing and solving a wide array of environmental problems both independently and as a team member greatly reflected my academic training and experience. One important component of my internship was the freedom to create and administer projects that I deemed appropriate and in accordance with the SWCD and Urban program goals. Through these opportunities I was able to supply innovative ideas and present new ways to deal with old issues.

As an IES student I quickly learned the significance of an interdisciplinary approach to environmental problem solving. This is an exciting concept and is, in fact, ever apparent in the natural resource conservation and stormwater management world. During my internship I worked with landscape architects, educators, civil engineers, planners, grant coordinators, agriculture conservationists, geographers, geologists, lawyers, developers, computer programmers, environmental engineers, lobbyists, and politicians. True, there was often discrepancy in thought and management strategy, but
overall the creative, cohesive solutions that resulted from such diverse groups were inspirational.

Throughout my internship my verbal and written skills were exercised. I gave presentations on a variety issues such as water quality, erosion and sediment control, the NPDES Phase II program, the results of rapid urbanization, and the applications of Geographic Information Systems in conservation to varied and diverse audiences. Conveying environmental concepts to audiences of varying age, experience, education level, and socio-economic background requires tactful delivery to ensure the greatest awareness. This was also true in writing. I wrote letters to developers and homeowners, grant applications to the Ohio Environmental Protection Agency, SWCD newsletter articles about current projects and events, and provided writing assistance to any office member in need.

Finally, I was able to gain a fuller understanding of the community and stakeholder role in environmental problem solving. From good housekeeping in one’s own backyard to active involvement in local government and grassroots organizations, it is crucial that community members understand the true value of their local natural resources and take efforts conserve, preserve, and protect them.
REFERENCES


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  http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=PEP&_subMenuId=datasets_1&_lang=en&_ts=
U.S. Environmental Protection Agency. “Clean Water Act”;
APPENDICES
APPENDIX I: EXCERPT FROM BUTLER SWCD 2006 ANNUAL PLAN OF OPERATIONS

Annual Plan of Operations

Butler County SWCD

2006
Butler SWCD  
**Annual Plan of Operations**  
**January 1, 2006 – December 31, 2006**

**Objective 1:** Increase Awareness of Water Quality  
**Goal 1:** Educate School Aged Children & Adults

<table>
<thead>
<tr>
<th>Action Items</th>
<th>Responsibility</th>
<th>Start Date</th>
<th>End Date</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Organize at least 2 Teacher Workshop for area teachers</td>
<td>Lynn White Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td>□</td>
</tr>
<tr>
<td>2. Conduct 150 school programs to grades Preschool – 12</td>
<td>Lynn White</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td>□</td>
</tr>
<tr>
<td>3. Participate in WaterFest for grades 5-6</td>
<td>All</td>
<td>10/01/06</td>
<td>10/31/06</td>
<td>□</td>
</tr>
<tr>
<td>4. Organize Area IV Envirothon for grades 9-12</td>
<td>All</td>
<td>01/01/06</td>
<td>12/31/06</td>
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<tr>
<td>5. Develop 5 new partnerships with schools</td>
<td>Lynn White Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td>□</td>
</tr>
<tr>
<td>6. Develop resource lending program for teacher use and be used 10 times this year</td>
<td>Lynn</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td>□</td>
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</tbody>
</table>
Objective 1: Increase the awareness of water quality and the reduction of non point source pollution in a watershed context

Goal 2: Educate Local Decision Makers, Homeowners, and Contractors/Developers

<table>
<thead>
<tr>
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<th>End Date</th>
<th>Completed</th>
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</thead>
<tbody>
<tr>
<td>1. Prepare at least 1 press release and distribute to local media for the Butler County Storm Water District</td>
<td>Lyan White, Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td>2. Provide Water quality information at public venues and appearances for the Butler County Storm Water District</td>
<td>All</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td>3. Complete construction of water quality basin and use as educational tool</td>
<td>Kevin Fall, Doug Dirksing, Jennifer Deaton, Lyan White</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td>4. Create portable displays highlighting water quality issues to be used at the County Fair, Monroe’s Cityfest, River Days, and any other local events.</td>
<td>Lyan White</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td>5. Conduct stream clean up programs for Butler County Storm Water District</td>
<td>Doug Dirksing, Lyan White, Kevin Fall</td>
<td>03/01/06</td>
<td>10/31/06</td>
<td></td>
</tr>
<tr>
<td>6. Organize at least 1 stream monitoring program</td>
<td>Doug Dirksing, Lyan White, Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
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<tr>
<td>Continuation: Objective 1, Goal 2</td>
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</tbody>
</table>
| 7. Conduct 3 educational stream walks | Doug DiRksing  
Lynn White  
Kevin Fall | 01/01/06  
12/31/06  
☐ |
| 8. Apply 300 Storm Drain Stencils for Butler County Storm Water District with volunteers. | Doug DiRksing  
Kevin Fall  
Lynn White | 01/01/06  
12/31/06  
☐ |
| 9. Conduct a meeting for developers and design engineers concerning water quality issues related to development impacts (wetlands, headwater streams, water quality structures, LID techniques etc.) | Jennifer Deaton  
Doug DiRksing | 01/01/06  
12/31/06  
☐ |
| 10. Conduct 2 joint pond clinics and present at 1 other pond program | Jennifer Deaton  
Ryan Smith | 01/01/06  
12/31/06  
☐ |
| 11. Provide technical assistance to health department officials regarding soils capability and suitability in the siting of submitted aerobic lagoons for onsite sewage disposal | Jennifer Deaton  
Ryan Smith  
Jeff Barnes | 01/01/06  
12/31/06  
☐ |
| 12. Produce 2 newsletters (spring & fall) for developers and homebuilders on related issues of erosion, stormwater management, drainage, urban hydrology, and water quality. | Doug DiRksing  
Jennifer Deaton  
Dane Pockett | 01/01/06  
12/31/06  
☐ |
Objective 2: Reduce excessive soil erosion by monitoring erosion control practices in Butler County and promoting the use of new BMP’s where appropriate.

Goal 1: Provide technical assistance to the public, developers, and local officials concerning the importance and need for effective erosion control / storm water management programs.

<table>
<thead>
<tr>
<th>Action Items</th>
<th>Responsibility</th>
<th>Start Date</th>
<th>End Date</th>
<th>Completed</th>
</tr>
</thead>
</table>
| 1. Organize at least 1 erosion control field day for e/c installers, home builders and developers | Jennifer Deaton
Doug Drksing | 01/01/06 | 12/31/06 | [ ] |
| 2. Review each SWPPP for every subdivision under our permit and provide feedback. Get compliance with structural and non structural water quality BMP’s. | Doug Drksing
Jennifer Deaton | 01/01/06 | 12/31/06 | [ ] |
| 3. Inspect and follow up with each active construction site at least once every 2 months | Doug Drksing
Urban Site Inspect. | 01/01/06 | 12/31/06 | [ ] |
| 4. Review all county subdivision plats submitted to Butler County and West Chester Township as well as give input on zoning requests, replats, lot splits, and block grant projects. | Jennifer Deaton
Doug Drksing
Kevin Fall | 01/01/06 | 12/31/06 | [ ] |
| 5. Continue working on adoption of Article VII subdivision regulations. | Jennifer Deaton
Doug Drksing
Kevin Fall | 01/01/06 | 12/31/06 | [ ] |
| 6. Continue SWCD Earth Moving Permit and fee implementation and strive for compliance | Jennifer Deaton
Doug Drksing
Kevin Fall | 01/01/06 | 12/31/06 | [ ] |
Butler SWCD
Annual Plan of Operations
January 1, 2006 – December 31, 2006

Continued: Objective 2, Goal 1

7. Strengthen relationship between OEPA (State and District Offices) and Butler SWCD to better implement both the NPDES permit and our Earth moving permit by formalizing our verbal working agreement
   Jennifer Deaton
   Doug Dirksing
   Kevin Fall
   01/01/06
   12/31/06

8. Organize an Urban Tour for SWCD Supervisors
   Jennifer Deaton
   Doug Dirksing
   Kevin Fall
   03/01/06
   10/31/06

9. From public/residential drainage, erosion, water quality call-ins or problems give advice and help design and install at least 1 BMP structures to solve a problem. Follow up with results and efficacy.
   Jennifer Deaton
   Ryan Smith
   Doug Dirksing
   01/01/06
   12/31/06
Objective 3: Increase of Awareness of Butler SWCD in Butler County

Goal 1: Educate government, local agencies, schools and public of different programs and services offered

<table>
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<tr>
<th>Action Items</th>
<th>Responsibility</th>
<th>Start Date</th>
<th>End Date</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Recruit at least one advertiser for the District quarterly newsletters and/or education newsletter</td>
<td>Lynn White</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kevin Fall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Promote Farm City Tour through newsletters, word of mouth and news releases</td>
<td>Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
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<tr>
<td></td>
<td>Lynn White</td>
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<tr>
<td></td>
<td>Diane Puckett</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Continue promotion of Website and increase its use through newsletters, brochures, etc</td>
<td>Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lynn White</td>
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<td></td>
<td>Diane Puckett</td>
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<tr>
<td>4. Organize and participate in booths at the County fair, city festivals, and other venues</td>
<td>All</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
</tr>
<tr>
<td>5. Promote Annual Banquet and increase attendance and participation to 180 people</td>
<td>Lynn White</td>
<td>01/01/06</td>
<td>12/31/06</td>
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<td></td>
<td>Kevin Fall</td>
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<td></td>
<td>Diane Puckett</td>
<td></td>
<td></td>
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<tr>
<td>6. Organize and promote annual tree sale through newsletters and news releases to sell at least 1500 tree packets</td>
<td>Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
<td></td>
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<tr>
<td></td>
<td>Diane Puckett</td>
<td></td>
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<tr>
<td>8. Continue district news release articles written to at least one per month to be used for local newspapers</td>
<td>Kevin Fall</td>
<td>01/01/06</td>
<td>12/31/06</td>
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<tr>
<td></td>
<td>Lynn White</td>
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<td></td>
<td>Doug Dirksing</td>
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<td></td>
<td>Ryan Smith</td>
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</table>
APPENDIX II: STORMWATER POLLUTION PREVENTION PLAN (SWP3) CHECKLIST FOR CONSTRUCTION SITES

BUTLER SOIL & WATER CONSERVATION DISTRICT
STORM WATER POLLUTION PREVENTION PLAN (SWPPP) CHECKLIST FOR CONSTRUCTION SITES

Project ___________________________ NPDES Permit # ___________________________
Location ___________________________ Developer ___________________________
Engineer ___________________________ Contractor ___________________________

No Fee at Present Time: Preliminary Plat ___________ SWPPP ___________

General Requirements: An SWPPP (a.k.a. ‘ESC Plan’) must be developed and reviewed before construction activities commence. The NOI must be submitted at least 21 days prior to the start of any construction activity. The developer must notify the local government entity (Butler SWCD) that an NOI has been filed and must post a copy of either the NOI or the Ohio EPA Director’s acceptance letter on site. The SWPPP must be retained on-site at all times during construction activity.

Minimum Standards: This plan must address all minimum components of the NPDES General Permit and conform to the specifications of the Ohio Department of Natural Resources Division of Soil and Water and Natural Resources Conservation Service handbook, Rainwater and Land Development.

ESSENTIAL COMPONENTS:

- Vicinity Map - Location map showing site in relation to surrounding area. Include location of receiving streams/surface waters.
- Limits of Clearing and Grading Plan - Indicate limits and show acreage of earth disturbing activity. Show borrow, spoil and topsoil stockpile areas. Include before and after contours with appropriate contour intervals. Delineate drainage watersheds, indicating acreage of each area.
- Project Description - Briefly describe the nature, purpose and scope of the land disturbing activity. This may be self evident from the plan. Include total area of site and acreages of individual phases if applicable. Include a narrative describing the overall erosion and sediment control scheme for this site.
- Soils Information - Show locations of bedrock, unstable, or highly erodible soils as determined by the Butler County Soil Survey and/or soil tests. Show location of any soil test borings on plan. Other soils information such as permeability, perched water table, etc. may be mentioned.
- Surface Water Locations - Show locations of all lakes, ponds, surface drainage patterns, wetlands, springs, etc. on or within 200 feet of the site. If storm water will be discharging into a municipal separate storm sewer system or into a storm water management structure such as a detention basin which is off the site, clearly indicate this on the plans.
- Site Development - show locations of all existing and proposed buildings, roads, utilities, parking facilities, etc.
- Schedule of Construction Activity - Included in this should be a schedule for implementing temporary and permanent erosion and sediment control practices and storm water management facilities. The NPDES permit requires that all sediment ponds and perimeter barriers be constructed within 7 days of first grubbing. All sediment control structures must remain functional until upland areas are stabilized.
Location of Practices - Show locations of all structural erosion and sediment control, storm water management, and water quality practices, including post-construction best management practices. Water ponding facilities should be drawn to scale, with the area of the contributing watershed given.

Detail Drawings - All structural practices should be explained with detail drawings of specifications. Installation specifications may also be necessary to aid contractor. Included should be outlet structures for retention, detention facilities and any special modifications to these structures to aid in improved sediment trapping capability.

Land Stabilization Measures - Provide specifications for temporary and permanent seeding, mulching, blanketing, etc., and also installation schedule for each practice. The NPDES permit requires that all areas at final grade or where construction activity has temporarily ceased for 21 days or longer be stabilized within 7 days of last activity. Erosion control blankets and matting should be used to stabilize channels where the flow velocity is greater than 3.5 ft/sec. steep slopes, on highly erosive soils and on areas slow to establish a vegetative cover.

Special Notes for Critical Areas - Include pertinent information regarding stream bank stabilization, riparian corridors, buffer areas, stream restoration plans, wetland areas.

Existing Natural Areas - Show existing or unusual vegetation, wetlands, springs, rock outcroppings, etc. Include vegetation to remain (trees, buffer areas, etc.).

Maintenance and Inspections - Provide notes and information regarding maintenance of each practice to assure continued performance. Erosion and sediment control must be inspected once every 7 days and with 24 hours of 0.5" or greater rainfall. A written log of these inspections must become part of the SWPPP. This log should indicate the dates of inspection, inspector weather conditions, observations, actions taken to correct problems, and the date action was taken.

Storm Water Runoff Considerations and Post-Construction BMPs - Show the pre- and post-construction runoff coefficients including information such as the method used to calculate runoff. Include a narrative describing post construction storm water management BMPs such as detention basins, grass filter strips or wetlands and show locations of all stormwater management facilities. Include vegetation to remain (trees, buffer areas, etc.)

Trap Efficiency, Location and Volume of Sediment Ponds - These calculations must be shown for all temporary or permanent sediment traps/ponds and any retention/detention facilities to be used for this purpose. All ponds used for the purpose of trapping sediment must have a volume of 67 cubic yards per acre of total drainage area to the pond (not disturbed area). Trapping efficiency of these structures must be at least 75%.

Disposal of Solid, Sanitary and Toxic Waste - Solid, sanitary and toxic waste must be disposed of in a proper manner in accordance with local, state and federal regulations. It is prohibited to burn, bury or pour out onto the ground or into the storm sewers any solvents, paints, stains, gasoline, diesel fuel, used motor oil, hydraulic fluid, antifreeze, cement curing compounds and other such toxic or hazardous wastes. Washout of cement trucks should occur in a diked, designated area where the washings can collect and be disposed of properly when they harden. Storage tanks should be located in diked areas away from any drainage channels. The diked area should hold a volume 110% of the largest tank.

Off-Site Sediment Tracking - Minimize such tracking of sediments by vehicles by making the use of gravel construction entrance and regularly scheduled sweeping good housekeeping.
General Notes to Contractor: (These are specific for Butler County and must be included on the plan)

- Sediment Ponds/Traps and Perimeter Controls shall be implemented as a first step of grading and within 7 days from the start of grubbing and shall continue to function until upland areas are stabilized.
- Temporary and Permanent Stabilization - Disturbed areas which will remain unworked for a period of 21 days or more, shall be stabilized with seeding and mulching or other approved means within 7 days. All disturbed areas within 50 feet of an intermittent or solid blue line stream (as defined by USGS 7.5-minute Quadrangles) shall be stabilized within two (2) days. All areas of a site which are at final grade shall be stabilized with seeding and mulching or other approved means within seven (7) days.
- Ditches with grades greater than 1.5% and all other slopes greater than 6% will have erosion control blankets/mattings installed as part of stabilization measures.
- Builder is responsible for erosion control on individual lot.
- No solid or liquid waste shall be discharged into storm water runoff.
- All erosion and sediment control practices must conform to the specifications of Rainwater and Land Development, Ohio’s standards for Storm Water Management, Land Development and Urban Stream Protection.
- Other erosion and sediment control items may be necessary due to environmental conditions.
- Regular inspection and maintenance will be provided for all erosion and sediment control practices. Permanent records of maintenance and inspections must be kept throughout the construction period. Inspections must be made a minimum of once every 7 days and immediately after storm events greater than 0.5 inches of rain in a 24-hour period. Provided will be name of inspector, major observations, date of inspection and corrective measures taken.

A NOTE ABOUT SUBLOTS

For developments with sub lots, NPDES permit coverage must be maintained on the lot until it reaches final stabilization.

- If the developer will also build the structures within the development or opts to maintain permit responsibility on lots where structures are being built, a detail drawing of a typical sublot indicating typical BMPs with notes specifying measures for critical areas, must be included in the SWPPP.
- If a developer opts to parcel off permit responsibility to the new lot owner once the lot is sold, the new lot owner must submit an Individual Lot Notice of Intent at least 7 days prior to the transfer of title from the developer to the new owner. The developer must allow the new owner access to the developer’s SWPPP. The new owner then must maintain and/or install any lot-specific sediment controls. It becomes the new lot owner’s responsibility to comply with the NPDES permit on his lot and to develop a lot site map indicating the location of BMPs.

*The Butler County Engineers Office (BCEO) Will Assume Responsibility of ESC Plans and Inspections for Individual Lots*
Butler Soil and Water Conservation District

Erosion and Sediment Control Earth Moving Permit Application
*(This is not an NPDES permit)*

| Subdivision, Residential | NO FEE AT PRESENT TIME |
| Subdivision, Commercial  | NO FEE AT PRESENT TIME |

| Project Name: |  |
| Project Location: | Total acres: |
| Acreage Disturbed: | Receiving Waters: |
| Owner: | Phone: | Fax: |
| Owners Address: |  |
| Site Contact: | Phone: | Fax: |
| Site Contact Address: |  |
| Engineer: | Phone: |
| ESC Contractor: | Phone: |

Applicant Name:  
Applicant Signature:  Date:  

Return application to: Butler County Department of Development and Planning  
130 High St, 6th Floor  
Hamilton, Ohio 45011  

Permit will be issued upon review and approval of ESC construction drawing plans and permit application

Office Use Only

Application received:  
Construction drawings received:  
Revisions received:  
Preconstruction meeting completed:  
Approved:  
Permit issued:  

*A separate permit which authorizes discharges of stormwater from construction sites is also required by the Ohio EPA for projects which disturb more than one acre of ground. Contact Chris Cotton at OEPAs Southwest District office at 937.285.6442 or via email at chris.cotton@epa.state.oh.us.*
APPENDIX IV: SWP3 REVISIONS REQUESTED LETTER

Butler Soil and Water Conservation
1810 Princeton Road
Hamilton, Ohio 45011
Telephone: (513) 887-3720
Fax: (513) 785-6668
www.butlercountyohio.org/conservation

July 11, 2006

Ms. Jennifer L. Richmond
Kleingers and Associates
6305 Centre Park Drive
West Chester, OH 45069

Re: Glenview Ridge Section One SWPPP Review

Dear Ms. Richmond,

On June 26, 2006 a storm water pollution prevention plan (SWPPP) was received by our office for the above mentioned subdivision located in Liberty Township. In accordance with Butler County Subdivision Regulations (Article VII) and your NPDES General Permit (#OR000002) for storm water discharges associated with construction activities, I have reviewed your SWPPP submitted as part of the improvement drawings. The review was conducted for the purpose of evaluating erosion and sediment controls against state and local standards. As a result of the review I have the following comments which require revisions:

1) A construction entrance is described in the Erosion Control Notes; however, its location has not been shown on the Erosion Control Plan plan. This is one of the best ways to prevent sediments from being tracked onto adjacent roads. Please revise your plan to show a temporary construction entrance that prevents the off-site tracking of sediments onto adjacent roads during the construction phase.

2) Silt Fence has been described in the Erosion Control Notes; however, its location has not been shown on the Erosion Control Plan. Our office highly recommends the use of mulch bems in lieu of silt fence. Mulch bems are more economical than silt fence, they can be constructed from on-site vegetation, and they often work better than traditional perimeter controls. If your site will have enough woody debris I would recommend this method for perimeter controls. Furthermore, in the Silt Fence section of the Erosion Control Notes it states that straw bale barriers may be substituted for silt fence. Straw bale barriers are highly ineffective in the field and our office does not recommend their use.

3) Furthermore, silt fence is most applicable for relatively small areas with flat topography. As this site contains steep topography, numerous areas of five feet or greater fill, and a blue line stream receiving most of the drainage, our office recommends a system of diversions and temporary settling ponds or traps. If silt fence is to be used, please


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reference the Silt Fence Maximum Drainage Area Based on Slope and Slope Length table located in Chapter Four of the Rainwater and Land Development Manual.

4) No water quality structures or detention of storm water volume equivalent to the first 0.75 inches per acre drainage area (WQc) has been provided for runoff emanating from this site. While Butler County is not currently reviewing for this post-construction provision, you should be aware that your site appears to be in violation of its NPDES General Construction Permit Part III (G)(2)(c) if a water quality volume is not detained. Please consider storm water quality best management practices (BMPs) found on page 22 of your NPDES General Permit to meet this requirement. These BMPs include extended detention, water quality units, vegetated filter strips or other approved Phase II devices which meet this water quality volume requirement.

5) In areas with concentrated flows, e.g. the channel behind lots 29-37 and 44-51, rock checks to be installed in order to catch sediment and dissipate flows. Your Erosion Control Notes detail rock check dams; however, none are located on the Erosion Control Plan. Silt fence and straw bales are not permitted in areas of concentrated flow. Please ensure that these ditch checks are made of 4-6” stone and entrenched per the specs in ODNR’s Rainwater and Land Development Manual for rock check dams.

6) Temporary risers have been detailed in the Erosion Control Notes; however, they have not been shown on the Erosion Control Plan.

7) Practices such as Straw Bale Barriers, Gravel and Fabric Mesh Drop Inlet Sediment Filter, and Silt Fence Filter Barrier, that will not be used for this project do not need to be shown in the Erosion Control Notes.

8) Lots # 1-3, 6, 11-12, 14-17, 28-41, 51-72, and 204-208 will have more than five (5) foot of fill placed on it therefore a compaction test must be approved by the Butler SWCD office prior to final plat approval.

9) The location of fill on lots adjacent to the 100 yr. flood plain and blue line stream, i.e. 11-12, 53-72, and 204-209, poses a serious threat to water quality in the stream. As such, it is imperative that the clearing limits and any earth moving adjacent to the stream be minimized to protect stream integrity and water quality.

10) It appears that alterations are planned for the blue line stream on this site. This work might require the necessary 404 Dredge and Fill Permit from the US Army Corps of Engineers and/or the necessary 401 Water Quality Certification Permit from the Ohio EPA in order to perform work in regulated waters. Please contact these authorities to ensure that you have obtained the appropriate permits and authorization forms. The contacts you will need are Denise Mariner (USACE) 513-825-4518 and Mike Smith (OEP) 614-644-2326.
Additional Notes:

1) According to Butler County’s Earth Moving Permit regulations a completed application must be submitted to our office for this site. A copy of this application may be found on our website at www.butlercountychio.org/conservation/Urban/ESC_Permit.htm. I have also included a copy with this letter. The completed application can be sent to our office by mail or via fax at 513-785-6668.

I appreciate your willingness to revise these plans and correct these matters which are important with respect to water quality in the Gregory Creek Watershed. If you have any questions, comments or concerns please feel free to contact me at 513-887-5720 or at dirksm@butlercountychio.org.

Sincerely,

Doug Dirksing
Urban Technician

Cc: Rhein Interests
APPENDIX V: SWP3 APPROVAL LETTER

August 1, 2006

Mr. Jeffrey L. Swartzbaugh, P.E.
Kleingers and Associates, Inc.
6305 Centre Park Drive
West Chester, OH 45069

Re: Glenview Ridge Section One

Dear Mr. Swartzbaugh,

On July 24, 2006 a revised stormwater pollution prevention plan was received by our office for Glenview Ridge Section One in Liberty Township. This letter is to confirm that the revisions were approved in accordance with Butler County Subdivision Regulations (Article VII) and your NPDES General Permit (#OHC000002) for Stormwater Discharges Associated with Construction Activities; however, regarding Item 6, the temporary riser pipe specifications on the initial SWPPP were appropriate yet required a detailed location on the Erosion Control Plan. This revision will not require another submission to our office, but the contractor will be required to understand this matter.

Please see that copies of the erosion control plan are given to the appropriate contractors and a pre-construction meeting is scheduled with all contractors who will be performing earth disturbing activities or erosion control contracting. In compliance with Butler SWCD’s Earth Mowing Permit, a preconstruction meeting must be held before construction activities begin. Furthermore, this plan approval does not discount an inspectors request for additional or alternative erosion and sediment control practices if needed. If you have any other questions or concerns please feel free to contact me at 513-887-3720 or at dirksing@butlercountyo.org.

Sincerely,

Doug Dirksing
Urban Technician

Cc: Jennifer Richmond
    Shane A. DeLong
APPENDIX VI: NOTICE OF VIOLATION (NOV) REPORT

Butler Soil and Water Conservation District

1910 Princeton Road
Hamilton, OH 45011
www.butlercountyohio.org/conservation

Phone: 513/887-3720
Fax: 513/795-6685
Email: butlerswcd@yahoo.com

Development Section/Phase: Glenview Farm Estate at Foxborough
Date: 05-17-06
Time: 10:00am
Inspector: Doug Dirksing

Contact: Mr. Mike Schoettelkotte
Phone: 859-578-4261

Butler County Subdivision Regulations
Erosion and Sediment Control (ESC)
Inspection Report

On May 17, 2006 I conducted an inspection at Glenview Farm Estates at Foxborough, Phase 1A in order to determine whether final erosion control measures had been installed and maintained before the phase was recorded. From this inspection I observed that final erosion and sediment controls were not installed and/or maintained, and there were several other areas that needed maintenance and/or repair. Below is a list of violations I encountered on this inspection.

Violation(s)
1) Curb inlet protection needs to be installed at all curb inlets as described in the details section of the construction drawings.

2) Silt fence needs repair and/or maintenance in several areas, most of which threaten the blue line stream.

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3) Mulch bermns need repair and/or maintenance in several areas.

4) The denuded area east of the blue line stream needs to have an erosion control device installed and should also be seeded and strawed if no further work will continue there.
5) All areas at final grade need to be seeded and mulched before this phase can be recorded.

6) The riser pipe for the detention basin has become clogged severely. This will require maintenance in order to function properly. Our office highly recommends wrapping the pipe with geotextile and then placing a mound of gravel in front of the orifice in order to keep sediments from clogging the pipe. The basin should also be reseeded as soon as possible.

7) Catch basins should be properly protected as described in the detail sheet of the construction drawings.
Additional comments:

1) The amount of sediment that is being permitted to escape through the curb inlets, catch basins, etc. is apparent through the near clogging of the inlet pipe to the detention basin. Proper erosion control protection and maintenance, as well as repair to the rivet pipe should prohibit this from happening.

I appreciate your assistance in correcting these matters which are important with regard to water quality in the Mill Creek Watershed and ensure compliance with Butler County regulations and your NPDES General Permit issued by the Ohio EPA. If you have any questions or comments regarding these violations, please feel free to call our office at 513-887-3720 or e-mail me at dirksingdm@butlercountyoiohio.org.

Inspector Signature: ________________

Doug Dirksing, Urban Technician

Cc: Broshear Contractors
    James H. Watson, P.E.
APPENDIX VII: BUTLER COUNTY PHASE II STORMWATER BMP MATRIX
APPENDIX IX: EXCERPT FROM DRAFT VERSION OF ARTICLE VII OF THE BUTLER COUNTY SUBDIVISION REGULATIONS

ARTICLE VII

SOIL AND WATER MANAGEMENT STANDARDS

SECTION I. GENERAL STATEMENT

These regulations establish technically feasible and economically reasonable standards to achieve a level of subdivision design and construction to minimize damage to property, degradation of natural resources, and to promote and maintain the health, safety and general well-being of all life and inhabitants of Butler County. Further, these regulations:

1.01 Promote development while keeping downstream flooding, erosion and sedimentation at exiting levels;

1.02 Reduce damage to receiving streams and drainage systems which may be caused by impairment of their capacity which may be caused by sedimentation.

SECTION II. PERFORMANCE STANDARDS

2.01 Permit Required

(a) Owner/operator must obtain a Butler County Earth Moving Permit with construction drawing approval from the Butler Soil and Water Conservation District before any Earth Disturbing Activity may begin; including clearing, grubbing, and cut/fill activity.

2.02 Erosion and Sediment Control

(a) To the maximum extent practicable Erosion and Sediment is to be kept on Development Area. Erosion and sedimentation caused by accelerated wind or storm water runoff over the Development Area due to Earth Disturbing Activities shall be stabilized and confined to within the boundaries of the Development Area.

2.03 Discharge of Polluted Storm Water.

(a) To the maximum extent practicable (having all ESC’s from the approved construction drawings installed and functioning) the Development Area shall not discharge Polluted Storm Water directly into a Waters of the State.
(b) The Butler County Storm Water District has defined allowable storm water discharges per its NPDES Phase II Permit as described in Subdivision Regulations, Article V, Storm Water Policies.

2.04 Structural and Nonstructural Soil and Water Management

(a) Non-structural and Structural Controls shall be designed in accordance with requirements and standards specified in these regulations and/or the Ohio EPA’s NPDES Construction Activity Permit #OHC000002. These practices must also comply with design standards specified in Article V.

(b) Permanent Structural and Non-structural Controls shall be placed in easements and recorded on the subdivision record plat and/or property deeds on which they are located and shall remain unaltered unless first approved by the Butler County Engineers Office. See Article VIII Subdivision Plat Requirements.

(c) In designing Structural Controls, access, storage volume, flood prevention and water quality benefits shall be considered to the maximum extent practicable to protect life and property. Refer to Article V for additional design criteria.

2.05 Channel Protection

(a) The Owner/Operator will protect channels from degradation due to water run off. Structural or Non-structural Controls shall be constructed by the Owner/Operator as prescribed in the latest edition of *Rainwater and Land Development* and/or *ODOT Location & Design Manual*.

(b) The design and installation of any storm water Channel shall comply with Article V of these regulations.

2.06 Unsuitable Soils

(a) When a soil with a high water table as defined in the Butler County Soil Survey is present, a note must be placed by the designing engineer on the final plat stating: “High water table soils are apparent in this area. If basements are constructed, it is the responsibility of the builder to take special precautions to ensure the basement stays dry.” If this note is not on the plans as the Butler Soil and Water Conservation District is reviewing the plans, revisions will be required with the note before the plans will be approved.

(b) Upon review of the construction drawings by Butler SWCD, if soil type
and/or severity of slopes requires additional testing as determined by the Butler SWCD, a report from a State Registered geotechnical engineer will be required. The report results of surface and subsurface exploration, conditions of the land, procedures for performing the grading operations, maximum slope to satisfy stability, and other geotechnical design requirements for the requested lots will determine if there are problematic conditions to overcome, what those problematic conditions may be, and possible solutions to overcome them to protect the home buyer. This report must be received and checked by the Butler SWCD that the conclusions appear reasonable and credible prior to construction drawing approval. The results of this report may warrant additional studies prior to the building permit being issued due to building code requirements.

(c) If a hydric soil or soils with hydric components, wetland vegetation and/or possible hydrologic conditions are present, Butler SWCD may require a wetland delineation. A note shall be placed on the preliminary plat stating “A wetland delineation study shall be complete for the necessary lots prior to construction drawing approval.” The delineated wetland boundaries shall be shown on the construction drawings, final plat and included within an easement on the property.

2.07 Temporary Soil Stabilization of Development Area due to Earth Disturbing Activity and Soil Stockpiles

(a) Temporary Vegetation shall be established within Development Areas subject to Earth Disturbing Activities as specified in Table 1 below.

<table>
<thead>
<tr>
<th>Area requiring Temporary Vegetation</th>
<th>Time frame to apply Temporary Vegetation</th>
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<tbody>
<tr>
<td>Any disturbed areas within 50 feet of a Stream and not at final grade.</td>
<td>Within 2 days of the most recent disturbance if that area will remain idle for more than 21 days.</td>
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<tr>
<td>For all construction activities within Disturbed Area, including soil stockpiles, that will be dormant for more than 21 days but less than one year.</td>
<td>Within 7 days of the most recent disturbance within the area.</td>
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<tr>
<td>Disturbed areas that will be idle over winter.</td>
<td>Prior to onset of winter weather.</td>
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(b) Soil stabilization measures should be appropriate for the time of year, Development Area conditions and estimated time of use. Stabilization methods include vegetation, mulching, and the early application of gravel base on areas to be paved.
(c) Topsoil removed shall be stored on Development Area and shall be stabilized with quick growing plants or other means, so that it is protected from wind and water erosion. Topsoil shall be maintained in a usable condition for sustaining vegetation and reused on the Development Area.

2.08 Permanent Soil Stabilization of Development Area due to Earth Disturbing Activity

(a) Permanent Vegetation shall be established on Development Areas as specified in Table 2 below.

<table>
<thead>
<tr>
<th>Area requiring Permanent Vegetation</th>
<th>Time frame to apply Permanent Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any area that will lie dormant for 6 months or more.</td>
<td>Within 7 days of the most recent disturbance.</td>
</tr>
<tr>
<td>Any area at final grade.</td>
<td>Within 7 days of reaching final grade within that area.</td>
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</table>

(b) Permanent vegetation shall not be considered established until a ground cover is achieved which is mature enough to control soil erosion.

2.09 Cut And Fill Slopes

(a) Cut and fill slopes shall be designed, constructed and stabilized in a manner which will minimize erosion. Consideration should be given to the length and steepness of the slope, the soil type, upslope drainage area, groundwater conditions and other applicable factors. If after final grading there is excessive erosion, where rill erosion become gully erosion, additional slope stabilizing measures by the owner, developer or builder will be required until the problem is corrected. The following guidelines are provided to aid in developing an adequate design.

1) Roughened soil surfaces are generally preferred to smooth surfaces on slopes.

2) Diversions should be constructed at the top of long steep slopes which have significant drainage areas above the slope. Diversions or terraces may also be used to reduce slope length.

3) Concentrated storm water should not be allowed to flow down cut or fill slopes unless contained within an adequate channel, flume or slope drain structure.
4) Wherever a slope face crosses a water seepage plane which endangers the stability of the slope, adequate drainage or other protection should be provided.

5) Fills located at the proposed house location and 10 feet around the perimeter of the proposed house should be compacted to densities not less than 98 percent of the Standard Proctor maximum Dry Density, ASTM D698. All other fill should be compacted to at least 95 percent Standard Proctor Dry Density ASTM D698. Compaction test results shall be submitted and approved by the Butler SWCD prior to final plat approval.

2.10 Protection Of Adjacent Properties/Public Right-of-Ways

(a) Properties, public right-of-ways, and thoroughfares adjacent to the Development Area of an earth disturbing activity shall be protected from sediment deposition. This may be accomplished by preserving a well-vegetated Buffer at the perimeter of the Development Area, by installing perimeter controls such as sediment barriers, filters, dikes, sediment basins, or by a combination of such measures.

2.11 Erosion & Sediment Control's (ESC's)

(a) ESC's shall be used to control erosion and trap sediment on a Development Area remaining disturbed for more than 14 days. Such structures may include, but are not limited to, silt fences, mulch berms, storm drain inlet protection, sediment traps, sediment basins and diversions or channels which direct runoff to a sediment basin. All ESC's must be capable of ponding or capable of allowing sediment to settle out of the storm water runoff in order to be considered functional.

(b) ESC's shall be constructed as a first step in grading and be made functional before upslope Earth Disturbing Activities take place. Earthen ESC's such as dams, dikes, and diversions shall be seeded and mulched as soon as the installation is complete. ESC's shall be functional throughout the course of Earth Disturbing Activity and until the Development Area is stabilized with Permanent Vegetation.

(c) Sheet flow runoff from the Development Area shall be intercepted by silt fence, mulch berms or diversions. Silt fence or mulch berms shall be placed on a level contour and shall be capable of temporarily ponding runoff. The relationship between the maximum drainage area to silt fence for a particular slope range is shown in Table 3 below.
Table 3: Maximum Drainage Area to Silt Fence

<table>
<thead>
<tr>
<th>Maximum drainage area (in acres) to 100 linear feet of silt fence</th>
<th>Range of slope for a particular drainage area (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>&lt;2%</td>
</tr>
<tr>
<td>0.25</td>
<td>&gt; 2% but &lt; 20%</td>
</tr>
<tr>
<td>0.125</td>
<td>&gt; 20% but &lt; 50%</td>
</tr>
</tbody>
</table>

(d) Storm water diversion practices shall be used to keep runoff away from disturbed areas and steep slopes. Such devices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres.

(e) Whenever storm water detention is required per Article V, the storm water runoff from the Development Area shall pass through a sediment basin or other suitable sediment trapping facility before discharge to Waters of the State. The Butler SWCD may require sediment basins or traps for smaller disturbed areas where deemed necessary due to Development Area challenges or issues that are not controllable with standards set forth within these regulations.

2.12 Stabilization Of Waterways And Outlets

(a) All on-site man made storm water conveyance channels shall be designed and constructed to withstand the expected velocity of flow without erosion as described in Article V. Conveyance channels are to be seeded and mulched within 14 days of completion. Methods adequate to prevent erosion shall also be provided at the outlets of all pipes and paved channels. Outlet will be stabilized with rock rip rap and/or other energy dissipation devices as approved by the Butler SWCD.

(b) Channel design and preventative scour measures to prevent erosion are to be designed per Article V.

2.13 Storm Sewer Inlet Protection

(a) All storm sewer inlets shall be protected so that sediment-laden water will not enter the conveyance system without first being filtered or otherwise treated to remove sediment. A rolled tile wrapped inlet sediment filter shall be used for all curb inlet protection or equivalent BMP.

2.14 Working In Or Crossing Watercourses

(a) All activities shall be kept out of watercourses to the maximum extent possible. Where in-channel work is necessary, precautions shall be
taken to stabilize the work area during construction to minimize erosion. The channel (including bed and banks) shall be restored to its original cross-section and all disturbed area stabilized immediately after in-channel work is completed.

(b) Where a watercourse will be crossed regularly during construction, a temporary Stream crossing shall be constructed per U.S. Army Corps of Engineers and the latest edition of the *Rainwater and Land Development Manual*. The Stream crossing will be used for the shortest period possible to complete the work, removed following Development Area construction, and restored as described in Section 2.13 (a) above.

2.15 Maintenance and Removal Of Temporary Measures

(a) All temporary erosion and sediment control practices shall be maintained and repaired by the Owner/Operator to assure continued performance.

(b) All temporary erosion and sediment control measures shall be removed within thirty (30) days after final Development Area stabilization is achieved or after the temporary measures are no longer needed. Trapped sediment and other disturbed soil areas resulting from the removal of temporary measures shall have the final grade re-established and be permanently stabilized to prevent further erosion and sedimentation.

2.16 Control Of Construction Development Area Debris and Wastes

(a) All owners, applicants, contractors and developers shall dispose of discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste on the Development Area in order to keep streets and gutters clear of all sediment and debris from the Development Area.

(b) A defined washout area shall be located within the Development Area and protected such that washout does not leave the area. Proper removal and disposal of the material shall take place upon hardening or drying.

2.17 Use, Safety, and Maintenance of Storm water / Erosion Control Practices

(a) Storm water management practices shall be designed for the permitted use of the Development Area and function safely and with minimal maintenance.
(b) If an inspection reveals that a control practice is in need of repair or maintenance because it is failing, with the exception of a sediment settling pond, it must be repaired or maintained within three days of the inspection by Owner/Operator. Sediment settling ponds must be repaired or maintained to the approved construction drawings within 10 days of the inspection Owner/Operator.

2.18 Inspection of Storm Water Controls/ Internal Inspections

(a) Development Area discharge locations shall be inspected to ascertain whether erosion and sediment control measures are effective in preventing significant impacts to the maximum extent practicable to the receiving Waters of the State.

(b) All controls on the Development Area shall be inspected at least once every seven calendar days and within 24 hours after any storm event greater than one-half inch of rain per 24 hour period and repaired or maintained as described in Article VII Section 2.18 above. The Development Area Owner/Operator shall assign certified inspection personnel experienced in the installation and maintenance of erosion and runoff controls to conduct these inspections to ensure that all storm water control practices are functional, that all provisions of the SWP3 and this regulation are being met, and whether additional control measures are required.

(c) All ESC’s shall be periodically inspected by the developer to ensure proper function and to identify failures. If the inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment settling pond, it must be repaired or maintained within three (3) days of the initial inspection. Sediment settling ponds must be repaired or maintained within 10 days of the inspection.

(d) The Development Area Owner/Operator shall maintain for three (3) years following the final stabilization of the Development Area a record summarizing inspections, names(s) and qualifications of personnel making the inspections, the date(s) of inspections, major observations relating to the implementation of the SWP3 and a certification as to whether the Development Area is in compliance with the SWP3 and identify any incidents of non-compliance.

2.19 Accessibility and Easements (See Subsection 4.08 for specific requirements)

(a) All permanent storm water management measures shall have easements sufficient to cover the facility and to provide access for
inspection and maintenance. See Articles V and VIII for additional information.

2.20 General Standards

(a) The standards identified in this Section are general guidelines. Each application shall be reviewed on a case by case basis and some may require additional and more stringent requirements, while others may have individual requirements waived by the authorized agent.

SECTION III. STORM WATER POLLUTION PREVENTION PLAN (SWP3) REQUIREMENTS

3.01 Storm water Pollution Prevention Plans (SWP3s) are intended to provide information on all soil erosion and runoff control activities and Best Management Practices (BMPs) to be used and incorporated on the Development Area both during and after Development Area development. This information includes, but is not limited to, Development Area grading, storm water management facilities and practices, erosion and runoff control information, maintenance plans, and other measures that focus on managing the effects of Earth Disturbing Activities on the Development Area.

3.02 Each SWP3 shall provide Development Area designs that meet the Performance Standards presented in Section III and provide practical treatment for both water quality and quantity of storm water from the Development Area as appropriate.

3.03 In general, SWP3s need to address:

(a) **Erosion and Sediment Control.** Providing measures to insure that earth disturbing activities at the Development Area during and after development will be managed in a manner that will not increased erosion and sedimentation to the maximum extent practicable from the Development Area resulting in impacts to water quality and that meet the Performance Standards specified in Section II.

(b) **Runoff Control.** Providing measures to insure that the rate of surface water runoff from the Development Area during and after construction will not exceed pre-development conditions and that meet the Performance Standards specified in Section II.

3.04 The SWP3 shall specifically include all the following:

(a) A Development Area Plan Map that shows the location of existing features and proposed improvements on the Development Area
including:

1) Total area of the Development Area and the area of the Development Area that is expected to be disturbed (i.e. grubbing, cleaning, excavation, filling or grading, including off-site borrow areas).

2) Surface water locations, including springs, wetlands, Streams, lakes, water wells, etc., on or within 200 feet of the Development Area, including the boundaries of wetlands or Stream channels and first subsequent named receiving water(s) the Owner/Operator intends to fill or relocate for which the Owner/Operator is seeking approval from the Army Corps of Engineers and/or Ohio EPA.

3) The general directions of surface water flow and 100-year floodplain when applicable.

4) All improvements, including buildings, retaining walls, sidewalks, streets, parking lots, driveways, utilities and storm water basins, drainage impoundments, channels and outlets, etc.

5) Appropriate soil information for the Development Area describing locations of bedrock, unstable, or highly erodible soils as determined by the Butler County Soil Survey and/or soil tests. Show location of any soil test borings on plan. Other soils information such as permeability, high water table, etc. may be mentioned.

6) If required by preliminary plat approval the geotechnical study must be completed and approved at the SWP3 review step.

7) An estimate of the impervious area and percent imperviousness created by the Earth Disturbing Activity.

(b) The contents of the SWP3 required by the Ohio EPA’s NPDES Construction Activity Permit #OHC000002 and incorporated here by reference (a copy of this permit is included in Appendix A). This Plan may be submitted as developed for the Ohio EPA, in conjunction with the other requirements of Subsection 5.04 The contents of the Ohio EPA’s SWP3 include, but are not limited to:

1) A description of current land uses at the Development Area.

2) Existing data describing if available, the quality of any discharge from the Development Area.

3) Appropriate soil information for the Development Area describing locations of bedrock, unstable, or highly erodible soils as determined by the Butler County Soil Survey and/or soil
tests. Show location of any soil test borings on plan. Other soils information such as permeability, perched water table, etc. may be mentioned.

4) A determination of runoff coefficients or curve numbers for both the pre-construction and post construction Development Area conditions.

5) For all Earth Disturbing Activities (involving the disturbance of five or more acres of land or will disturb less than five acres, but part of a larger common plan of development or sale which will disturb five or more acres of land), a description of post construction BMP(s) chosen and designed to detain and treat a water quality volume (WQv) equivalent to the volume of runoff from a 0.75-inch rainfall (See Ohio EPA Construction Activity Permit for methodology). Design of water quality volume within detention / retention facilities must comply with Article V.

6) For all small Earth Disturbing Activities (which disturb one or more, but less than five acres of land and is not a part of a larger common plan of development or sale which will disturb five or more acres of land), a description of measures that will be installed during the development process to control pollutants in storm water discharges that will occur after construction operations have been completed.

7) An implementation schedule which describes the sequence of major construction operations (i.e., grubbing, excavating, grading, utilities and infrastructure installation) and the implementation of erosion, sediment and storm water management practices or facilities to be employed during each operation of the sequence.

8) For subdivided developments where the SWP3 does not call for a centralized sediment control capable of controlling multiple individual lots, a detail drawing of a typical individual lot showing standard individual lot erosion and sediment control practices.

9) A detailed description of the storm water controls to be incorporated and how these meet or exceed the appropriate Performance Standards presented in Section III. This shall include the identification of which entity (developer, contractor, owner) is responsible for implementation of each individual control (e.g., contractor A will clear land and install perimeter controls and contractor B will maintain perimeter controls until final stabilization).
10) A detailed maintenance plan that describes procedures (e.g., inspections—see section 2.19 Inspection of Storm Water Controls/Internal Inspections) needed to ensure the continued performance of control practices shall be located at the entrance of the Development Area or at the job trailer in a well marked container accessible at all times. Such plans must ensure that pollutants collected within structural post-construction practices be disposed of in accordance with local, state, and federal regulations.

11) A Development Area Map that includes:

1) Limits of Earth Disturbing Activity of the Development Area including associated off-site borrow or spoil areas.
2) Soil types on the Development Area, including locations of unstable or highly erodible soils.
3) Existing and proposed contours. A delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed, in acres.
4) Existing and planned locations of buildings, roads, parking facilities and utilities.
5) The location of all erosion and sediment control practices, including areas likely to require temporary stabilization during development of the Development Area.
6) Sediment and storm water management basins noting their sediment settling volume and contributing drainage area.
7) Permanent storm water management practices to be used to control pollutants in storm water after construction operations have been completed.
8) Areas designated for the storage or disposal of solid, sanitary, and toxic wastes, including dumpster areas, cement truck washout areas, and vehicle fueling and maintenance.
9) The location of designated construction entrances where vehicles will access the Development Area.
10) The location of any in-Stream activities, including Stream crossings.

(c) Copies of pertinent Notices of Intent (NOI), permits, public notices and letters of authorization must be included with SWP3 submissions. These may include, but are not limited to, Ohio EPA NPDES Permit authorizing storm water discharges associated with construction activity, Ohio EPA Phase II Storm Water Permits, Section 401 and 404
Clean Water Act Permits, Ohio EPA Isolated Wetland Permit, and Ohio Dam Safety Law Permits.

(d) Supplemental requirements as provided in Subsection 3.06.

3.05 Storm water discharge to critical areas with sensitive resources (i.e. wetlands, steep slopes, scenic river designation, recharge areas, etc.) may be subject to additional criteria, or may need to utilize or restrict certain storm water practices to protect these critical areas with sensitive resources and functions.