

**Unincorporated Monroe County  
Storm Water Quality Management Plan  
Part B  
April 2004**



Jackson Creek in Jackson Creek Park

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Clear Creek in Cedar Bluff Nature Preserve

"The most effective way to keep surface waters clean is to keep pollutants from those waters in the first place. That is, address the pollution at the source - the minds and hearts of the common man, . . ."

"Fix the worst first. Do things people want and will notice to build public support for the rest."

Andy Reese (VP of AMEC Earth & Environmental Inc., Nashville, TN)

"Premature responsibility breeds superficiality."

**Albert Einstein**

**Monroe County Storm Water Quality Management Plan – Part B**

# Baseline Characterization

## Introduction

By virtue of falling within the requirements of Phase II of the Federal Clean Water Act, Monroe County is required to, among many other things, develop a baseline characterization of the streams located within the urban areas of the county, also known as the MS4 Regulated Areas. The Monroe County Plan Commission is assisting the Monroe County Highway Department in developing this baseline characterization. It is further anticipated that the Plan Commission will continue to work with the Highway Department in expanding and enhancing this characterization.

Indiana Code (327-IAC- 15-13 and 327-IAC 15-5) describes what is expected in this initial baseline characterization and is summarized in the following:

All MS4 operators shall characterize the water quality of all known waters of the state that receive storm water outfall discharges within the MS4 area. This baseline characterization must include:

- 1) Existing land use
- 2) Assessment of existing structural and non-structural storm water BMP locations
- 3) Identification of appropriate observation or monitoring locations
- 4) Identification of known sensitive areas such as public swimming areas, surface drinking water intakes, waters containing threatened or endangered species and their habitat, or state outstanding resource and exceptional use waters.
- 5) Known existing and available monitoring data of the MS4 area receiving waters
- 6) Identification of areas having a reasonable potential for, or actually, causing storm water quality problems based on the available and relevant chemical, biological, physical, land use, and complaint data
- 7) Recommendations for placement of additional BMP's within the MS4 area

The Plan Commission agreed to address items 1, 2, 4, and 6 and to assist in the remaining areas.

## **Guiding Principles**

In December, 2002 the Monroe County Storm Water Quality Group adopted the following guiding principles. These are the management practices that will best guide our strategies to improve storm water quality.

1. Keep it positive
2. Coordinate (It takes everybody)
3. Plan
4. Control storm water pollution at its source where possible
5. Include the public

## **Existing Drainage Patterns in the MS4 Area**

When contemplating measures to improve storm water quality in the MS4 area, it is important to note its defining drainage characteristics. Bloomington is centrally located in Monroe County, and the next largest municipality, Ellettsville is located to the northwest of Bloomington. The MS4 area of unincorporated Monroe County surrounds Bloomington and spikes towards the northwest along State Road 46 to encompass Ellettsville. Because of the way the Census Bureau designated urbanized areas along major roads, the MS4 area also extends to the northeast towards Unionville along State Road 45 and extends east along State Road 46, although these are not highly urbanized areas. Along State Road 45 to the southwest, the MS4 area includes some older residential areas. The MS4 area is similar to the former two-mile fringe. The City of Bloomington had planning jurisdiction within the two-mile fringe until 1997.

As a general rule, runoff from about two-thirds of Bloomington flows to the south (Clear Creek), while the northern third of the city drains to the north as tributaries to Beanblossom Creek. The flow pattern is from the city out to the unincorporated area. The runoff from Ellettsville also flows to unincorporated Monroe County. Therefore, the combination of the baseline characterizations for Bloomington and Ellettsville substantially amount to the baseline characterization for the Monroe County MS4 area.

Bloomington is an unusual city in that there are no rivers in or even very close to it. The city's quest for water is an interesting story (which will not be recounted here), culminating in the completion of Monroe Lake in 1965.

As previously stated, Clear Creek receives runoff from about two-thirds of Bloomington, including most of another MS4 entity (Indiana University), where it is affectionately known to students as the Jordan River. It is the single stream that receives most of the nonpoint source pollution from Bloomington, including runoff from the major commercial areas on the west and east sides of town, the highest traffic areas, and much of the industry on the west side. Important tributaries to Clear Creek include Jackson Creek, West Fork Clear Creek, and Sinking Creek. Clear Creek flows to the south, where it picks up effluent from the Dillman wastewater treatment plant, and joins Salt Creek about a mile downstream from the Monroe Lake Dam.

Within Bloomington, much of the course of Clear Creek and its tributaries is enclosed in old storm sewers or is channelized within stone walls and may receive illicit discharges in these reaches. Runoff from the Illinois Railroad Spring (Lemon Lane landfill) drains to the creek. Like many landfills in the area, Lemon Lane received PCB laden waste.

Despite the impairment caused by nonpoint source pollution, effluent from the wastewater treatment plant (including occasional sanitary sewer overflows), PCBs during high flows which may not be captured by the treatment plant on the Illinois Central Spring, and loss of riparian flora caused by encroaching residential and farm uses (contributing to thermal pollution), Clear Creek flows through a scenic valley in southern Monroe County past Cedar Bluff nature preserve. During high flows, canoeists sometimes venture from Dillman Road to points downstream.

## **Existing Drainage Patterns in the MS4 Area – (continued)**

The north side of Bloomington is drained by Griffy Creek (including a major tributary named Cascades Creek which flows through Cascades Park) and Stout Creek, all of which are tributaries of Beanblossom Creek. Beanblossom Creek flows basically from east to west through a wide agricultural valley across the north part of Monroe County outside of the urbanized area, where it picks up drainage from Jacks Defeat Creek before its confluence with West Fork White River.

The area to the west of Bloomington is particularly interesting because there are two streams which drain to so called “blind valleys” - that is, they have no surface outlet. The terminal sinkhole area for Sinking Creek is located in the northwest quadrant of the intersection of State Road 45 and Curry Pike. Sinking Creek flows from the north to the south through a highly urbanized watershed encompassing commercial, industrial, and residential areas along Curry Pike (including older residential areas such as Highland Village and Westwood Estates). The City of Bloomington Utilities has been active in lining leaky sanitary sewers in this area. Sinking Creek “sinks” in the terminal sinkhole area, and the runoff comes out in any number of springs (depending on the rate of flow) in the area of Leonard and Shirley Springs. This area was once the site of one of Bloomington’s early and ill-fated water supply lakes, and is now a city park occupied by beavers and traversed by a stream that feeds into Clear Creek.

To the west of Sinking Creek is Cave Creek. This watershed contains an important industrial park (Park 48 – including Ivy Tech, another MS4 entity), a major subdivision (Fieldstone), and the Monroe County Airport. Whereas the Sinking Creek watershed is almost completely developed, the Cave Creek watershed is in more of a developing stage. It flows from north to the south and then turns to the west. Cave Creek is at the western edge of the MS4 area. Flow from the terminal sinkhole emanates primarily in Richland Creek outside of the MS4 area, which continues to the west, picking up PCBs (during high flows) from the old Neals landfill before entering Owen County.

Stout Creek has been heavily quarried in its headwater areas. Not to be left out of the PCB scene, the old Bennetts dump is located in this watershed. The quarry has recently been transected by a new route of State Road 46, and Curry Pike will be extended on a new route to intersect with it. This sets the stage for one of largest developments in Monroe County, dubbed North Park. This development is in the planning stage and will consist of a mix of industrial, commercial, and residential uses.

Jacks Defeat Creek flows basically from south to north from the unincorporated county into Ellettsville and then out the north side back into the unincorporated county. A major tributary to Jacks Defeat Creek runs to the northwest along the south side of State Road 46, starting near the intersection of Smith Pike and State Road 46. State Road 46 is lined with commercial land uses, including gas stations and auto repair shops. There are no known PCB inputs to Jacks Defeat Creek, but it does receive substantial nonpoint source pollution in addition to sanitary sewer overflows. In Ellettsville, there has historically been substantial encroachment of development within the Jacks Defeat Creek floodplain. Despite the storm water pollutant loadings and increasing development in the Ellettsville area, Jacks Defeat Creek flows through a riparian corridor north of Ellettsville with high habitat value and supports a bass fishery.

## **Existing Drainage Patterns in the MS4 Area – (continued)**

Nonpoint source pollutant loadings from the MS4 areas to the north and east of Bloomington seem relatively insignificant at this time. There are some residential developments along the west side of Russel Road that drain to Griffy Reservoir (which suffers from high nutrient and sediment loadings). Runoff from Gentry East Subdivision on the east side of State Road 446 goes to Monroe Lake. A portion of the MS4 area to the east and southeast of Bloomington overlaps the Monroe Lake watershed.

### **1) Existing Land Use**

The Planning Department determined existing land use through the review and interpretation of a variety of data sets including current aerial photography, USGS Gap Analysis Data, the National Land Cover Data Set (1992), and current zoning classifications. For this initial characterization it was determined that the current zoning most accurately reflected the existing land use conditions. Exhibit 1 and the accompanying table provide the relevant existing land use information.

### **2a) Existing Nonstructural Best Management Practices**

Monroe County has for many years utilized planning policies and best management practices in a comprehensive effort to protect a variety of natural features and water quality. Planning policies include a concerted effort to guide development and public investments to areas less constrained by natural features. Best management practices include development limitations in karst sensitive areas and development limitations on steep slopes within critical water supply areas, stringent erosion control standards, and the requirement to provide riparian buffer areas.

#### *Karst protection*

Chapter 829 of the Monroe County Zoning Ordinance provides for the substantial protection of karst features including limits on land disturbance within such areas, the provision of buffer areas, extraordinary erosion control measures in such areas and recently the required installation of water quality protection measures including infiltration basins. The chapter can be found on-line under the Planning Department on the county's website ([www.co.monroe.in.us](http://www.co.monroe.in.us)).

#### *Erosion Control Standards*

Chapter 816 of the Monroe County Zoning Ordinance establishes erosion control standards for construction activities within Monroe County. All construction activities (other than individual single family residences) and development proposals are required to plan for and implement erosion control measures. The County works in concert with the Indiana Department of Natural Resources and the Monroe County Soil and Water Conservation District to inspect and enforce the provisions of the Ordinance. The chapter can be found on-line under the Planning Department on the county's website ([www.co.monroe.in.us](http://www.co.monroe.in.us)).

## **2a) Existing Nonstructural Best Management Practices – (continued)**

### *Critical Drinking Water Supplies*

Monroe Reservoir is the single source of municipal water supply in Monroe County, and Griffy Reservoir serves as an emergency backup. Practices unique to these two watersheds (in the unincorporated county) have been in effect since 1997 and are elucidated in Chapter 825 of the County Zoning Ordinance (also known as the ECO chapter). This chapter provides for the substantial protection of area drinking water supplies including the Lake Monroe and Lake Griffy watersheds. It places strict limitations on the amount and type of land disturbances that are permitted within each of these watersheds. The text of this chapter can be found under Planning on the County's website at [www.co.monroe.in.us](http://www.co.monroe.in.us). The primary practices of note include building and tree harvesting restrictions on steep slopes and provision of riparian buffer zones on parcels that are subdivided. A majority of the zoning in Monroe County within the Monroe Reservoir watershed is designated as Forest Reserve (with a minimum 5 acre lot size). Only about 17 percent of the Monroe Reservoir watershed is in Monroe County (with over half of the watershed within Brown County).

### *Stormwater Management*

Several provisions of the Monroe County Code address the adequate management of stormwater including requirements regarding water quality. In most development proposals a large vegetated buffer area that is to remain free of development activities is required for streams of all classifications. Additional requirements are often required through the subdivision review process as performed by the Monroe County Plan Commission and the Monroe County Drainage Board.

## **2b) Existing Structural Best Management Practices**

There are only two structural practices constructed for the purpose of storm water quality improvement in Monroe County of which I am aware. A project involving a series of ponds is nearly complete in Miller Showers Park, located on an urbanized tributary to Cascades Creek between Walnut and College Streets north of 17<sup>th</sup> Street. Incorporated in this design are hydrodynamic (swirl technology) devices for sediment and floatables removal.

Sometime around 1997, a couple of ponds were built in the headwater area of Sinking Creek on either side of Jonathan Drive (north of State Road 48 and east of Curry Pike) as part of a cleanup of an industrial site. These ponds incorporate wetlands in addition to storm water detention.

The City of Bloomington has also done a restoration project on a small tributary to Clear Creek that runs through Bryan Park. The purpose of this project is mainly aesthetic but there may be water quality benefits as well.

## **2b) Existing Structural Best Management Practices – (continued)**

Clean ups have been completed at numerous PCB contaminated areas in Monroe County including the former Winston Thomas wastewater treatment plant, Bennetts dump, the Lemon Lane landfill, the Anderson Road landfill, and Neals landfill (the latter two of which are outside of the MS4 area). Some of these sites were dumps in sinkholes. Springs emanate from the Lemon Lane landfill, Neals landfill, and Bennetts dump. Activated carbon treatment plants treat much of the water in the springs from Lemon Lane and Neals landfills. The capacity of the Neals landfill treatment plant may be increased, and a treatment plant may be installed for the Bennetts dump springs. Under a federal consent decree, these springs are monitored for PCBs, and fish sampling is periodically conducted on Clear Creek to test for PCBs.

There are numerous existing wet ponds that probably influence water quality but were not constructed for that purpose. Griffy Reservoir, Wapehani Lake (WFK Clear Creek), lower Twin Lake (WFK Clear Creek), University Lake (tributary to Griffy Creek), and the wetlands in the area of the old Leonard Springs lake (Clear Creek) are all former Bloomington water supply projects that receive runoff from urbanized areas. Developments such as Stone Ridge (north of Rogers Road and west of Smith Pike along a tributary to East Fork of Jackson Creek) and Winslow Farm (along a tributary to Clear Creek) incorporate a series of ponds.

Dry detention ponds associated with development do not normally promote substantial sedimentation because detention times are short – often on the order of an hour or two. An exception to this are ponds constructed in the last several years in the Sinking Creek and Cave Creek watersheds along with other areas that drain to sinkholes. In an attempt to reduce downstream flooding associated with ponding in the terminal sinkhole areas, the drainage board has specified longer detention times in these karst watersheds. These ponds may collect significant amounts of sediment over a period of time, but there has been no regular inspection to determine whether this has been occurring. The dam at Fieldstone Subdivision (Cave Creek) is gated to allow for complete closure of the outlet when the water elevation in the terminal sinkhole reaches a critical level.

## **3) Identification of Characterization Sites**

The purpose of the baseline characterization is to direct us to a strategic use of practices to meet water quality standards. The 303(d) list (appendix – Table 1) shows that all of the major streams in Monroe County are impaired. Although the degree to which nonpoint source pollution plays in the restriction of water uses is not always clear, it is likely that it contributes in all cases where impaired biotic community was found.

What is clear is that it would be prudent to institute ongoing characterization not only to direct remedial practices to areas that are contributing pollutants but also to gage the effectiveness of individual measures. Another possible use of ongoing characterization is as feedback to property owners regarding how well they are doing in reducing pollutant loadings. An initial set of long-term characterization sites is listed as Table 2 in the appendix and is depicted in Exhibit 11.

#### **4) Identification of Sensitive Areas**

The Planning Department identified existing sensitive areas through the review of relevant local, state, and federal documents, including current aerial photography, the Geographic Information System Atlas for Southwest Indiana, the National Wetlands Inventory Map, and the Monroe County Comprehensive Land Use Plan. Through this analysis it was determined that there are three primary areas of concern relative to sensitive areas within the MS4. These include wetland, karst features, and threatened or endangered species. Exhibit 2 identifies the known wetland features within the MS4. Exhibit 3 identifies the known karst areas within the MS4. It should be noted that more detailed wetlands and karst information is contained in the watershed and floodplains, wetlands, and karst releases of the Monroe County Natural Features Inventory. Exhibit 4 identifies the watersheds containing known locations of threatened or endangered species and their associated habitat.

As mentioned in 2a under Critical Drinking Water Supplies, the Monroe Reservoir and Griffy Reservoir watersheds are sensitive areas.

#### **5) Existing Water Quality Data**

In assessing existing water quality data, two studies were particularly useful. The Ellettsville Urban Storm Water Improvement Project (conducted for IDEM by Commonwealth Biomonitoring and completed in May 2000) not only targeted storm water runoff (as opposed to characterizing only dry weather stream water quality) but looked at the effectiveness of a particular management practice (storm inlet filters) as well. The July 2001 report by the City of Bloomington Environmental Commission entitled Bloomington Environmental Quality Indicators included chapters on wildlife and natural areas, soils, erosion and siltation, and water quality and quantity. There are no long term USGS water quality stations in the urbanized area.

Although not conclusive, the Ellettsville study strongly suggested that toxins found in storm water were automobile related. Toxins found using semipermeable membrane devices have been associated in other studies with vehicle service areas. The study found that removal of particulates reduced toxicity. Another interesting finding was that day time temperatures in Jacks Defeat Creek and a major tributary (with the local name of Turtleback Creek) sometimes exceeded 30 degrees C. It was noted that many forms of aquatic life are unhappy with temperatures over 25 degrees C and experience mortality at temperatures over 30 degrees C. The high temperatures were attributed to lack of shading. The study also gave cost information for instituting a program of storm inlet filters.

The Bloomington study noted PCB and mercury contamination problems in Clear Creek and Stout Creek and found elevated e. coli levels in portions of Jackson Creek and Clear Creek. The study suggested the possibility of illicit discharges in the enclosed portion of Clear Creek. In general, the study found riparian habitat damage, sediment loading, and hydrocarbon loading problems in the urban streams. A recommendation was made for a storm water retention area in the Cascades Creek watershed to improve storm water quality (the almost completed Miller Showers park renovation represents the culmination of this recommendation).

## 5) Existing Water Quality Data – (continued)

Completed in September, 1997, the Bloomington/Monroe County Urban Nonpoint Source Pollution Assessment and Brief Planning Feasibility Study was a precursor to the Ellettsville and Bloomington studies previously described. This study observed that while riparian habitat was good on many area streams, biological diversity was below potential. Clear Creek and Jackson Creek had indications of toxic substances, sedimentation, excessive nutrient loading, and sewage related problems. Storm water in Cascades Creek exhibited acute toxicity to a crustacean used as a test animal. Sedimentation problems were also noted in West Fork Clear Creek, East Fork Jackson Creek, South Fork Griffy Creek, Cave Creek, Jacks Defeat Creek, and Ramp Creek. A defining statement from this study is found in the Field Chemistry part of the Results section on page 38, which states, “The lack of pollution intolerant species in the urban streams of Monroe County when compared to the ambient stream background chemistry would indicate that the limiting factor on pollution intolerant species survival is related to acute pollution from episodic storm events and habitat degradation from alteration and sedimentation rather than intolerable ambient water quality conditions.” Simply stated, pollutants picked up by storm water and lack of shade from trees are making conditions difficult for aquatic life.

The Lake Monroe Diagnostic and Feasibility Study was completed in March 1997 to diagnose problems with the lake and to identify solutions. This study noted sedimentation and phosphorus loading issues and cautioned about construction on steep slopes as Bloomington expands southward. Arsenic, chromium, nickel, and zinc were found in sediments in Sugar Camp Creek Bay in the upper reservoir.

Other water quality data was received from the Surveys Section of IDEM. These sites are depicted in Exhibit 10. The macroinvertebrate data total scores for the Clear Creek sites were lower than those for Indian Creek (which is outside of the MS4 area), reinforcing the idea that the biotic potential in Clear Creek is being limited. The metals data shows elevated levels of zinc in sediment at Lake Wapehani (WFK Clear Creek) and at Griffy Lake. Temperatures in excess of 25 degrees Celcius (77 degrees F) were noted on Clear Creek and Jacks Defeat Creek, with a temperature of 31.45 degrees Celcius (88.6 degrees F) on WFK Clear Creek at Victor Pike. High turbidity was not found on the urban streams, but it is likely that the sampling was not conducted during rain events.

Long-term characterization sites for the MS4 area have been selected. It is anticipated that observations from these sites will be used to gain information regarding the health of waterways in the MS4 area, to identify potential water quality problems, and to track water quality trends. Many of these sites were visited during rainfall events in early April of this year. As noted previously, these sites are depicted in Exhibit 10, and recent photos are also included in the appendix.

## **6) Identification of Areas having Potential for Water Quality Problems**

The Planning Department utilized the preceding information and performed additional analyses in an effort to determine areas where water quality problems might currently exist or may in the future. This analysis was performed based on the physical and land use characteristics only. Analyses that include chemical, biological, and complaint data will be included in future iterations of this analysis.

The analysis performed by the Planning Department focused on the portions of each of the major watersheds located within the MS4 and focused on the following physical features:

- Land Use Based Impervious Surface Cover
- Soil Erodibility
- Steep Slopes
- Wetlands
- Karst
- Threatened and Endangered Species

The Planning Department used ArcGIS 8.x and the Spatial Analyst Extension to conduct a multi-criteria sensitivity analysis, identifying the most relevant data sets, clipping the data sets to the study area, converting the data to raster format, reclassifying all of the data, weighting the data based on the percentage of impact, and generating a raster output of the most impacted areas.

Exhibit 5 displays the impervious surface coefficients for the MS4 area. These were determined by identifying existing land use through current zoning classifications. Each land use was then assigned an impervious cover coefficient based on the “Watershed Vulnerability Analysis” prepared by the Center for Watershed Protection. The resulting map indicates that the greatest concentrations of existing or future impervious surfaces are located in the western portions of the MS4 area and are especially concentrated in the non-residential areas along SR37, SR45, SR46, and SR48. The least impervious areas are located in the southeastern and northeastern portions of the MS4 area.

Exhibit 6 displays the slopes for the MS4 area. These were determined from digital contours that were developed from recent aerial photography prepared for Monroe County and the City of Bloomington. The slopes were then classified into three categories; minimal slope, moderate slope, and steep slope. The resulting map indicates concentrations of moderate to steep slopes throughout the MS4 area with the heaviest concentrations located in the southern and western portions of the area.

Exhibit 7 displays the erodable soils within the MS4 area. These were determined from the Monroe County Soil Survey and related tables on the physical and chemical properties of each of the soil classifications. The resulting map indicates that highly erodable soils dominate essentially all of the MS4 area. This is especially notable in the western and southern portions of the area and along area streams.

## **6) Identification of Areas having Potential for Water Quality Problem Areas – (continued)**

Exhibits 2 and 3 display the karst and wetland features present in the MS4 area. These were determined from the Monroe County Natural Features Inventory, the GIS Atlas for Southwest Indiana, and the National Wetlands Inventory Map. The resulting maps indicate extensive karst areas in the southwestern portions of the MS4 area, with smaller concentrations located in the northwestern and southeastern portions of the MS4 area. The northern and northeastern portions of the MS4 area appear to be the least impacted areas. The maps further indicate concentrations of wetlands in the southern and northern portions of the MS4 area, though few areas contain large concentrations of wetlands.

Exhibit 4 identifies watersheds within the MS4 area that exhibit the presence threatened and endangered species. These areas were generated from reviewing the “individual sightings” data provided by the Indiana Natural Heritage Center. The resulting map indicates that the Beanblossom Creek, Jack’s Defeat Creek, and Stephens Creek watersheds contain known habitats of threatened and endangered species including Northern Catalpa, Butternut, and Trailing Arbutus.

Exhibit 8 displays the results of combining the weighted (reclassified) datasets previously discussed and presented in Exhibit 2,3,5,6, and 7. The purpose of this analysis is to identify areas that are or may be most susceptible to water quality issues and are thus priority areas for planning actions and BMP’s. The results of the analysis reveal that areas most impacted and/or most sensitive to water quality issues are concentrated in the western portions of the MS4 area. This is especially evident in the vicinity of SR37 and SR45 and SR48. The impacts associated with these areas are largely due to the presence of significant karst features and due to the large areas of impervious surfaces. The least impacted areas appear to be in the southeastern and northeastern portions of the MS4 area.

## **7a) Recommendations for Future BMPs – Developing Areas**

Existing water quality data in Monroe County tells us that storm water runoff from high traffic roads, large parking lots, and commercial areas results in sporadic pollutant loadings to urban streams that reduce biotic potential. Maintenance considerations will play a role in choosing practices to reduce these loadings. For example, it may be feasible to periodically replace storm inlet filters in large parking lots, but their use on high volume roads would likely be limited by traffic flow impacts associated with maintenance.

The Karst Ordinance (Chapter 829) provides for provision of permanent practices such as sediment ponds in areas that drain to sinkholes, and the Board has approved such practices for several developments. In one case, a vegetated berm constructed with a sand/soil mix was installed between a new subdivision road and several small sinkholes. Chapter 761 (Storm Drainage Control) has been rewritten (with the proposed title of Storm Water Management) and is currently being reviewed by the County Plan Commission for approval. This rewrite will set the stage for incorporating storm water quality practices in new developments.

## **7a) Recommendations for Future BMPs – Developing Areas – (continued)**

The Monroe County Drainage Board has been meeting to determine a strategy for structural practices in new developments by October of this year. The Board has been reviewing EPA's Storm Water Phase II Menu of BMPs, Indianapolis' Chapter 700 (Storm Water Quality), the City of Knoxville BMP Manual, the Lexington-Fayette County Storm Water Manual, and any available studies that shed light on BMP effectiveness, application, and misapplication.

It is anticipated that the Board will develop a system of assigning point values to structural and nonstructural water quality practices and to set criteria relating to their required use (such as density of residential developments or traffic volume of roads). This approach will give developers options to employ a mix of structural measures (such as extended dry detention, biofiltration, swales, or vegetated berms), with nonstructural measures (such as preservation of open space, riparian buffers, reduced impervious surfaces, or designated pesticide and fertilizer free areas). It will be important to avoid practices that allow for significant mosquito breeding opportunities and practices that promote infiltration in karst areas with thin soils.

A consensus has developed that the county will need to play a significant role in BMP monitoring and maintenance, and funding will undoubtedly be required. Practices need to be monitored to determine when maintenance is required and to determine their effectiveness. This information will then be used to fine tune BMP requirements as the program moves forward. The Board will need to estimate costs associated with BMP monitoring (which may be accomplished by interns) and maintenance.

The water quality data also point to sediment loading as a problem. Construction site runoff is undoubtedly playing a significant role. Adoption of the revised Rule 5 requirements as part of the County Zoning Ordinance, along with increased education and awareness, should reduce these loadings. IDEM currently charges one hundred dollars for Rule 5 permits. The County Planning Department could charge the same amount when it assumes primacy of this program. When trained, County Building Inspectors can take pictures of sites where remedial action may be required and forward this information to the appropriate personnel in the Planning Department.

As pointed out at the LTAP Storm Water Conference this year, communication and cooperation are often the forgotten BMPs for construction site erosion control. The Monroe County Soil & Water Conservation District has sponsored an Erosion Control Workshop for Contractors this past February, and a presentation relating to the Rule 5 requirements was made in a televised broadcast of a presentation to the League of Women Voters in March. The County Drainage Engineer has made a short Rule 13 presentation focusing on erosion control to the County Plan Commission in February. The Storm Water Environmental Education Team (SWEET) is dedicated to improving awareness of issues relating to storm water pollution. The frequency of meetings at active construction sites between county inspectors and contractors needs to be at least one time per month. Complaints by the public relating to erosion issues will be tracked.

It is too early to tell whether failed septic systems are resulting in significant pollutant loadings. Clear Creek, and, to a lesser degree, Jackson Creek, were receiving sewage loadings at the time of the 1997 and 2001 studies, but it was not clear whether these were from septic system failures or from sanitary sewer overflows. The County Health Department overhauled their septic system requirements in 1998. A certification test for all septic system installers is required.

### **7a) Recommendations for Future BMPs – Developing Areas – (continued)**

Issues that should be pursued include extension of City of Bloomington Utilities sanitary sewers to existing developments with a high rate of septic system failures (which may be discovered through dry weather screening), promoting alternatives to septic systems (such as package plants) for large rural subdivisions and for developments in the Monroe Reservoir and Griffy Reservoir watersheds, and investigation of the effectiveness of septic systems in karst areas. The Monroe County Regional Sewer District has expressed a willingness to adopt package plants if they are constructed according to their specifications.

The county can encourage use of information that will promote better development decisions by making it available on our GIS website. For example, HUC codes (needed for Rule 5 applications) is on our website, along with soils information. The county should continue to investigate ways to promote informed planning and development decisions.

### **7b) Recommendations for Future BMPs – Existing Developed Areas**

Based on the sensitivity analysis it would appear that the most appropriate BMP's to use in the MS4 area will be to continue to closely manage land use, reduce additional impervious surfaces, provide additional vegetated filters and extended detention facilities, and to continue to proactively protect existing karst features. Due to the extent of possible impact it is also likely that certain areas may be appropriate for retrofitting existing development areas with similar BMP's in an effort to reduce current impacts to water quality.

Throughout 2004 and 2005 the Planning Department will be working with the Monroe County Drainage Board on development of appropriate planning tools and BMP's for the appropriate management of development within the watersheds of the MS4. It is important to note that these tools and BMP's will expand the already large array of tools utilized by Monroe County including protection of steep slopes within critical watersheds and limits on development within areas exhibiting karst features.

Retrofitting existing ponds to act as storm water quality practices is a possibility if a funding source becomes reality. Storm inlet filters could be employed in large parking lots, street sweeping on high traffic roads could be done more frequently, and permanent measures to target particulates from the transportation system could be constructed and maintained. The county can promote urban forestry, including tree plantings in riparian corridors. The SWEET is working on strategies to promote integrated pest management and reduced fertilizer use in residential areas. This will be especially important in the Griffy Lake watershed as well as the Jackson Creek watershed (where eutrophic conditions were noted in the 1997 study).

Monroe County owns only a couple of detention ponds at this time. The pond behind K-Mart on State Road 48 on the west side of town also receives runoff from the Menards site. In Northwest Park, there is at least one detention pond within the right of way of Loesch Road.

At some point in time, Monroe County could look at the possibility of constructing regional ponds designated for water quality improvement. No planning for such a regional approach has begun or is anticipated in the near future, but its likelihood will increase as the county's storm water management program matures. The land use analysis conducted by the Planning Department points to areas immediately west of Bloomington where commercial, industrial, and residential development has occurred in karst areas.

**7b) Recommendations for Future BMPs – Existing Developed Areas – (continued)**

Dry weather screening will be used to discover illicit discharges, and strategies will have to be developed to eliminate these discharges. Ordinance revisions may be necessary to facilitate the elimination of these discharges. Dry weather screening will take place at outfall sites and will be done with a field testing kit as specified in Rule 13. Outfalls include all culverts and storm sewer outlets in the MS4 area along with some open channels. The County Health Department currently checks septic systems when property is transferred if requested by the property owner. The charge for this service is fifty dollars. This type of septic system could be required by ordinance (if the system has not been checked within a certain time frame such as one year) and the permitting fee utilized for increased screening.

As mentioned in previous sections, long-term characterization sites can be used as a tool to provide feedback to property owners within their respective watersheds. When people see that there are pollutants in small waterways only a short distance from their homes, the likelihood of behavior changes is enhanced. The mechanism for providing this feedback and the types of parameters collected during the characterization have yet to be determined. Cathy Meyer from the County Parks Department is helping to coordinate Hoosier Riverwatch volunteers in Monroe County and will be directing volunteers to the chosen characterization sites. Kriste Lindberg is working with Hoosier Riverwatch volunteers in the city parks.

The first of six control measures specified by the Environmental Protection Agency is Public Education, and the second is Public Participation. Projects such as storm drain marking (Martha Miller (SWCD), unincorporated Monroe County & Ellettsville, Kriste Lindberg, City of Bloomington, Dan Derheimer, Indiana University) can allow for both education and participation. Although the format of Part B of the Storm Water Quality Management plan focuses on particular water quality treatment practices, building healthy education and participation programs will be the key to success.

## **Expansion and Enhancement of Data and Analyses by the Planning Department**

Early in the process it became clear that additional and more detailed information would allow more effective management of the MS4 area. Likewise, it quickly became apparent that analyzing an area (the MS4) created for regulatory purposes rather than one that corresponds to natural boundaries limits the effectiveness of the analysis. In response to these shortcomings, the Planning Department has initiated the following additional steps:

### *Data Collection and Enhancement*

The Planning Department will be securing the services of an intern from the Indiana University School of Public Affairs and Environmental Sciences (SPEA) to aid the Department in the collection of new physical, biological, and chemical data for areas within the MS4 to expand the multi-criteria sensitivity analysis and to field verify the findings of the analyses. It is anticipated that the intern will begin work in the summer of 2004 and will continue for as long as necessary.

### *Expansion of the Study Area*

The Planning Department has developed a “trial analysis” that is more detailed and that encompasses the entire sub-watershed area, not just the portion that is located within the MS4. It is further assumed that this expanded study area will incorporate the enhanced data collected by the Department to further segment the individual watersheds into more “fine-grained” areas to help ensure that the sub-watershed is described as accurately as possible and that recommended BMP’s best reflect the appropriate needs of that specific portion of the watershed. Exhibit 9 displays the findings of this initial trial analysis for one of the major watersheds located within the MS4. It is anticipated that these more detailed analyses will be substantially complete in 2005 or 2006.

## **Staff Resources**

This report was prepared by the Monroe County Highway Department and the Planning Department using resources from the Indiana Department of Environmental Management, the Indiana Geologic Survey, The Center for Watershed Protection, The Indiana Natural Heritage Data Center, The City of Bloomington, Commonwealth Biomonitoring, Inc., and others. The following staff members were involved in the preparation of this report:

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