Indiana Water Resources Research Center Annual Technical Report FY 2003

Introduction

Efforts at the Indiana Water Resources Research Center (IWRRC) over FY 2003 have focused on water quality issues including runoff and NPS pollution and wastewater treatment (septic systems). Information transfer activities include a constructed wetlands workshop help on the Purdue campus in the fall 2003, and the planning of a state-wide water summit that will provide local Indiana policy makers with the best information and knowledge about the role water resources play in their efforts to promote economic development and improve the quality of life for citizens in their local jurisdiction.

Research Program

Minimizing Runoff and Nonpoint Source Pollution Due to Urbanization

Basic Information

Title:	Minimizing Runoff and Nonpoint Source Pollution Due to Urbanization
Project Number:	2003IN110B
Start Date:	3/1/2003
End Date:	2/28/2004
Funding Source:	104B
Congressional District:	4
Research Category:	None
Focus Category:	Hydrology, Management and Planning, Models
Descriptors:	None
Principal Investigators:	Bernard Engel, Jon Harbor

Publication

Minimizing Runoff and Nonpoint Source Pollution Due to Urbanization

Problem:

Urban expansion requires the careful selection of areas for development or urbanization to ensure sustainable environmental development. One of the major direct environmental impacts caused by the conversion of open spaces to impervious urban and suburban areas is the degradation of water resources and water quality (EPA, 2001). The impact of urbanization on water resources is typically reflected in the alteration of the natural hydrological systems in terms of increasing the runoff rate and volume and decreasing infiltration, ground water recharge, and base flow (Carter, 1961; Lazaro, 1990; Harbor, 1994; Moscrip and Montgomery, 1997). Increasing concern about the problems caused by urban sprawl has encouraged development and implementation of smart growth approaches to land use management. Land managers and urban planners have long realized the importance of land allocation in urban planning, however, the development of a land acquisition strategy has generally not been included as part of the formal planning process. The reason for this neglect is largely the lack of good analytical tools for modeling land allocation, although this need has been expressed by land managers, decision makers, urban planners, and others. In particular, little or no research has been conducted in the field of applying spatial optimization techniques to land use planning from the perspective of minimizing surface runoff and associated NPS pollutants. To investigate the magnitude of the potential benefits of land use planning for water resources protection, possible runoff impacts of historical and projected urbanization were estimated for two watersheds in Indiana and Michigan using a long-term hydrological impact analysis model.

Research Objectives:

The proposed work builds on significant past and ongoing efforts to quantify the impacts of land use change or urbanization on long-term runoff and NPS pollution (see http://www.ecn.purdue.edu/runoff/). Researchers at Purdue have developed a simple, user-oriented hydrologic and non-point source pollution impact assessment model (Harbor, 1994; Bhaduri et al, 1997, 2000; Pandey et al, 2000, 2001; Grove et al., 2001). Making use only of data readily available to the public, web-based and downloadable GIS versions of the model can be used by planners, consultants, farmers, and decision makers to assess the relative impacts of past, present, and alternate future land management decisions. Model results make use of location-sensitive data, such climate, land use, and soils, and thus the user can generate results for a specific watershed or subwatershed. In addition, the model allows users to modify parameters such as nonpoint source pollutant loading rates, based perhaps on local data or management approaches, and thus the model is flexible enough to allow for very local and site specific comparisons of different management alternatives. The model is simple to use, and is freely available at www.ecn.purdue.edu/runoff.

The work presented here illustrates both an approach to assessing the magnitude of the impact of smart growth, and the significant potential scale of smart growth in moderating runoff changes that result from urbanization. We have investigated the potential benefits of optimizing land use placement patterns to minimize impacts on water resources. The specific objectives of this study were: (1) to quantify possible runoff reductions of historical and projected urbanization by optimizing the placement of land use change within representative watersheds, and (2) to evaluate actual and projected development plans in terms of the potential minimum and maximum runoff impact of the development.

Methods:

Study Areas

This study was conducted in two watersheds: Little Eagle Creek (LEC) and Little Muskegon River (LMR), which represented actual and projected urban development, respectively. The LEC watershed, 70.4 km^2 in area, is located in the northwest side of Indianapolis, Indiana, and its suburbs (Figure 1). Because of its proximity to the city, this watershed has experienced rapid and extensive urbanization over the past three decades, which constitutes a potential threat to the water resources of the watershed. Land uses ranging from non-urban natural grass, forested areas, and agricultural areas to typical urban residential, and commercial categories exist in the LEC watershed. As of 1973, the land use distribution was 48.3% urban, 15.3% agriculture, 19.5% forest, and 15.5% grass, with the remainder (0.4%) in open water (Grove et al., 2001).

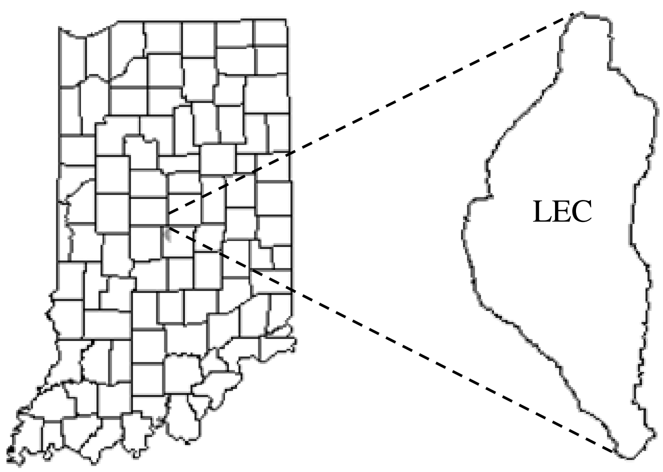

Figure 1. The Location of the Little Eagle Creek Watershed.

The LMR watershed is part of the Muskegon River watershed located on the east side of Lake Michigan in north-central Michigan. The Muskegon watershed consists of forty subwatersheds defined by USGS 14 digit hydrologic unit codes (HUCs). The three HUCs (38, 39, and 40) along the coast of Lake Michigan were grouped and named LMR by the authors in order to simplify the explanation for the rest of the paper (Figure 2). Surface water from HUC1 and HUC2 drains into HUC3. The LMR watershed covers an area of 332 km^2. HUC3 accounts for half of the total LMR watershed area, the other half is shared by HUC1 (37%) and HUC2 (13%). The city of Muskegon is partially located in HUC3. In a parallel study (Tang et al., 2003), LMR was predicted as the most urbanized watershed with significant runoff impact among the forty subwatersheds of the Muskegon River watershed. As of 1978, the land use distribution of LMR was 24.1% urban, 13.3% agriculture, 42.4% forest, 8.8% grass, 10.8% water, with the remainder (0.6%) in bare soil.

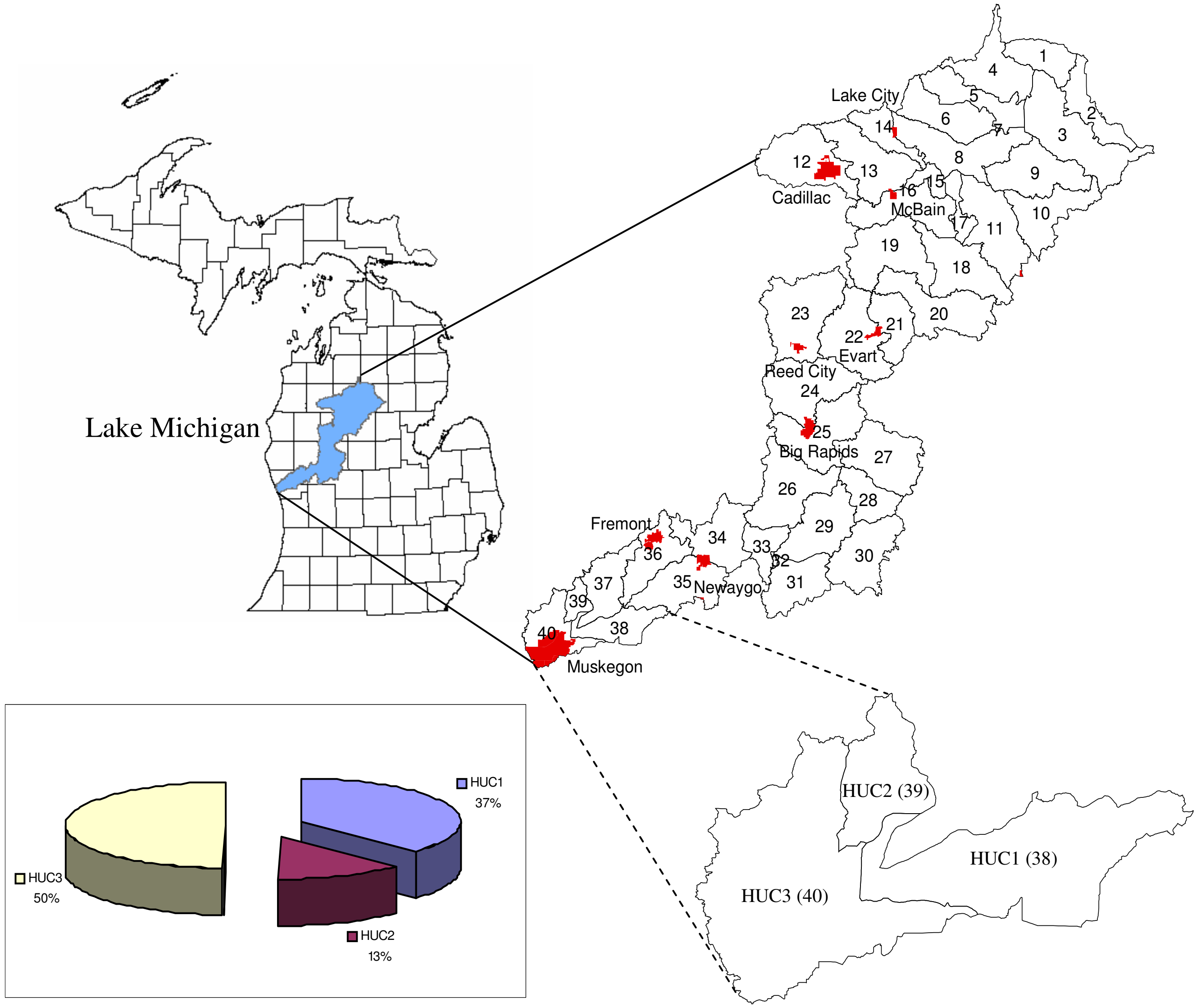

Figure 2. The Location of the Little Muskegon River Watershed and the Area Distribution of HUCs. The dark areas shown in the Muskegon River Watershed are cities.

Enhancement of the Long-Term Hydrologic Impact Assessment (L-THIA) model

The Long-Term Hydrologic Impact Assessment model, LTHIA (Harbor, 1994; Pandey et al., 2000), was enhanced and then employed for runoff optimization in this study. The L-THIA model is a straightforward assessment tool that provides estimates of changes in runoff, recharge, and NPS pollution resulting from past or proposed land-use changes (Harbor, 1994). It gives long-term average annual runoff and NPS pollutants for a land use configuration based on actual long-term climate data, soils, and land-use data for an area (Figure 3). The core of the model is based on the Curve Number (CN) method (NRCS, 1986), a widely applied technique for estimating the change in discharge behavior as a watershed undergoes urbanization. Pollutant loading rates are used to quantify NPS pollutants (Pandey et al., 2000). By applying the method to actual and proposed urban developments, the long-term effects of past, present, and future land use can be assessed (e.g., Leitch and Harbor, 1999, Minner et al., 1998, Bhaduri et al., 2000). A detailed description of the model structure and approach can be found in Harbor (1994), Bhaduri et al. (2000), and Pandey et al. (2000). The L-THIA model is freely accessible in web-based and downloadable GIS versions (http://www.ecn.purdue.edu/runoff/lthianew/).

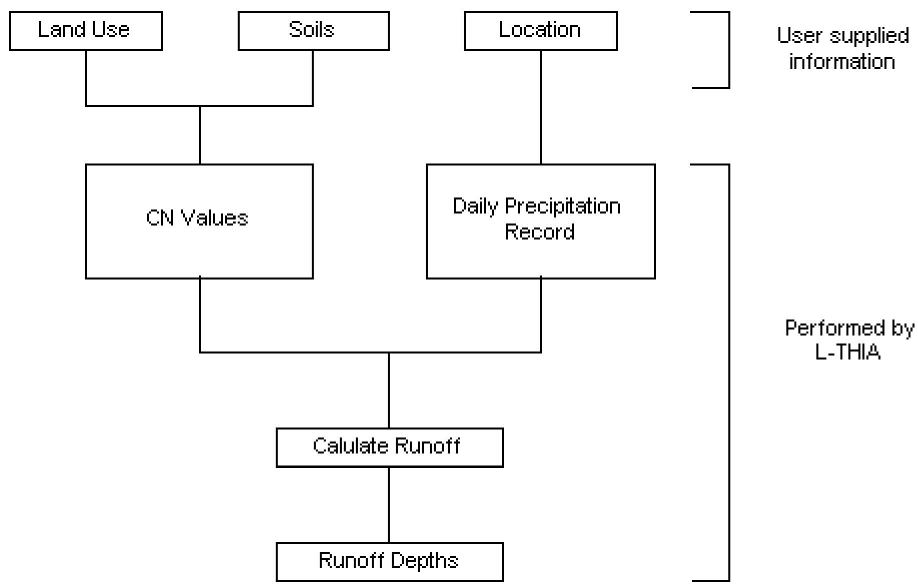

Figure 3. Basic Data Requirements and Components for Analysis in the L-THIA Model (Pandey et al., 2000).

Making use of data that are readily available to the public, the L-THIA model can be used to assess the relative impacts of past, present, and alternate future land management decisions. However, the L-THIA model is not capable of evaluating a development plan with respect to its potential minimum and maximum levels of impact. This research extended the capabilities of the existing and widely used web version of the L-THIA model by developing a runoff optimization component called ROMIN (RunOff MINimization). ROMIN applies a simple model with only an area constraint and a straightforward solution algorithm to provide general estimates of minimum runoff impacts due to land use change.

Principal findings and significance:

Both historical and projected urban development in the LEC and LMR watersheds increase runoff significantly. This impact can be minimized by careful land use planning. Runoff increase can be reduced as much as about 4.9% from 1973 to 1997 in the LEC watershed which is almost totally urbanized, with 95% urban cover in 1997. The reduction of runoff increases from projected development will be as much as 12.3% and 20.5% for the non-sprawl and sprawl scenarios, respectively, in the entire LMR watershed from 1978 to 2040. The magnitude that runoff can be minimized depends on site specific land use types, soil properties, and the urbanization level of a watershed. The influence of urbanization can be generally expressed in two ways. On the one hand, with the increase of urban proportion within a watershed, its impact will be generally expected to increase and therefore the room to minimize this impact also increases potentially. On the other hand, when urban becomes the predominant land use in the area, the available non-urban areas become limited and the possibility and room to minimize the runoff impact will be very small. This was the case in the LEC watershed. Urban uses made up about 50% of the total watershed area in 1973. By 1997, the urban proportion increased to 95% of the total area. The available non-urban area for planning in 1997 was thus only 5%. Although the runoff increase due to development is as large as 69%, it can only be reduced by 4.9%. Therefore, land use planning at an early stage of development is much more effective. Few future planning options exist if urbanization trends continue.

The optimization component of the enhanced L-THIA, ROMIN, satisfied the need for an inexpensive computation approach required by the web executable L-THIA model. It also established the basis for the enhanced L-THIA to be an easy-to-use and easy-to-access land use planning tool. However, it has limitations compared to more sophisticated and computationally expensive spatial optimization models (Wright et al., 1983; Minor and Jacob, 1994; Williams and ReVelle, 1996; Brookes, 1997; Lin and Kao, 1999). In particular, the resultant optimal placement of proposed land uses on available land use and soil group patterns may not be contiguous because the model does not have a constraint for contiguousness to force spatially connected development. Such solutions may not be realistic for development in some cases, but the optimization approach would allow proposed solutions in such instances to be evaluated with respect to the optimal and worst case development scenarios. To overcome this limitation, on-going research efforts employ a multiobjective spatial optimization model with constraints including contiguousness, compactness, and shape, to allocate proposed land uses. However, this spatial optimization model is a computationally expensive solution algorithm, which means that the user must accept relatively lengthy computation times before a result is produced.

The enhanced L-THIA model assumes proposed urban development occurs only in non-urban land use, as it is a major development style in urban sprawl. This assumption can be removed if a more comprehensive analysis of land use change, including urban to urban change, is required.

The estimated runoff impact for the LEC and LMR watersheds in this study are potential minimums and maximums that do not account for regulatory or other social or economic restrictions on the placement of development which would modify the optimization results. For example, a farm land protection regulation may restrict development on agricultural land, which may increase the estimated minimum runoff increase. A wetland protection regulation may restrict development in wetland areas, which may reduce the estimated maximum runoff increase. Since the enhanced L-THIA model provides the option that allows users to specify restricted land uses, the effects of regulation that consider land use protection can certainly be considered when necessary.

The results of this study have significant implications for urban planning. They suggest that even relatively simple internet-accessible tools can provide significant guidance regarding the potential reductions in runoff that can be achieved if urbanization locations are selected to minimize runoff changes. The runoff model L-THIA enhanced by the optimization technique provides a decision support capability that can be used by land use planners and other decision makers to identify land use plans that minimize runoff for a desired set of land uses. As a result, planners and developers could modify the location of proposed land use changes to reduce environmental impacts. In other instances planners and developers may wish to compare the impact of proposed development to the optimal situation. Regulations could presumably be developed based on the results of this work that require land use plans to minimize impacts on runoff, or incorporate best management practices that would allow the area they wish to develop to achieve runoff levels that are comparable to the optimal location for the planned development.

Information transfer activities:

1. Submitted to JAWRA (Journal of American Water Resources Association): *Minimizing the Impact of Urbanization of Long-Term Runoff*
   Z. Tang, B. A. Engel, K. J. Lim, B. C. Pijanowski, and Jon Harbor[1]

   [1] Respectively, Research Assistant, Dept. of Agricultural and Biological Engineering, Purdue University; Professor, Dept. of Agricultural and Biological Engineering, Purdue University; Post-Doctoral Research Associate, Dept. of Agricultural and Biological Engineering, Purdue University; Associate Professor, Dept. of Forestry & Natural Resources, Purdue Universit; Professor, Dept. of Earth & Atmospheric Sciences, Purdue University.

2. The L-THIA model is freely accessible in web-based and downloadable GIS versions (http://www.ecn.purdue.edu/runoff/lthianew/).

Students supported:

Ms. Zhenxu Tang, graduate student, Department of Agricultural and Biological Engineering.

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Soil and Mineralogical Processes Involved in Septic System Failure

Basic Information

Title:	Soil and Mineralogical Processes Involved in Septic System Failure
Project Number:	2003IN112B
Start Date:	3/1/2003
End Date:	2/28/2004
Funding Source:	104B
Congressional District:	4 & 6
Research Category:	None
Focus Category:	Non Point Pollution, Waste Water, None
Descriptors:	None
Principal Investigators:	Brad Lee, Brad Joern

Publication

Soil Mineralogical Processes Involved in Septic System Failure

Problem and Research Objectives

Septic systems serve as the wastewater treatment system for 25% of the United States population. However, 10 to 20 percent of these systems are in failure. Often these failures are attributed to homeowner negligence and lack of maintenance. Typically these negligence induced failures occur after several years of use. In contrast, septic systems that fail very early after being properly installed and inspected by the health departments may not be the result of homeowner negligence, but rather the soils where the prescribed septic system was installed. A recent survey of county health departments throughout the state indicates that soils are the major reason for septic system failure.

The Indiana State Department of Health (ISDH) has utilized a prescriptive regulatory code (Rule 410 IAC 6-8.1) since 1990 for septic system management, which relies on proper design and assumes that a system is functioning adequately if designed properly. As with codes established in many other states, the soil absorption field design relies on inferred soil hydraulic conductivity from field evaluation of soil texture and soil structure, without input from other soil parameters such as soil dispersion characteristics or soil mineralogy. We propose to compare the measured hydraulic conductivity of typical soils in northeastern Indiana to the current design code.

Methodology

Eight similar pedons along a transect from Allen County to Grant County on the Bluffton Till Plain in northeastern Indiana were sampled and described according to NRCS standard procedures. Soil samples were collected by horizon and analyzed for chemical, mineral, and physical properties. Hydraulic conductivity was evaluated in the field at incremental depths from the surface horizon to the unweathered glacial till in 4 distinct zones (surface horizon, top of the argillic horizon, transition zone between solum and parent material, and parent material). The transition zone is the most critical depth in northeastern Indiana as this zone starts at ~ 0.6 m deep, the depth of a typical conventional trench septic system. The hydraulic conductivity of the soil was compared to the soil loading rates prescribed by the Indiana State Department of Health.

Principal Findings and Significance

The variability of the soil hydraulic conductivity was greatest at the surface and decreased with depth. This trend was most likely due to the large cracks near the soil surface. The hydraulic conductivity decreased with depth from the surface to the dense glacial till parent material. Hydraulic conductivity of the transition zone (~ 0.6 m to 1.0 m deep) ranged from 0.02 – 0.87 cm h^{-1}. The top of the argillic horizon had a greater hydraulic conductivity, ranging from 0.30 to 1.29 cm h^{-1}. These results suggest that shallower soil absorption field trenches may have a lower failure rate due to a greater soil hydraulic conductivity in the top of the argillic horizon.

Information Transfer Activities

This information was provided to the Indiana State Department of Health during several meetings with the Indiana Association of Professional Soil Classifiers, the Indiana State Department of Health, and the Indiana Environmental Health Association – Wastewater Management Committee. This new information has been interpreted by state health officials and incorporated into the promulgated Rule 410 IAC 6-8.2, Residential Onsite Sewage Disposal Systems.

Students Supported

Two undergraduate students and a graduate student have been supported by these funds. Current and ongoing work by the graduate student includes a detailed mineralogical evaluation of the soils to determine the soil shrink-swell potential and dispersion in waters with varying ionic strengths.

Septic System Permit Database

Basic Information

Title:	Septic System Permit Database
Project Number:	2003IN129B
Start Date:	1/1/2003
End Date:	1/1/2003
Funding Source:	104B
Congressional District:	4
Research Category:	Ground-water Flow and Transport
Focus Category:	Groundwater, Law, Institutions, and Policy, Waste Water
Descriptors:	
Principal Investigators:	, Brad Lee

Publication

Septic System Permit Database

Problem and Research Objectives

There are an estimated 800,000 residences and small businesses in Indiana that depend on soil wastewater infiltration systems (SWIS) for the treatment and disposal of their wastewater. Approximately 15,000 SWIS permits are issued each year. Most of the data included on these permits have been archived in paper format and not easily accessible or integrated with other water quality and natural resource database information. Many county health departments continue to use this format because there is not a feasible alternative due to time constraints, staff requirements, and inadequate computer skills.

Our objective was to develop an updated, spatially referenced septic system permit database.

Methodology

Develop a septic system permit database that will utilize geographic information systems (GIS), global positioning systems (GPS), and portable computers to improve the accuracy and efficiency of current septic system permit databases.

The hardcopy septic system permit forms were converted to digital format using ArcPad (Environmental Systems Research Institute, Inc.) and a GPS to input coordinate locations of septic system components on a handheld computer. This spatially referenced information collected onsite can then uploaded to a county septic system permit database developed in Access (Microsoft). For those counties that have GIS, the spatially referenced septic system permit database can be converted to a datalayer.

Principal Findings and Significance

The Hendricks County Health Department began beta test the system with a sample population in May of 2004. Feedback to date has been positive, suggesting that the database has potential to replace the hardcopy permitting system.

Through discussions with various groups including the Indiana Environmental Health Association – Wastewater Management Committee, Indiana Onsite Wastewater Professionals Association, and the Indiana Land Resources Council Rural Wastewater Task Force, other counties including LeGrange, Howard, and Elkhart Counties have expressed interest in testing the beta version of the software.

Information Transfer Activities

The database has been presented to the following groups: Indiana Environmental Health Association, Indiana Onsite Wastewater Professionals Association, and the Indiana Land Resources Council.

Students Supported

Support contributed to a published laboratory exercise developed by a graduate student for AGRY 399V, Soils and Land Use.

Stout, H.M., and B.D. Lee. 2004. Land use planning exercise using geographic information systems and digital soil surveys. J. Nat. Res. Life Sci. Educ. 33:11-15.

Phosphorus Deposition in an Agricultural Drainage Ditch and

Basic Information

Title:	Phosphorus Deposition in an Agricultural Drainage Ditch and
Project Number:	2003IN132B
Start Date:	12/1/2003
End Date:	12/1/2004
Funding Source:	104B
Congressional District:	4
Research Category:	Water Quality
Focus Category:	Water Quality, Wetlands, Nutrients
Descriptors:	
Principal Investigators:	George Parker

Publication

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Phosphorus Deposition in an Agricultural Drainage Ditch and Constructed Wetlands System

Problem:

The Midwest agricultural area, including Indiana has been identified in numerous national studies as contributing some of the highest concentrations of total nitrogen and total phosphorus to streams and rivers. In addition to local and regional water quality problems, export of nutrients from the Midwest has been linked to hypoxia in the Gulf of Mexico. Continued expansion of confined feeding operations for livestock production with consequent increases in animal waste management difficulties will lead to further increases in nutrient non-point source pollution. Although changes in farm practices can help mitigate nutrient export, other approaches including creating and restoring wetlands and riparian buffers will be necessary to effect significant improvements in water quality.

Methodology

Sediment sampling sites. Thirty-five composited sediment samples will be collected from the headwaters of Marshall Ditch and the experimental constructed wetlands in one sampling round. Each sediment sample will be a composite of five sub-samples, in order to adequately characterize each sampling site. The five streambed sampling sites will be: 1) upstream of the Dairy Farm gage station weir, 2) halfway between the gauging station and the constructed wetlands, 3) immediately upstream of the wetland pumps, 4) upstream of the output from the wetlands, and 5) downstream of the output from the wetlands. Three sites will be sampled in each of the two sediment traps (6 total). The sites will be located in a path from the pipe discharging water into the traps, to the pipe feeding water into the first set of wetland cells. Water depth of the sediment traps will be measured at the time of sampling. Three samples will be taken across the width of each end of the four wetland cells (total of 24).

Sediment sampling methods. At most ditch sites, water levels will be low enough that sediment samples can be collected using a spoon or scoop, composited in a stainless steel bowl, and placed into 2, 1-L, wide-mouth, acid-washed Nalgene bottles. Excess water will be removed with a syringe. Temperature, pH, dissolved oxygen, and conductivity of water will be recorded during sample collection at each site. Due to water depth, sediment trap sites and potentially some wetland cell sites may require the use of a tube sampler to retrieve sediment samples. Once collected, samples will be placed on ice for transport back to the limnology laboratory, where they will be packaged and shipped to the contracted analytical lab within 24 hours. The contracted certified soil lab will analyze the samples for orthophosphorus (Bray), total phosphorus (EPA, digestion, ICP), and grain size (hydrometer).

Temperature monitoring. Bottom sediments of the gravel cell and surface water cell will be monitored using programmed Optic Stowaway temperature probes on a 4-hour data storage interval.

Water sampling. Water samples of the spring flush of the wetlands will be collected using programmed ISCO automated water samplers. Samples will be analyzed for major anions, TKN, TP and TSS at the Limnology Laboratory, Department of Forestry and

Natural Resources, Purdue University. YSI multi-parameter probes will be attached to the ISCO samplers to monitor temperature, pH, dissolved oxygen, and conductivity during the spring flush event.

Principal Findings and Significance

This project was designed to provide information on the value and effectiveness of constructed wetlands in the removal of nutrient non-point pollution in an agricultural watershed. Total phosphorus concentrations were elevated in sediments upstream of the Dairy Farm gage station weir and in the two sediment traps of the constructed wetland system. Concentrations in sediments of the gravel cell were higher than in the surface water cell, reflecting slower flow rate and longer residence time. Information from this study, in conjunction with previous data on the functioning of the wetlands, will aid in determining the most effective wetland design and placement for reducing the export of nutrients from the agricultural watershed.

Information Transfer Activities

As part of the Indian-Pine Natural Resources Field Station, this project has provided opportunity for both graduate students and undergraduate assistants to be trained and participate in a variety of data collection, processing, and interpretation.

Information Transfer Program

This workshop was sponsored by the IWRRC and the Environmental Sciences & Engineering Institute and called to examine the value of constructed wetlands as systems for filtering non-point source nutrients. The morning session included several presentations on the use and efficiency of constructed wetlands in the midwestern United States. Professor William Mitsch of The Ohio State University presented the Keynote lecture: Restoring the Mississippi River Basin with Wet Lands: Local and Gulf of Mexico Benefit.s. Additional topics presented include: regulatory aspects of constructed wetlands used as waste treatment options; wetlands engineering; and hydrologic issues related to development. An informal discussion and poster session followed the presentations. After lunch, the design, operation, and value of constructed wetlands were examined in a field tour of local projects:

Animal Sciences Farm: These experimental wetlands were constructed to examine their effectiveness in removing non-point source nutrients from agricultural runoff in Marshall Ditch. A portion of the water is pumped from the ditch into two sediment traps, water then flows by gravity through two parallel series of wetland cells, and is returned to the ditch. A second source of water is relatively low-nutrient concentration water from the Aquaculture Center discharge tile.

Animal Sciences Swine Research Center Lagoons : Aquatic Engineers, Inc. is beginning to test their ECO-Wheel© filtration system for effectiveness in treating high-nutrient agricultural waste water. Water from the swine lagoons is being pumped through the Eco-Wheel system set-up in the trailer. The system uses algae grown on wheels to remove nutrients, carbon and suspended solids, and generally improve water quality. Input and output water quality parameters will be tested and the type and quantity of algae produced will be determined.

Purdue Kampen Golf Course Constructed Wetlands: Purdue Universitys Kampen golf course is part of the Birck Boilermaker Golf Complex located on the North edge of the Purdue West Lafayette campus. Re-design of the course provided the opportunity to address concerns about potential, but unknown golf course related non point-source (NPS) pollution to the highly-valued bordering natural wetland, known locally as the Celery Bog. Additionally with the planned re-design came the opportunity to address untreated runoff from the adjacent urban area that was previously tiled under the golf course directly to the Celery Bog. An innovative treatment system consisting of constructed wetlands and water re-cycling for irrigation was designed to treat the combined urban and golf course runoff with the idea that the approach could serve as a model for the development of dual-use best management

The IWRRC director, Dr. Ronald Turco is an active member of the Indiana Triennial Review, a board established to review the states water quality standards. The workgroup consist of representatives from the regulated community, academia, environmental groups, and state and federal agencies. Dr. Turco also serves as a member of the E Coli Task Force and the states TMDL Task Force. Dr. Turco and R. Filley gave a presentation entitled E coli: Seasonal vs. Year-round Disinfection to the Indiana Department of Environmental Management

Along with a committee from Purdue and the State of Indiana, Dr. Lovejoy is developing the agenda and corrdinating a conference to be held in Indianapolis to provide local Indiana policy makers with the best information and knowledge about the role water resources play in their efforts to promote economic development and improve the quality of life for citizens in their local jurisdiction. . This effort will produce a significant summit and opportunity for individuals from the environmental community to interact and exchange ideas. We will use focus sessions, a research poster session and general talks to engage the widest array of individuals. The goal of the meeting is to resolve tension of the implementation of TMDLs, and water usage issues. All presentations and underlying data sets will be compiled onto a searchable CD to further the dissemination of the information and allow for other researchers and policymakers to examine the logic behind researchers conclusions. These CDs will be provided to all attendees to the Hoosier Water Summit and additional copies will be available for those unable to attend and along with abstracts and key papers will be made available at our website.

Hoosier Water Summit

Basic Information

Title:	Hoosier Water Summit
Project Number:	2003IN113B
Start Date:	3/1/2003
End Date:	2/28/2004
Funding Source:	104B
Congressional District:	4
Research Category:	None
Focus Category:	Water Supply, Non Point Pollution, Water Quality
Descriptors:	None
Principal Investigators:	Stephen Lovejoy, Stephen Lovejoy

Publication

Hoosier Water Summit

Statement of critical regional or state water problem

We all know the importance of adequate supplies of water for households, communities and industries. Most also realize the necessity of cleaner water for industrial production, drinking water and more robust eco-systems. But what do we know about the "state of Indiana's water resources"? Has water quality been getting better? If so, how much better? How is that measured? Is water quality only measured by chemical concentrations or also by some biological indices? Where do we still have impaired waters? What is causing the impairment? Can we change that impaired status? Are there alternative methods to meet our water quality objectives? If so, what are the trade-offs? Indiana has not had a significant conference concerning water resources in some ten years.

While government agencies (federal, state and local) and academics have collected massive amounts of data and performed substantial analysis of the water quality causes and consequences of our activities, there has not been an adequate format to communicate this information and knowledge to the general public. This symposium will bring together the various constituencies to illustrate what we know and how that information can be useful in assisting local decision makers in their attempts understand the current water quality situation, with a format to discuss future implications of improving the quality of Hoosier water, promoting economic development and complying with federal mandates.

The focus will be on the implications of the data and analysis for real world local decision-makers as they grapple with a variety of water issues. These issues include drinking water safety, POTW upgrades, combined storm/sewer systems, industrial sources of water pollution, nonpoint sources of pollution, land use questions, water quality implications for recreation and tourism and ecological integrity.

Statement of results/benefits

The summit will be a combination of presentations and discussion groups to assist in understanding how local decision makers can utilize the best scientific information in their deliberations and how the scientific community can look ahead to future information needs. Technical researchers and decision makers will discuss the background for water quality decisions, the status of the water quality indicators (chemical and biological), the future constraints and how Indiana can satisfy the demands of Hoosier citizens for clean water, economic growth and a myriad of other goods and services.

Audience: local policy makers (elected or appointed officials from government, economic development agencies, community groups); government agency personnel, scientific community,

. County commissioners
. Surveyors, city engineers
. Local health department officials
. Mayors
. City water and sanitation administrators
. Indiana SWCD's
. IDNR, IDEM

. Farm Bureau, state and local
. Water Resources Research Center (associated researchers)
. IN Dept of Commerce
. IN Commissioner of Ag

Expected deliverables

Along with a committee from Purdue and the State of Indiana, Dr. Lovejoy will develop the agenda and arrange for the conference to be held in Indianapolis. This effort will produce a significant summit and opportunity for individuals from the environmental community to interact and exchange ideas. We will use focus sessions, a research poster session and general talks to engage the widest array of individuals. The goal of the meeting is to resolve tension of the implementation of TMDLs, and water usage issues. All presentations and underlying data sets will be compiled onto a searchable CD to further the dissemination of the information and allow for other researchers and policymakers to examine the logic behind researchers' conclusions. These CDs will be provided to all attendees to the Hoosier Water Summit and additional copies will be available for those unable to attend and along with abstracts and key papers will be made available at our website.

Student Support

Student Support					
Category	**Section 104 Base Grant**	**Section 104 RCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	0	0	0	0	0
Masters	0	0	0	0	0
Ph.D.	2	0	0	0	2
Post-Doc.	1	0	0	0	1
Total	3	0	0	0	3

Notable Awards and Achievements

Dr. Brad Lee and Larry Thellar have developed a septic system permit database that utilizes a GIS, global positioning systems (GPS), and field computers to improve the accuracy and efficiency of current septic system permit databases. The resulting septic system permit datalayer can be integrated into a larger multilayer spatial database for planning purposes by local decision makers. The Hendricks County Health Department will beta test the system with a sample population and provide feedback so that improvements can be integrated into the final product. The resulting database will be available for use by other county health departments throughout the state. As more and more counties develop a countywide geographic information system (GIS), there are opportunities to incorporate the septic system permit database into the county GIS to aid in the land use decision making process.

Publications from Prior Projects