

VFC Index - Watershed (Plan)

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Fayette County Watershed Initiative

Sponsored by:
The Fayette County
Soil and Water Conservation District

Garrison Creek Watershed Management Plan



The Fayette County Watershed Initiative is a partnership of concerned citizens dedicated to fostering a healthy environment by assessing the natural resource conditions within Fayette County, developing and implementing watershed management plans and providing water quality education to Fayette County Citizens.

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Community Education Coalition

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Natural Resources Conservation Service

Fayette County Farm Bureau

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I. Introduction

In the Fall of 2000, the Fayette County Soil and Water Conservation District (FCSWCD), submitted a Section 319 Grant Application to the Indiana Department of Environmental Management (IDEM) to implement a 2-year public input process and develop a watershed management plan for the Garrison Creek watershed. Section 319 of the Federal Clean Water Act provides funding for various types of projects that work to reduce nonpoint source (NPS) water pollution.

A two-year grant in the sum of \$89,000 was awarded to the FCSWCD from the US Environmental Protection Agency (EPA) and the Indiana Department of Environmental Management (IDEM). The grant period was from June 2, 2001 through September 1, 2003. The Section 319 grant included the following requirements:

1. Hire a Watershed coordinator,
2. Organize a local Steering Committee,
3. Evaluate the water quality conditions of the Garrison Creek Watershed,
4. Develop a watershed management plan that meets the requirements of the IDEM's checklist titled, "What Needs to be in a Watershed Management Plan Checklist".

The FCSWCD Board of Supervisors chose to hire contract personnel to serve in the role of "watershed coordinator". The FCSWCD entered into a sub-contractual agreement with a professional environmental staffing company, Goode & Associates, Inc., whose specialty is water quality management, policy analysis, and watershed coordination. This subcontract allowed for twenty-one (21) months of coordination, meeting facilitation, water quality field sampling, map preparation, and various related coordination and management services. Goode & Associates, Inc. provided a watershed coordinator and a supporting watershed coordination team (referred to throughout this document) consisting of a land use planner, a biologist/water quality chemist, an agricultural specialist, a local government policy and regulatory specialist, and a Geographical Information Systems (GIS) mapping and database specialist. The lead representative from the watershed coordination team is referred to throughout this document as the "watershed coordinator."

The watershed coordination team drafted the Garrison Creek Watershed Management Plan, which meets the checklist requirements of the "What Needs to be in a Watershed Management Plan" FFY 2003.

What is Watershed Management and Planning?

Historically, water quality management focused solely on individual wastewater discharges from municipal and industrial facilities. These wastewater discharges are classified as "point" sources of pollution (PS). However, watershed planning and management take a broad, holistic approach to water quality issues by focusing on all potential sources of pollution with an emphasis on polluted runoff or nonpoint pollution sources. Funds for this grant are limited to nonpoint source (NPS) pollution.

NPS pollution stems from a variety of sources and is often the largest source of water pollution in watersheds. NPS pollution occurs when rain, snowmelt, or other sources of water runs off the landscape while picking up and carrying pollutants to nearby streams, rivers, lakes, and groundwater supplies. The level of NPS pollution carried to waterways is directly related to the land use and land management practices occurring within a given watershed.

Watershed management involves a wide variety of activities, including: the identification and assessment of land use and land management practices, the identification of priority areas and problems, promoting the involvement of interested and affected stakeholders, and developing and implementing strategies to address NPS pollution sources.

Watershed management is being widely adopted across the United States and is heavily endorsed by the Environmental Protection Agency (EPA) and other public and private organizations concerned with water quality. In fact, by developing watershed management plans, targeted areas become eligible for funding to implement a wide array of water quality related projects. Funding sources include, but are not limited to, the Indiana Department of Environmental Management, the Environmental Protection Agency, the Indiana Department of Natural Resources, and the United States Department of Agriculture.

Watershed Maps & Location

The Garrison Creek watershed is 1 of 32 14-digit hydrologic unit code (HUC) watersheds located in the Whitewater River Basin in East Central Indiana (HUC 05080003040100) (Figure 1-1). The United States is divided and sub-divided into successively smaller hydrologic units, which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system. A HUC is simply the address of a particular watershed (USGS, 2003).

Description and History of the Garrison Creek Watershed

The following is an overview of the physical and cultural characteristics of the Garrison Creek Watershed.

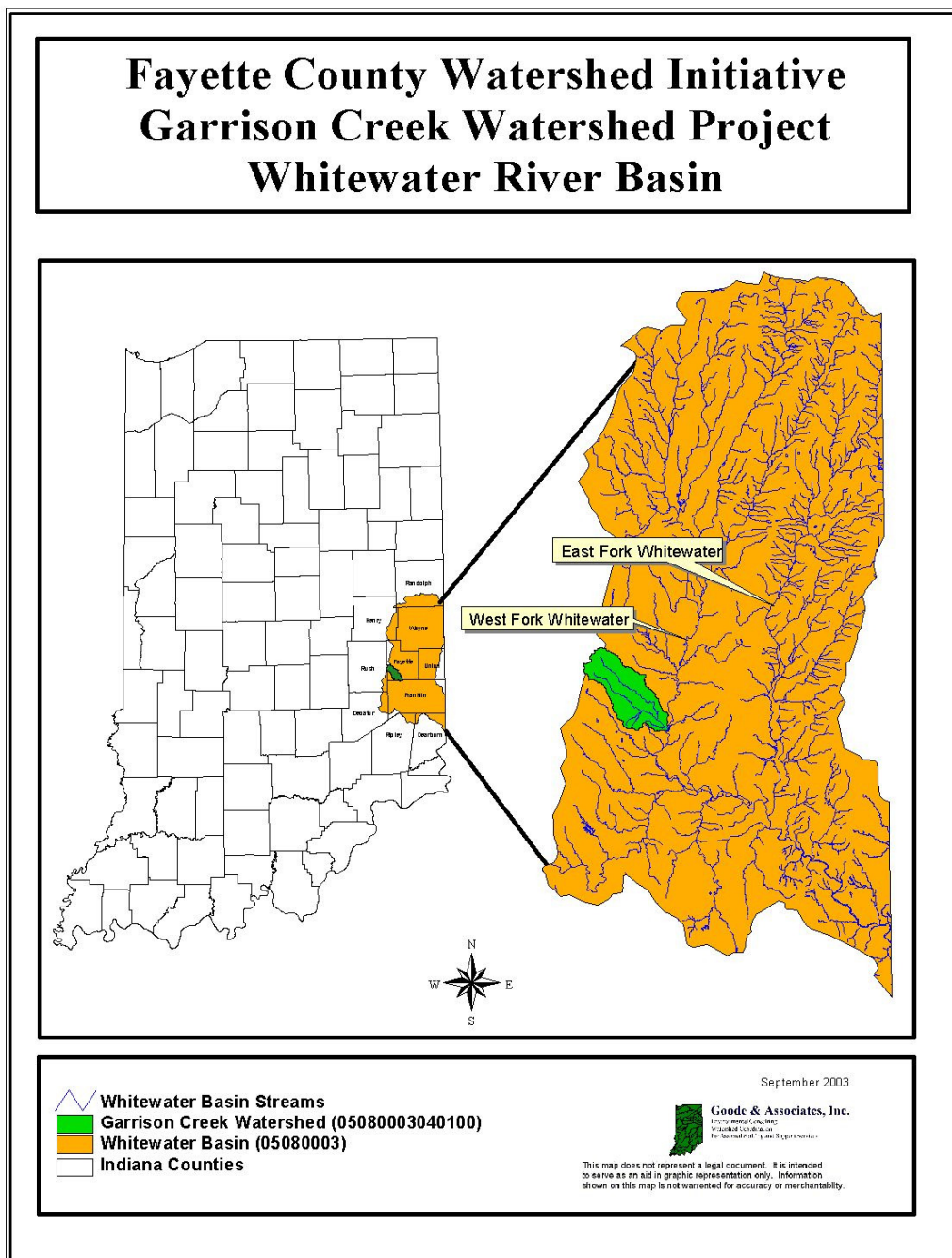
Climate

Fayette County has a continental type of climate. There are erratic changes of temperature within and between the seasons. The winters are moderately cold and the summers are fairly hot and humid. Fayette County has an average frost free period of 155 days with the average date of the last killing frost on May 3rd and an average date of the first frost on October 5th.

Rainfall is fairly uniform throughout the year, but it does vary from season to season. The heaviest rains typically arrive in the spring, which may cause erosion of upland soils

and flooding in the lowlands. As a result, floods are a constant threat to crops on the bottomlands of the Whitewater River and many of its tributaries, including Garrison Creek. Conversely, in some areas crops are frequently damaged by a lack of moisture during July and August, which are typically the regions driest months.

Figure 1-1: Garrison Creek Watershed and the Whitewater Basin



Most of the snowfall takes place during the period from December through March, but the average annual snowfall is limited. The winter season is well known for its rapid changes in temperatures. Sub-freezing temperatures last for an average of 2 to 3 days and are typically followed by short periods of warmer weather. The resulting freezing and thawing effects sometimes cause heaving of the soil and winterkilling of such crops as alfalfa, clover, and winter wheat.

Geography

Fayette County encompasses approximately 215 square miles of land and is located approximately 55 miles east southeast of Indianapolis. The county is bordered by Henry and Wayne Counties on the north, Union County on the east, Franklin County on the south, and Rush County on the west.

The Garrison Creek Watershed consists of 16,583 acres and lies primarily within Fayette County in East Central Indiana with small portions of the watershed extending into Rush County and Franklin County (Figure 1-2). The Garrison Creek watershed encompasses 15,961 acres within Fayette County, 396 acres within Franklin County, and 226 acres within Rush County (Table 1-1). There are approximately 18.5 miles of perennial streams within the Garrison Creek watershed and an undetermined, yet significant, length of drainage ditches, all of which eventually drain to the West Fork Whitewater River.

Table 1-1: Garrison Creek Watershed Acres by County

| County | Acres | % of Watershed |
|---------------|--------------|-----------------------|
| Fayette | 15961 | 96.0 |
| Franklin | 396 | 2.4 |
| Rush | 226 | 1.6 |

The Garrison Creek watershed lies within Columbia and Orange Townships in southwestern Fayette County. Columbia and Orange Townships encompass a few small communities, however, only the community of Columbia lies within the Garrison Creek watershed.

Hydrology

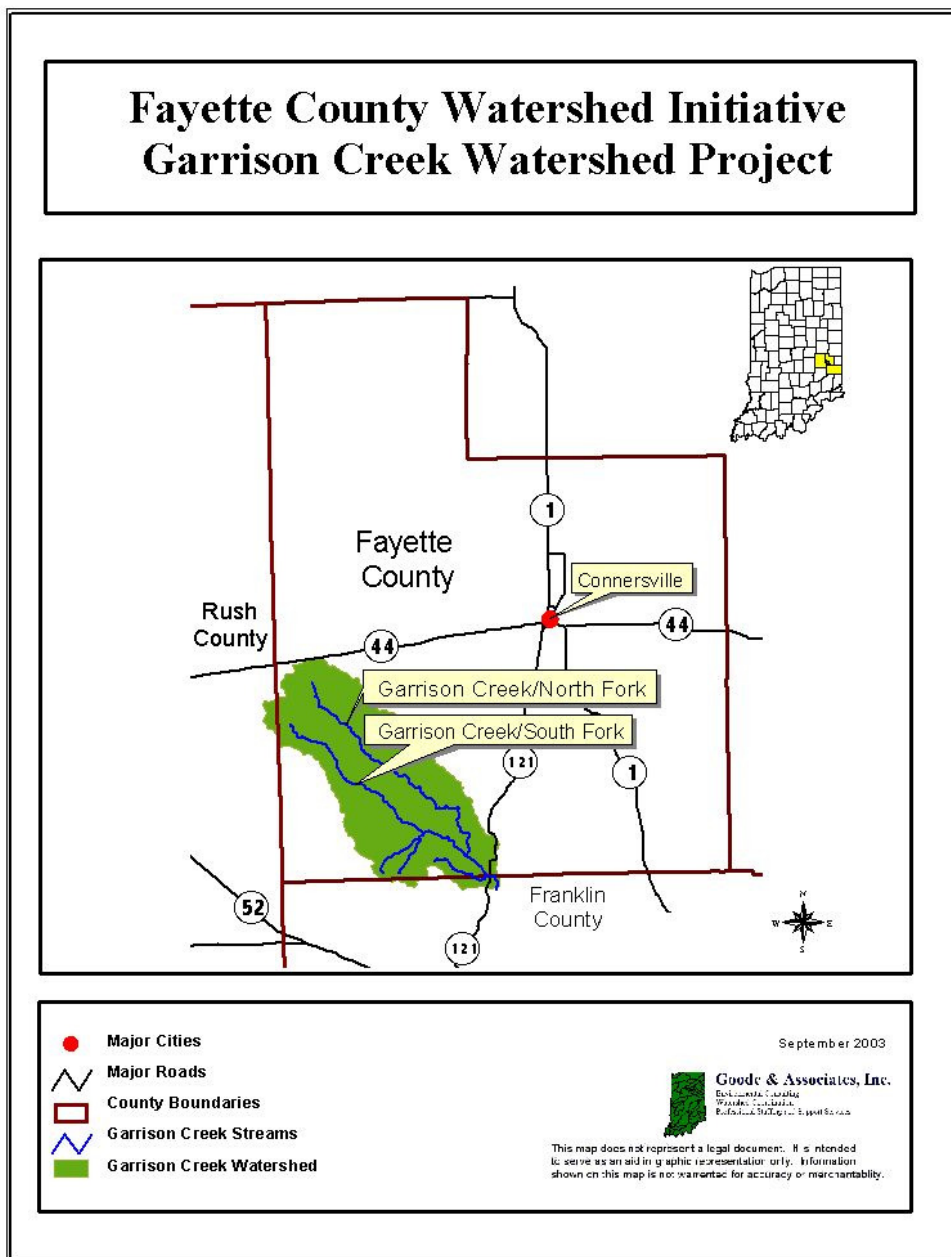
Garrison Creek and its tributaries are small headwater streams that drain the southwestern portion of Fayette County and small portions of Rush and Franklin Counties into the West Fork Whitewater River.

Garrison Creek is not on the state's 303d list. Section 303(d) of the Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards with federal technology based standards alone. States are also required to develop a priority ranking for these waters taking into account the severity of the pollution and the designated uses of the waters. Once this listing and ranking of waters is completed, the states are required to develop Total Maximum Daily Loads (TMDLs) for these waters in order to achieve compliance with the water quality

standards. Indiana's 303(d) list was approved by EPA on February

The Whitewater River rises in Indiana in southern Randolph and Wayne Counties and flows in two main branches, the East Fork and West Fork, which are just 10 miles apart as they flow southward before joining at Brookville. From the Brookville Reservoir, the Whitewater flows southeasterly into Ohio where it eventually joins the Miami River, a tributary of the Ohio River.

Figure 1-2: Garrison Creek Watershed of Fayette County



While there is no true “white water” on the river, there are many rapids due to the steep gradient. The Whitewater is the swiftest river in Indiana, falling an average of six (6) feet per mile (WRAS, IDEM 2002).

The West Fork of the Whitewater River, from Cambridge City to the Indiana/Ohio line, has been classified as an “Outstanding River” by the Indiana Natural Resources Commission (NRC). This stretch of the River extends from Fayette County through Franklin County and into Dearborn County before it reaches the Indiana-Ohio line.

In 1993, the Indiana Natural Resources Commission (NRC) adopted its “Outstanding Rivers” List for Indiana. This listing is referenced in the standards for utility line crossings within floodways, formerly governed by IC 14-28-2 and now controlled by 310 IAC 6-1-16 through 310 IAC 6-1-18. Except where incorporated into a statute or rule, the “Outstanding Rivers List” is intended to provide guidance rather than to have regulatory application (NRC 1997). To help identify the rivers and streams that have particular environmental or aesthetic interest, a special listing has been prepared by IDNR’s Division of Outdoor Recreation. This listing is a corrected and condensed version of a list compiled by American Rivers and dated October 1990 (NRC, 2003).

Geology

The bedrock strata in Fayette County are predominately comprised of limestones, shales, sandstones, and dolomites that stem from Ordovician to the Silurian periods. Silurian limestones and dolomites, with some shales, are found in most of the western third of the county, including parts of the Garrison Creek watershed (Soil and Water Survey, 1967).

Glacial deposits in the Garrison Creek watershed include Illinoian stage drift, Wisconsin stage drift, and Upper Pleistocene undifferentiated materials.

The *Illinoian drift* is composed mostly of till, largely clay which is generally hard and compact, with small areas of sand and gravels in thin beds. The thickness of the Illinoian drift in the Garrison Creek watershed ranges from less than 50 to over 100 feet. (Soil and Water Survey, 1967)

The *Wisconsin drift* includes ground moraine, end moraine, and ice-contact stratified drift. These moraines constitute over one-half of the surface area of Fayette County and are composed mostly of till, with small areas of ice-contact stratified drift and lake sediments. The till is composed principally of clay, sand and gravelly clay, boulderly clay, and sand and gravel. The thickness of the Wisconsin drift varies from less than 50 feet in several areas to over 300 feet (Soil and Water Survey, 1967).

The *Upper Pleistocene* undifferentiated deposits cover the West Fork of Whitewater River Valley. These deposits consist of outwash plain sediments, mainly Wisconsin outwash composed of clay, sandy clay, gravelly clay, boulderly clay, clayey sand and gravel, and sand and gravel. The thickness of these deposits increases from less than 100 feet to 200 feet (Soil and Water Survey, 1967).

Physiography

Fayette County and the Garrison Creek watershed lie within parts of three physiographic units: the Tipton till plain, the Dearborn Upland, and the Muscatutuck regional slope.

The Garrison Creek watershed lays predominately in the Dearborn Upland. The Dearborn Upland is characterized by smooth, steep slopes and long, flat-topped fingers of upland between deeply entrenched valleys. The majority of the valley bottoms within the Garrison Creek watershed are narrow. The upland ranges generally from 950 to 1,00 feet in altitude (Soil and Water Survey, 1967).

Soils

The soils of Fayette County and the Garrison Creek watershed have been developed from glacial materials. The upland soils in the Garrison Creek watershed range from slowly to very slowly permeable. Many of the low-lying soils, along the Garrison Creek channel are composed of granular materials.

The United States Soil Conservation Service (SCS), now known as the Natural Resources Conservation Service (NRCS), in cooperation with the Purdue University, classified Fayette County soils into 12 types, which are grouped into seven classes and three general categories. The three general categories are as follows:

Class I Soils of the flood plains

Class II Soils of the river and terraces and former glacial channels

Class III-VII Soils of the Uplands

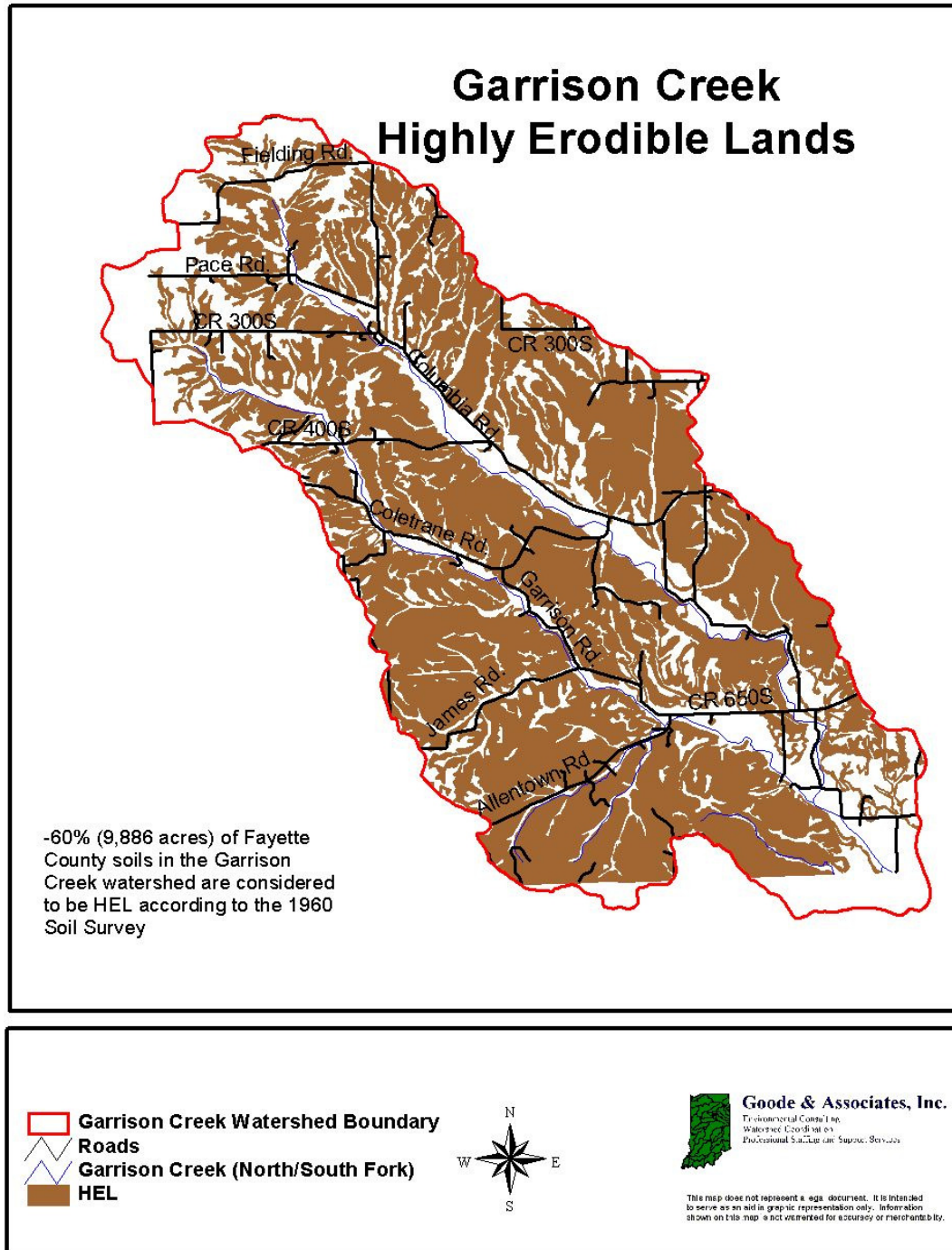
All classes of soils, except Class V, are found within the Garrison Creek watershed. In general, the upland soils (Classes III-VII) present fewer problems to residential and commercial development than do the soils of the flood plains (Class I), but more problems than do the soils of the of the river terraces and former glacial channels (Class II). The suitability of most of the upland soils as sources of topsoil is good and their suitability for foundations for buildings is fair to good. However, the upland soils are not suitable as sources of sand and gravel, their suitability for road sub-grade is fair to poor, and most of them have moderate to severe limitations for septic systems and a moderate to high corrosion potential for metal conduit (Soil and Water Survey, 1967).

Highly Erodible Lands (HEL)

The Natural Resources Conservation Service (NRCS) uses the soil erodibility index (EI) to provide a numerical expression of the potential for a soil to erode considering the physical and chemical properties of the soil and the climatic conditions where it is located. As a result, the basis for identifying highly erodible land is the erodibility index of a soil map unit. The erodibility index of a soil is determined by dividing the potential erodibility for each soil by the soil loss tolerance (T) value established for the soil. The T value represents the maximum "tolerable" annual rate of soil erosion that could take place without causing a decline in long-term productivity.

Figure 1-3 identifies those areas of the watershed that are considered to be highly erodible by the 1960 Fayette County Soil Survey. Approximately 60% or 9,886 acres within the watershed fit the HEL classification.

Figure 1-3: Highly Erodible Lands of the Garrison Creek Watershed



Wildlife in the Garrison Creek Watershed

Fayette County has many of the same wildlife species that exist in the rest of Indiana. For example, deer, rabbit, hawks, owl, raccoon, opossums, coyotes, foxes, and songbirds (such as the American Robin, Starlings, Blackbirds, Flycatchers, etc.) exist in Fayette County in prevalence. In addition, game species such as bobwhite quail, wild turkey, and some ruffed grouse also exist in Fayette County.

Additionally, there are resident populations of Canada Geese and species of ducks including Mallard, Blue-Winged Teal, Scaup, Redhead and Widgeon that migrate through the area as well as Osprey, Sandhill Crane, Woodcocks, several species of hawks and even an occasional bald eagle. All of these species exist as part of a diverse landscape and habitat model in Fayette County. Fayette County is a fairly rural part of the state and as such lends itself to the propagation of the aforementioned species. (IDNR District Biologist, 2003).

Endangered and Threatened Species of Fayette County

There are a number of endangered, threatened, and rare plants and animals that have been identified in Fayette County (Table 1-2). However, the FCWI did not conduct a detailed study to verify these plants and animals are located in the Garrison Creek watershed.

Table 1-2: Endangered and Threatened Species per IDNR Wildlife Biologist

| Species Name | Common Name | State Listing | Federal Listing |
|--|-----------------------|----------------------|------------------------|
| <i>Carex Sparganioides Var cephaloidea</i> | Thinleaf Sedge | Threatened | Not Listed |
| <i>Juglans cinerea</i> | Butternut | Watch List | Not Listed |
| <i>Poa paludigena</i> | Bog Bluegrass | Watch List | Not Listed |
| <i>Utricularia cornuta</i> | Horned Bladderwort | Threatened | Not Listed |
| <i>Plethodon richmondi</i> | Ravine Salamander | Not Listed | Not Listed |
| <i>Aimophila aestivalis</i> | Bachman's Sparrow | Endangered | Not Listed |
| <i>Botaurus lentiginosus</i> | American Bittern | Endangered | Not Listed |
| <i>Dendroica cerulea</i> | Cerulean Warbler | Special Concern | Not Listed |
| <i>Vermivora chrysoptera</i> | Golden-Winged Warbler | Endangered | Not Listed |
| <i>Lynx rufus</i> | Bobcat | Endangered | Not Listed |
| <i>Mustela nivalis</i> | Least Weasel | Special Concern | Not Listed |
| <i>Nycticeius humeralis</i> | Evening Bat | Endangered | Not Listed |
| <i>Taxidea taxus</i> | American Badger | Endangered | Not Listed |

Land Use in the Garrison Creek Watershed

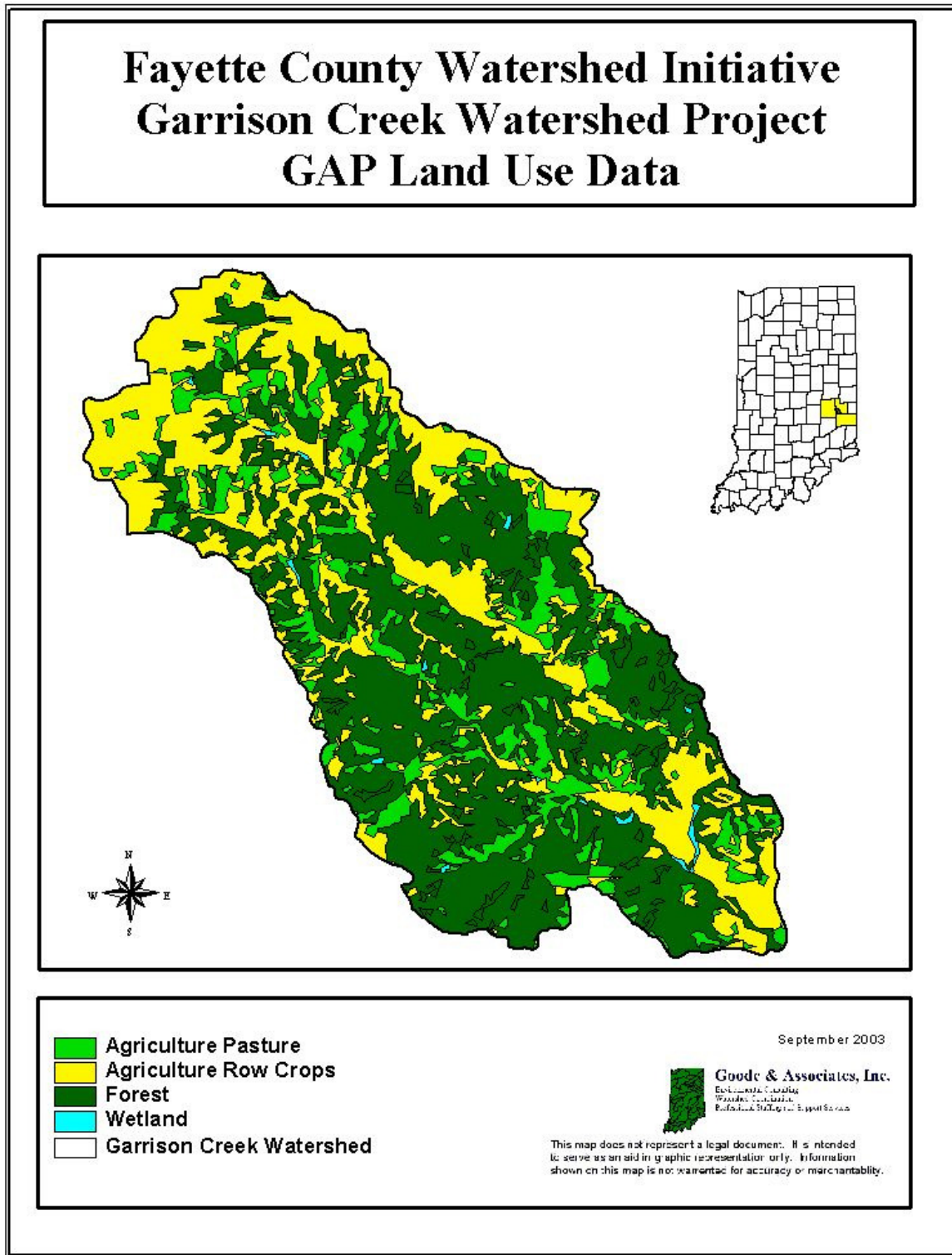
Garrison Creek falls well outside of the urban and industrial regions of Fayette County. The residential areas are limited to the community of Columbia and scattered residents along the county roads of the watershed. Development in the watershed has been slow but there is a steady increase of new residences in both the bottomlands and uplands of the watershed. The watershed is evenly divided between hardwood forests and agricultural lands with a few stands of coniferous forests throughout as well as a small percentage of naturally existing wetlands (Table 1-3 and Figure 1-4).

Table 1-3: Land Use in the Garrison Creek Watershed

| Land Use Types (GAP Datum) | Garrison Creek (05080003040100) | |
|-----------------------------------|--|----------|
| | <u>ACRES</u> | <u>%</u> |
| <i>Pasture</i> | 2688 | 16.2 |
| <i>Row Crop</i> | 5385 | 32.5 |
| <i>Deciduous Forest</i> | 8,409 | 50.7 |
| <i>Coniferous Forest</i> | 24 | .1 |
| <i>Open Water</i> | 0 | 0 |
| <i>Urban High Density</i> | 0 | 0 |
| <i>Urban Low Density</i> | 0 | .02 |
| <i>Wetland</i> | 77 | .5 |
| <i>Total Acres:</i> | 16,583 | |

The U.S. Geological Survey - Biological Resources Division and the U.S. Fish and Wildlife Service are overseeing the National Gap Analysis Program (GAP). In Indiana, Indiana State University and Indiana University are carrying out the Indiana GAP Project that involves an analysis of current vegetative land cover through remote sensing (ISU 2001). This analysis provides vegetative land cover data in 30 by 30-meter grids (Figure 1-4). The following is a summary of vegetative cover in the watershed determined from the GAP image:

Figure 1-4: Land Use in the Garrison Creek Watershed



The majority of the forests within Fayette County are located in the southern half of the county in Orange, Columbia, and Jackson Townships. The Garrison Creek watershed, located in Colombia and Orange Townships, is capable of producing some of the highest quality timber in the world according to Jayson Waterman IDNR District Forester.

The agricultural lands in the watershed involve primarily corn, soybean, wheat, hay, tobacco and cattle production. The majority of the row crop production occurs in those areas where the topography is slightly to gently rolling while cattle and hay production occurs on the more steep slopes, which are not ideal for grain production. The majority of land in the Garrison Creek watershed is privately owned. The one significant natural area within the Garrison Creek watershed is the Mary Gray Bird Sanctuary.

The Mary Gray Bird Sanctuary, a classified nature preserve, is owned and operated by the National Audubon Society. The late Congressman Finley H. Gray and his wife Alice Green Gray gave the Society 752 acres as a living memorial to their daughter who never fully recovered from a childhood illness.

The Indiana Audubon Society is committed to maintaining the Mary Gray Bird Sanctuary not only a sanctuary for birds, but also as a wildlife refuge and as a natural laboratory. Church groups, community groups, clubs, schools, and other organizations use the sanctuary for meetings, conferences, picnics, and nature study.

Cultural History of Fayette County

Fayette County is part of an area originally claimed by the Miami Confederacy of Indiana. In 1795, the Greenville Treaty Line cut through the area and in 1803, the land to the east of the line was ceded to the United States under terms of the Old Boundary Line Treaty. The area west of the line was ceded to the United States as part of the 12-mile Purchase under terms of a treaty signed at Fort Wayne in 1811 (Connersville Chamber of Commerce, 2003).

John Conner, one of the signers of the purchase document, was the first settler in Fayette County. In 1809, Conner opened a trading post along the Whitewater River in an area that later came to be known as Connersville. Conner's trading post attracted more and more settlers who cleared the woodlands of the area to cultivate crops for food. Those settlers opting not to farm the lands opened trading posts or began to operate gristmills, sawmills, or tanneries. In 1817, with a population of 3,000, the county was officially recognized by the State of Indiana and was named in honor of General Lafayette (Connersville Chamber of Commerce, 2003).

The only roads the earlier settlers had were old Indian trails through the forest. The rivers and streams were crossed at shallow fords and the livestock had to be driven to market on foot. An attempt was made to provide transportation by canal, and the first canal boat arrived at Connersville in 1845. The canal provided a means of shipping products such as flour, eggs, apples, bacon, cracklings, lard, and hob bristles. The

boats on the canal were pulled by mules or horses along a path called the towpath. Severe floods, however, destroyed much of the canal, and little use was made of it. The canal was soon after sold at a heavy loss to the Whitewater Railroad for a right-of-way. The Whitewater Canal eventually succumbed to the railroad. In 1863 a railroad company purchased the local canal company and laid tracks along the towpath. The railroad was responsible for catapulting Connersville and Fayette County into the 20th Century as a center of industrial production (Connersville Chamber of Commerce, 2003).

Connersville quickly became known as a “furniture and buggy town” due to the many factories involved in the production of these items. However, once the automobile or horseless carriage was invented, the buggy and wagon were pushed aside. The different automobiles produced in Connersville include: the Lexington, the McFarland, the Cord, the Auburn, and the Empire (Connersville Chamber of Commerce, 2003).

In 1909, the McFarland Carriage Company manufactured the first medium-priced 6-cylinder automobile, the Lexington, in the United States. Not only did Connersville and its people produce the automobiles themselves, they also made nearly all the parts necessary to build a complete automobile. This earned Connersville the title of “Little Detroit.”

The industries in Connersville quickly became the major employers. Among the articles manufactured were automobile parts, dishwashers, kitchen cabinets, refrigerators, heating equipment, caskets and burial vaults, tools, diesel tank and casings, and feed for livestock (Connersville Chamber of Commerce, 2003).

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II. Watershed Planning Process

The two-year Section 319 Grant was awarded to the FCSWCD in September of 2001. Actual watershed planning efforts, however, did not begin until January 2002 when the FCSWCD contracted with Goode & Associates, Inc., a professional watershed coordination team, to manage the project. The lead representative from Goode & Associates, Inc. is known as the watershed coordinator and is referred to hereafter by that title.

In January 2002, the FCSWCD and the watershed coordinator hosted the first public meeting at the Connersville High School to discuss the details of 319 Grant, the concept of watershed planning and, most importantly, to solicit input and participation from the public. Unfortunately, the meeting was not well attended due to a winter storm advisory. There were, however, six (6) individuals in attendance. As a result of the meeting, three individuals volunteered to participate by serving on the Steering Committee.

The watershed coordinator then initiated a search for the remaining necessary Steering Committee members. Based upon recommendations from a variety of individuals, Steering Committee “candidates” were contacted via telephone, e-mail, or through face-to-face interactions and invited to attend a meeting at Roberts Park on February 6, 2002.

The February 6, 2002 meeting involved a presentation given by the Watershed coordinator to discuss the grant, the concept of watershed planning and the importance and necessity of having a group of individuals from the community to serve as Steering Committee members to guide the development of the watershed plan. The meeting was well attended and the majority of those in attendance agreed to participate in the process. Table 2-1 identifies the Steering Committee members who volunteered numerous hours of their personal and professional time to guide this project. The Steering Committee officially gathered for the first time in February 2001 and opted to recognize their efforts as the Fayette County Watershed Initiative (FCWI).

Table 2-1: FCWI Steering Committee Members

| Steering Committee | Representing |
|---------------------------|--|
| Cindy Bernzott | Community Education Coalition (CEC) |
| Gary Breitenbach | Community Stakeholder/Earlham College |
| Ed Herrell | Community Education Coalition (CEC) |
| Bill MacDaniel | Area Plan Commission (APC) |
| Matt Sherck | Fayette County Health Department (FCHD) |
| Darrell Smith | Connersville News Examiner |
| Nicole Viars | Natural Resources Conservation Service (NRCS) |
| Joe Waggener | Community Stakeholder |
| Jayson Waterman | District Forester- Indiana Department of Natural Resources |

Water Quality Issues Identified by the FCWI Steering Committee

The first task of the FCWI Steering Committee was to identify water quality and natural resource issues within the Garrison Creek watershed. The Steering Committee participated in a “brainstorming” exercise to identify potential or perceived water quality issues within the Garrison Creek watershed with the intent of proving or disproving these issues through the assessment phase of this project. The issues identified by the Steering Committee are below in Table 2-2.

Table 2-2: Water Quality Concerns Identified by the FCWI Steering Committee

| |
|---|
| Failing or non-existent septic systems |
| Improper management of livestock and manure |
| Erosion and sedimentation from agricultural fields, pasture, and wood lots |
| Lack of utilization of logging best management practices |
| Lack of public knowledge and understanding regarding the link between land use activity and water quality |
| Uncontrolled development in the watershed |
| Nutrient and fertilizer runoff and infiltration |
| Streambank erosion |
| Lack of water quality data |
| Lack of groundwater supplies |
| Flooding |

As a result of the natural resource concerns identified in Table 2-2, the FCWI Steering Committee developed the following Mission Statement and goals for this project:

FCWI Mission:

The Fayette County Watershed Initiative is a partnership of concerned citizens dedicated to fostering a healthy environment by assessing the natural resource conditions within Fayette County, developing and implementing watershed management plans and providing water quality education to Fayette County Citizens.

FCWI Goals:

1. Educate all watershed residents, landowners and land managers about the importance of protecting water quality, how to protect water quality and how to get involved in community efforts to protect water quality.
2. Minimize erosion and sedimentation originating from all sources (e.g. woodlands, agricultural lands, stream banks and developments)
3. Minimize nutrient loading to surface and groundwater from all sources (e.g. agricultural lands and residential areas)
4. Minimize bacteria loading to surface and groundwater from all sources (e.g. livestock facilities, households, septic systems and pet waste)
5. Minimize toxic chemical discharges to surface and groundwater from all sources (e.g. woodlands, agricultural lands and residential areas)

The Planning Process

Recognizing that time was an issue considering the vast amounts of information necessary to create this plan, the Steering Committee opted to address water quality issues through a systematic process. Based upon the issues identified in Table 2-2, the different land uses in the watershed, the different audiences that exist in the watershed (farmers, forest owners, residents and governmental agencies) and the different mechanisms necessary to address water quality issues (local ordinances, state laws, state and federal programs, etc.) the Steering Committee opted to segment the process into the following subjects:

1. Water Quality
2. Public Education
3. Forestry in the Garrison Creek Watershed
4. Agriculture in the Garrison Creek Watershed
5. Septic Systems in the Garrison Creek Watershed
6. Other Residential Issues in the Garrison Creek Watershed
7. Local Government's Role in Watershed Management

Realizing that the above subjects had the most influence on the water quality conditions of the Garrison Creek watershed, the Steering Committee, with the assistance of the watershed coordinator, investigated and assessed each of these topics, developed strategies based on their findings, and identified resources and funds to implement those strategies.

The remainder of this plan is divided among the seven subjects identified above. The individual sections highlight the current conditions of the resources within the watershed, the different land use practices in the watershed, and the different strategies the Steering Committee devised to address the conditions and land use practices in the watershed. The FCWI Steering Committee felt that by dividing this plan into different subject matters, the plan would be more "user friendly" to the common reader.

Partnerships

Numerous partnerships evolved through the efforts of the FCWI. The different partners played varying roles from providing technical assistance, attending and participating in Steering Committee meetings, writing letters of recommendations for grant applications, etc. Below is a list of the different entities involved in the development of this watershed plan:

- ❑ Stakeholders from the Garrison Creek watershed
- ❑ Fayette County Soil and Water Conservation District (FCSWCD)
- ❑ Natural Resources Conservation Service (NRCS)
- ❑ Community Education Coalition (CEC)
- ❑ Indiana Department of Environmental Management (IDEM)
- ❑ Indiana Department of Natural Resources (IDNR)
- ❑ Fayette County Health Department (FCHD)
- ❑ Connersville Wastewater Treatment Plant

- ❑ Area Plan Commission (APC)
- ❑ Connersville News Examiner
- ❑ Earlham College, Biology Department
- ❑ IU East, Natural Science and Math Division
- ❑ Three Rivers Solid Waste Management District (SWMD)
- ❑ Fayette County Farm Bureau

Public Participation

In order to encourage participation by additional stakeholders, the watershed coordinator developed and submitted press releases to the Connersville News Examiner announcing all FCWI meetings as being open to the public. The Steering Committee met the third Wednesday of each month at 4pm in the Area Plan Commission at the Fayette County Annex. Additional newspaper articles highlighting the FCWI were also published throughout the project.

A series of eight newsletters were developed highlighting this project and urging public participation. Newsletters were placed at the local library, the FCSWCD office, the Community Education Coalition office and at the annual Fayette County Free Fair. The FCWI was also highlighted in the quarterly FCSWCD newsletter that was mailed to over 300 residents within Fayette County. A survey was conducted during the 2002 Fayette County Free Fair to help the Steering Committee identify the level of water quality understanding on behalf of Fayette County citizens. The findings of the survey helped the Steering Committee prioritize their efforts.

A public meeting was held at the beginning and at the end of the planning phase of this project to encourage public participation and public input into the draft document of this plan.

III. Garrison Creek Water Quality Assessment

In an effort to establish baseline water quality data and to determine if the efforts of the FCWI were that of restoration or protection, the watershed coordination team conducted physical, chemical and biological monitoring within the Garrison Creek watershed. The data collected was used to assist in identifying broad, watershed-wide water quality issues and for developing the watershed management strategies discussed throughout the remainder of this document. Water quality monitoring activities were conducted in accordance to the Quality Assurance Project Plan (QAPP) which was developed prior to the initiation of monitoring activities. The QAPP is on file with the IDEM Watershed Management Section.

Monitoring Objectives

Data collected by the study was compared to concentration based water quality standards to identify “hot spots” or priority areas in the watershed where water quality standards are not being met. In addition, the data collected during this study serves as “baseline data” to track changes in conditions of the watershed and may be used in the future to track the success of any watershed management efforts undertaken as a result of this watershed management plan.

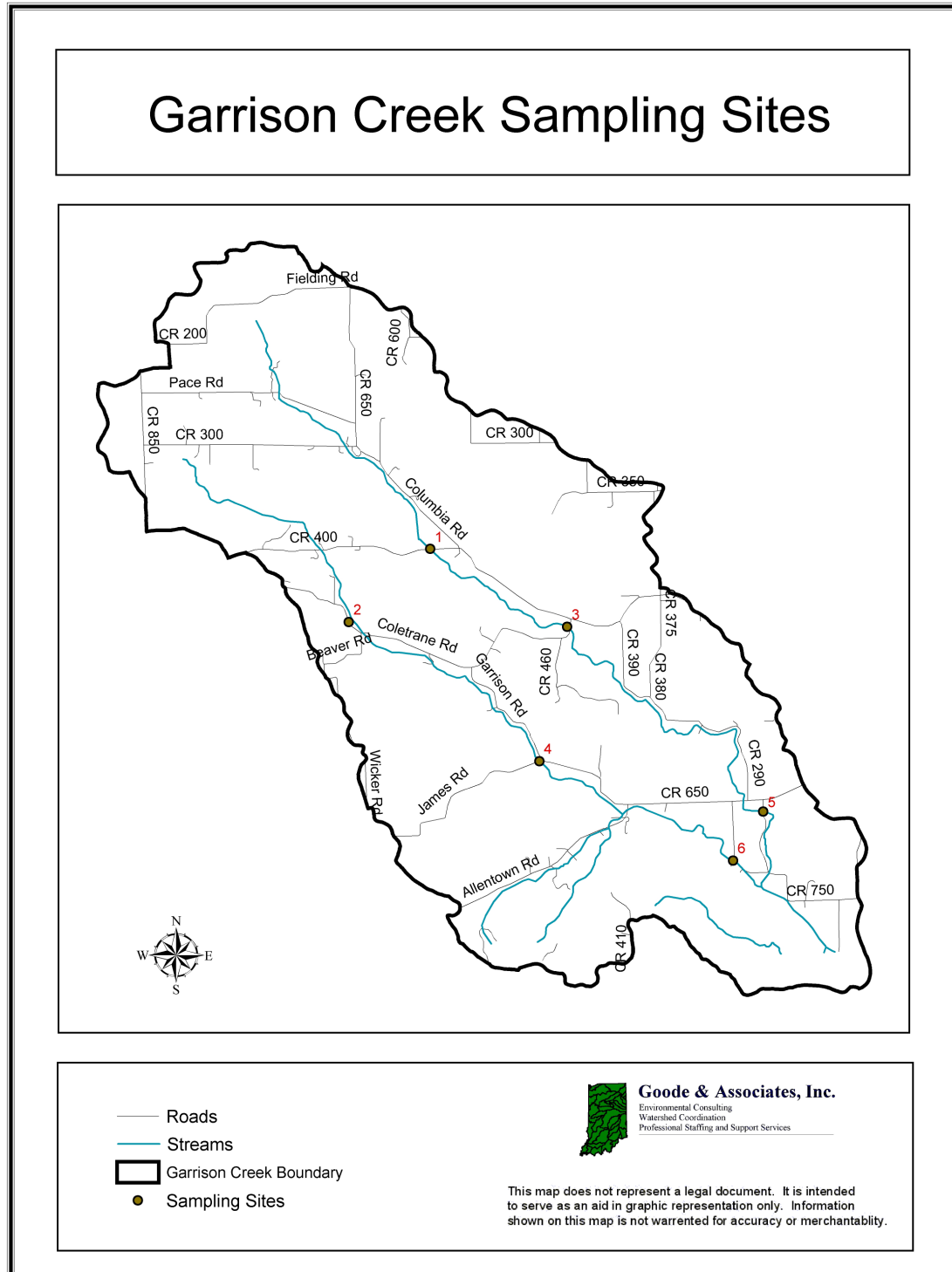
To achieve the goal of evaluating and ranking “hot spots” in the watershed relative to one another and assisting the prioritization of management efforts, emphasis was placed on maintaining standard procedures at each water quality sampling site. Consistencies in protocol were used to ensure that sampling sites could be compared to one another, enabling the watershed coordination team to determine which sites are most degraded relative to others in the watershed.

Study Area

Preliminary sites for monitoring sites were selected utilizing a road map and then field checked by the watershed coordination team for verification of site accessibility. Following the field inspection, six (6) sampling sites were selected within the Garrison Creek watershed. The locations of these sites are shown in Figure 3-1 and Table 3-1 provides additional site details.

Water quality parameters sampled at each site include pH, *E. coli*, nitrogen, ammonia, biological oxygen demand (BOD), and total suspended solids (TSS). The Connersville Waste Water Treatment Plant analyzed the samples for these parameters at their laboratory at no charge. Surface water temperature was measured in the field using a standard stream thermometer.

Figure 3-1 Garrison Creek Monitoring Sites



Garrison Creek Watershed Management Plan

Table 3-1: Garrison Creek Watershed Monitoring Site Descriptions

| Site #: | Waterbody Name | Location |
|---------|----------------|---|
| GC1 | Garrison Creek | 400S, just west of Columbia Rd. |
| GC2 | Garrison Creek | Coletrane Rd., just north of Beaver Rd. |
| GC3 | Garrison Creek | Coletrane Rd., just south of Columbia Rd. |
| GC4 | Garrison Creek | James Rd., just south of Coletrane Rd. |
| GC5 | Garrison Creek | Twin Dry Ford Rd., just south of CR 650S |
| GC6 | Garrison Creek | CR 310W, just south of CR 650S |

Sampling Design and Project Timetable

The above-mentioned, chemical parameters were monitored a total of six (6) times: during 3 wet weather sampling events and 3 dry weather sampling events.

Water chemistry data was collected during the project period (Table 3-2). Collection of water quality data provided an overview of the water quality conditions in the watershed under varying conditions.

Macroinvertebrate bio-assessments were conducted on a bi-annual basis beginning in May 2002 (Table 3-2). This timing allowed the data to be consistent with standard bio-assessment protocols. A subsequent habitat analysis was conducted during each bio-assessment.

Table 3-2. Parameters to be Studied and Project Schedule

| | Type of Sample/ Parameter | Sampling Event Frequency | Sampling Period |
|-------------------|---------------------------------|---|------------------------------------|
| Chemical | Water Quality | <ul style="list-style-type: none">• 3 Dry Weather Events &• 3 Wet Weather Events | Summer 2002 thru Summer 2003 |
| Biological | Macroinvertebrates and CQHEI | <ul style="list-style-type: none">• Biannual Macroinvertebrate• Biannual CQHEI | Summer 2002 thru Summer 2003 |

Water Quality Sampling

The watershed coordination team collected samples for all of the chemical water quality parameters. Samples were taken using grab sampling protocols as outlined in Standard Methods for the Examination of Water and Wastewater, 19th Edition. Samples were delivered to the Connersville WWTP lab within 6 hours in order to meet sample-holding times outlined in the Connersville WWTP's sampling procedures. Sample bottles were labeled by date and sampling location. Water quality samples were processed at the Connersville WWTP lab using standard operating protocols.

Biological Sampling

The watershed coordination team collected macroinvertebrate samples from the Garrison Creek watershed utilizing the Hoosier Riverwatch Kick Seine method. Once

collected, each sample was spread onto a grid and randomly selected grids were completely picked until a 100-organism sub-sample was obtained. In the event 100-organisms did not result, the sample was sorted through for one hour and those organisms collected were identified and counted. Macroinvertebrates were identified to the Order and Family level where possible. The data was analyzed using Riverwatch identification and scoring methods.

Benthic macroinvertebrates are animals that are big enough (macro) to be seen with the naked eye. They lack backbones (invertebrates) and live in or on the bottom (benthos) of a body of water (Hoosier Riverwatch, 2002). Macroinvertebrates include aquatic insects such as mayflies, stoneflies, caddisflies, midges, beetles, snails, worms, freshwater clams, mussels, and crayfish. Some benthic macroinvertebrates, such as midges, are small and grow no larger than ½ inch in length. Others, like the three ridge mussel, can be over ten inches long (Hoosier Riverwatch, 2003).



Stone Fly



Caddis Fly Larvae



Riffle Beetle



Right Handed Snail

Biological monitoring focuses on the aquatic organisms that live in streams and rivers. Scientists observe changes that occur in the number of types of organisms present in a stream system to determine the richness of the biological community. Scientists also observe the total number of organisms in an area, or the density of the biological populations present. If community richness and community density change over time, it may indicate the effects of human activity on the stream.

Biological stream monitoring is based on the fact that different species react to pollution in different ways. Pollution-sensitive organisms such as mayflies, stoneflies, and caddisflies are more susceptible to the effects of physical or chemical changes in a stream than other organisms. These organisms act as indicators of the absence of pollutants. Pollution-tolerant organisms, such as midges and worms are less susceptible to changes in physical and chemical parameters in a stream and are more indicative of a presence of pollutants (Hoosier Riverwatch, 2003).

Macroinvertebrate Sampling Procedures-Kick

The watershed coordination team conducted macroinvertebrate sampling using a Kick Seine twice at each sampling site, once in June of 2002 and once in May of 2003. The kick seine method, indicated in Figure 3-2 is a simple procedure for collecting stream-

dwelling macroinvertebrates. It is used in riffle areas where the majority of the organisms live.

Figure 3-2: Demonstration of Kick Seine Sampling Method



Figure 3-3: Macroinvertebrates Collected from Garrison Creek



The watershed coordination team would identify a riffle at each site and select a 3' x 3' section of the riffle. One member of the team would place the net at the downstream section of the 3' x 3' area perpendicular to the flow. The other member of the team would approach from the upstream edge of the sampling area and kick the streambed vigorously for 2-3 minutes until the entire 3' x 3' section was disturbed. The "kicker" would then reach into the stream and begin rubbing off particles from cobble stones, rocks, twigs and leaves into the net. Once completed the "netter" would remove the net with a forward upstream scooping motion to maintain the contents of the net. The two together would then go to the shore and begin picking the particles from the net and place them on a sieve. Once the specimens were on the sieve, the watershed coordination team would spray water on all of the particles until the macroinvertebrates were separated from the particles (Figure 3-3). The team would then collect their specimens in jars and conduct this process two additional times for a total of three (3) replicates.

The watershed coordination team would then record the presence of each type of organism collected and provide an estimate of the number of each type of organism. This information was then incorporated into the Biological Monitoring Data Sheet, Figure 3-4, to determine the Pollution Tolerance Index Rating (PTIR). Based on the PTIR score, the team was then able to determine whether the water quality conditions were excellent, good, fair, or poor.

Garrison Creek Watershed Management Plan

Figure 3-4: Biological Monitoring Data Sheet

| BIOLOGICAL MONITORING DATA SHEET | | | |
|---|--|--|------------------|
| Date ____/____/____ MM DD YY | | Begin Time ____:____ (am/pm) | # Adults _____ |
| | | End Time ____:____ (am/pm) | # Students _____ |
| Certified Monitors' Names _____ | | Volunteer ID _____ | |
| Organization Name _____ | | | |
| Watershed Name _____ | | Watershed # _____ | |
| Stream/River Name _____ <small>(Please do not abbreviate.)</small> | | Site ID _____ <small>(Above ID numbers are required.)</small> | |

| | |
|--|--|
| Check Methods Used <input type="checkbox"/> Kick Seine Net (3 times) <input type="checkbox"/> D-Net (20 jabs or scoops) | Check Habitats Sampled <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Riffles <input type="checkbox"/> Leaf Packs </div> <div> <input type="checkbox"/> Undercut Banks <input type="checkbox"/> Snags/Vegetation </div> <div> <input type="checkbox"/> Sediment <input type="checkbox"/> Other </div> </div> |
|--|--|

| POLLUTION TOLERANCE INDEX (PTI) | | | |
|--|---|---|---|
| PT GROUP 1 <i>Intolerant</i> | PT GROUP 2 <i>Moderately Intolerant</i> | PT GROUP 3 <i>Fairly Tolerant</i> | PT GROUP 4 <i>Very Tolerant</i> |
| Stonefly Nymph _____ | Damselfly Nymph _____ | Midges _____ | Left-Handed Snail _____ |
| Mayfly Nymph _____ | Dragonfly Nymph _____ | Black Fly Larvae _____ | Aquatic Worms _____ |
| Caddis Fly Larvae _____ | Sowbug _____ | Planaria _____ | Blood Midge _____ |
| Dobsonfly Larvae _____ | Scud _____ | Leech _____ | Rat-Tailed Maggot _____ |
| Riffle Beetle _____ | Crane Fly Larvae _____ | | |
| Water Penny _____ | Clams/Mussels _____ | | |
| Right-Handed Snail _____ | | | |
| # Of TAXA _____ | # Of TAXA _____ | # Of TAXA _____ | # Of TAXA _____ |
| Weighting Factors: (x 4) _____ | (x 3) _____ | (x 2) _____ | (x 1) _____ |

| | | | | | | | | | | |
|--|------------|-----------|---------|------|---------|------|------------|------|--|--|
| <table style="width: 100%;"> <tr> <td style="text-align: center;">23 or More</td> <td style="text-align: center;">Excellent</td> </tr> <tr> <td style="text-align: center;">17 - 22</td> <td style="text-align: center;">Good</td> </tr> <tr> <td style="text-align: center;">11 - 16</td> <td style="text-align: center;">Fair</td> </tr> <tr> <td style="text-align: center;">10 or Less</td> <td style="text-align: center;">Poor</td> </tr> </table> | 23 or More | Excellent | 17 - 22 | Good | 11 - 16 | Fair | 10 or Less | Poor | POLLUTION TOLERANCE INDEX RATING <small>(Add the final index values for each group.)</small> | <div style="border: 2px solid black; width: 100px; height: 40px; margin: 0 auto;"></div> |
| 23 or More | Excellent | | | | | | | | | |
| 17 - 22 | Good | | | | | | | | | |
| 11 - 16 | Fair | | | | | | | | | |
| 10 or Less | Poor | | | | | | | | | |

| Other Biological Indicators | | | |
|---|--|---|--|
| <input type="checkbox"/> Native Mussels | <input type="checkbox"/> Zebra Mussels | <input type="checkbox"/> Submerged Aquatic Plants | <input type="checkbox"/> % Algae Cover _____ <input type="checkbox"/> Diversity Index _____ |

Habitat Assessment - Habitat evaluations were conducted using the Citizen's Qualitative Habitat Evaluation Index (CQHEI). The condition of the substrate and the land within and adjacent to the stream channel is critical to the health of the stream and its ability to support aquatic life. The Citizens Qualitative Habitat Evaluation Index (CQHEI) utilizes land use, substrate, flow rate, depth, shape, riparian vegetation, and erosion to provide a measure of stream habitat that affects fish and other aquatic life (Figure 3-5).

Figure 3-5: Citizens Qualitative Habitat Evaluation Index

| | | | | | |
|--|--|--|--|---|--|
| Date: <input style="width: 100px;" type="text"/> | | Citizens Qualitative Habitat Evaluation Index | | CQHEI Total: <input style="width: 100px;" type="text"/> | |
| Vol ID: <input style="width: 100px;" type="text"/> | | Site ID: <input style="width: 100px;" type="text"/> | | River and Watershed: <input style="width: 200px;" type="text"/> | |





I. Substrate (Bottom Type) Score:

| | | |
|--|--|---|
| <p>a) Size</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Mostly Large (Fist Size or Bigger) 14 pt </div> <div> <input type="checkbox"/> Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock) 6 pt </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <input type="checkbox"/> Mostly Medium (Smaller than Fist, but Bigger than Fingernail) 10 pt </div> <div> <input type="checkbox"/> Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky) 0 pt </div> </div> | <p>b) "Smothering"</p> <div> <input type="checkbox"/> Are Fist Size and Larger Pieces Smothered By Sands/Silts? NO 5 pt </div> <div> <input type="checkbox"/> Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects YES 0 pt </div> | <p>c) "Siltting"</p> <div> <input type="checkbox"/> Are Silts and Clays Distributed Throughout Stream? NO 5 pt </div> <div> <input type="checkbox"/> Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two YES 0 pt </div> |
|--|--|---|

II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present Score:

| | | | | |
|--|--|---|--|--|
| <input type="checkbox"/> Underwater Tree Roots (Large) 2 pt | <input type="checkbox"/> Boulders 2 pt | <input type="checkbox"/> Downed Trees, Logs, Branches 2 pt | <input type="checkbox"/> Water Plants 2 pt | <input type="checkbox"/> Undercut Banks 2 pt |
| <input type="checkbox"/> Underwater Tree Rootlets (Fine) 2 pt | <input type="checkbox"/> Backwaters, Oxbows or Side Channels 2 pt | <input type="checkbox"/> Shallow, Slow Areas for Small Fish 2 pt | <input type="checkbox"/> Deep Areas (Chest Deep) 2 pt | <input type="checkbox"/> Shrubs, Small Trees that Hang Close Over the Bank 2 pt |

III. Stream Shape and Human Alterations Score:

| | |
|---|--|
| <p>a) "Curviness" or "Sinuosity" of Channel</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> 2 or More Good Bends 8 pt  </div> <div> <input type="checkbox"/> 1 or 2 Good Bends 6 pt  </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <input type="checkbox"/> Mostly Straight Some "Wiggle" 3 pt  </div> <div> <input type="checkbox"/> Very Straight 0 pt  </div> </div> | <p>b) How Natural Is The Site?</p> <div> <input type="checkbox"/> Mostly Natural 12 pt </div> <div> <input type="checkbox"/> Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders) 6 pt </div> <div> <input type="checkbox"/> A Few Minor Man-made Changes (e.g., a bridge, some streambank changes) 9 pt </div> <div> <input type="checkbox"/> Heavy, Man-made Changes (e.g., leveed or channelized) 0 pt </div> |
|---|--|

IV. Stream Forests & Wetlands (Riparian Area) & Erosion Score:

| | | | |
|---|--|---|--|
| <p>a) Width of Riparian Forest & Wetland - Mostly:</p> <div> <input type="checkbox"/> Wide (Can't Throw A Rock Through/ Across It) 8 pt </div> <div> <input type="checkbox"/> Narrow (Can Throw A Rock Through/ Across It) 5 pt </div> <div> <input type="checkbox"/> None 0 pt </div> | <p>b) Land Use - Mostly:</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Forest/Wetland 5 pt </div> <div> <input type="checkbox"/> Shrubs 4 pt </div> <div> <input type="checkbox"/> Overgrown Fields 3 pt </div> <div> <input type="checkbox"/> Fenced Pasture 2 pt </div> <div> <input type="checkbox"/> Park (Grass) 2 pt </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <input type="checkbox"/> Conservation Tillage 2 pt </div> <div> <input type="checkbox"/> Suburban 1 pt </div> <div> <input type="checkbox"/> Row Crop 1 pt </div> <div> <input type="checkbox"/> Open Pasture 0 pt </div> <div> <input type="checkbox"/> Urban/ Industrial 0 pt </div> </div> | <p>c) Bank Erosion - Typically:</p> <div> <input type="checkbox"/> Stable Hard or Well-Vegetated Banks 4 pt </div> <div> <input type="checkbox"/> Combination of Stable and Eroding Banks 2 pt </div> <div> <input type="checkbox"/> Raw, Collapsing Banks 0 pt </div> | <p>d) How Much of Stream is Shaded?</p> <div> <input type="checkbox"/> Mostly 3 pt </div> <div> <input type="checkbox"/> Partly 2 pt </div> <div> <input type="checkbox"/> None 0 pt </div> |
|---|--|---|--|

V. Depth & Velocity Score:

| | |
|---|--|
| <p>a) Deepest Pool is At Least:</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Chest Deep 8 pt </div> <div> <input type="checkbox"/> Knee Deep 4 pt </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <input type="checkbox"/> Waist Deep 6 pt </div> <div> <input type="checkbox"/> Ankle Deep 0 pt </div> </div> | <p>b) Check ALL The Flow Types That You See (Add Points):</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Very Fast: Hard to Stand in the Current 2 pt </div> <div> <input type="checkbox"/> Moderate: Slowly Takes Objects Downstream 1 pt </div> <div> <input type="checkbox"/> None 0 pt </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <input type="checkbox"/> Fast: Quickly Takes Objects Downstream 3 pt </div> <div> <input type="checkbox"/> Slow: Flow Nearly Absent 1 pt </div> </div> |
|---|--|

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) Score:

| | |
|---|---|
| <p>a) Riffles/Runs Are:</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Knee Deep or Deeper & Fast 8 pt </div> <div> <input type="checkbox"/> Ankle Deep or Less & Slow 4 pt </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <input type="checkbox"/> Ankle/Calf Deep & Fast 6 pt </div> <div> <input type="checkbox"/> Do Not Exist 0 pt </div> </div> | <p>b) Riffle/Run Substrates Are:</p> <div> <input type="checkbox"/> Fist Size or Larger 7 pt </div> <div> <input type="checkbox"/> Smaller Than Your Fingernails or Do Not Exist 0 pt </div> <div> <input type="checkbox"/> Smaller Than Fist Size, but Larger Than Fingernail 4 pt </div> |
|---|---|

Evaluating Water Quality Pollutants

A number of substances including bacteria, nutrients, oxygen demanding wastes, metals and toxic substances cause water pollution. Pollution refers to the substances that enter surface waters that result in water quality degradation and impairment. Sources of these pollution causing substances are divided into two broad categories: point sources and nonpoint sources (IDEM, 2002). Point and nonpoint sources of pollution are described as follows:

Point sources of pollution refer to discharges that enter surface waters through a pipe, ditch or other well defined point of discharge. The term applies to wastewater and storm water discharges from a variety of sources. Wastewater point source discharges include municipal (city, town, and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems that may serve schools, commercial offices, residential subdivisions and individual homes. Storm water point source discharges include storm water discharges associated with industrial activities and storm water discharges from municipal separate storm sewer (MS4s) systems for municipalities that meet the requirements of 327 IAC 15-13.

The primary pollutants associated with point source discharges are bacteria, oxygen demanding wastes, nutrients, sediment, color and toxic substances including chlorine, ammonia and metals. Point source dischargers in Indiana must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state. Discharge permits are issued under the NPDES program (See Appendix A), which is delegated to Indiana by the US Environmental Protection Agency (EPA).

Nonpoint sources of pollution refer to discharges of runoff that enter surface waters from storm water runoff, contaminated groundwater, snowmelt or atmospheric deposition. There are many types of land use activities that can serve as sources of nonpoint source pollution including land development, construction, mining operations, crop production, animal feeding lots, timber harvesting, failing septic systems, landfills, roads and paved areas, and wildlife.

Sediment and nutrients are major pollution causing substances associated with nonpoint source pollution. Others pollutants can include *E. coli* bacteria, heavy metals, pesticides, oil and grease, and any other substance that may be washed off the ground or removed from the atmosphere and carried into surface waters. Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur at random depending on rainfall events.

Types of Pollution

Causes of pollution refer to the substances that enter surface waters from point and nonpoint sources and result in water quality degradation and impairment. Major causes of water quality impairment include *E. coli* bacteria, biochemical oxygen demand (BOD), nutrients, and toxicants (such as polychlorinated biphenyls [PCBs] and ammonia). The following discussion provides a general overview of causes of impairment and the

activities that may lead to their introduction into surface waters (IDEM, 2002).

Bacteria

E.coli bacteria are associated with the intestinal tract of warm-blooded animals. Although not a pollutant in itself, *E.coli* is widely used as an indicator of sewage pollution, which may harbor additional waterborne disease causing (pathogenic) bacteria, protozoa, and viruses. *E.coli* is also used as an indicator because it is easier and less costly to monitor and detect than the actual pathogenic organisms, such as *Giardia*, *Cryptosporidium*, and *Shigella*, which require special sampling protocols and very sophisticated laboratory techniques. The presence of these waterborne disease-causing organisms can cause outbreaks of diseases, such as typhoid fever, dysentery, cholera, and cryptosporidiosis.

Water quality standards (WQS) for *E.coli* bacteria have been established in order to ensure safe use of water bodies for drinking water and recreation. 327 IAC 2-1-6 Section 6(d) states that *E.coli* bacteria, using membrane filter count (MF), shall not exceed 125 per 100 milliliters as a geometric mean based on not less than five samples equally spaced over a 30 day period nor exceed 235 per 100 milliliters in any one sample in a 30 day period.

Within the Garrison Creek watershed, the absence of land uses associated with point sources of pollution dictate that *E.coli* bacteria is entering watershed from nonpoint sources of runoff, such as failing septic systems, straight pipe discharges from septic tanks, livestock, domestic pets, and wildlife. Water quality monitoring conducted for this project identified *E.coli* violations at several locations in Garrison Creek.

Monitoring locations were prioritized according to the level of impairment, which was judged by the percentage of exceedances of the *E.coli* water quality standard at each site (Table 3-3). In most cases, the percentage method of prioritizing sites is appropriate for identifying stream segments with the most need for mitigation; however, this ranking is independent of the results from other parameters.

Table 3-3. *E.coli* Monitoring Results; Percentage of Samples Exceeding Water Quality Standards (WQS) of 235 CFU; Priority Ranking of Sites (1 = Least Impaired, 6 = Most Impaired)

| Garrison Creek Site # | % of Samples Exceeding WQS | Priority Ranking |
|------------------------------|-----------------------------------|-------------------------|
| GC # 1 | 50 | 1 |
| GC # 2 | 50 | 1 |
| GC # 3 | 83 | 4 |
| GC # 4 | 66 | 2 |
| GC # 5 | 75 | 3 |
| GC # 6 | 50 | 1 |

Oxygen Consuming Wastes

Since maintaining sufficient levels of dissolved oxygen in a waterbody is critical to the survival of most forms of aquatic life, evaluating oxygen-consuming wastes in a river or stream is central to diagnosing the health of a watershed. Pollutants associated with oxygen consuming wastes are typically composed of either decomposing organic matter or chemicals that bind with available instream oxygen to reduce the available concentrations of dissolved oxygen in the water column. Organic causes of oxygen consuming wastes are measured as biochemical oxygen demand (BOD).

Although there is not an ambient water quality standard for BOD, the Indiana Department of Natural Resource's Hoosier Riverwatch Program has published a "rule of thumb" for evaluating BOD concentrations in ambient water quality samples, as follows:

- 1-2 mg/L = Clean water with little organic waste;
- 3-5 mg/L = Fairly clean with some organic waste;
- 6-9 mg/L = Lots of organic material and bacteria;
- 10+ mg/L = Very poor water quality with large amounts of organic material.

Nonpoint sources of pollution, such as failing septic systems, straight pipe discharges from septic tanks, livestock, domestic pets, and wildlife can contribute organic wastes to streams. As organic waste decays it binds with available in-stream oxygen, lowering the available oxygen concentrations in a waterbody and stressing resident aquatic life.

In addition, organic waste within streams can cause a condition of nutrient enrichment. Monitoring for this project detected the presence of elevated concentrations of nutrients (ammonia) in sufficient quantities to support an overabundance of algae growth within the stream. Although the process of photosynthesis in the algae produces a large volume of oxygen during periods of daylight, respiration by algae during the nighttime hours absorbs more oxygen than the water column can maintain, resulting in times when dissolved oxygen concentrations are significantly reduced or depleted. This situation can be intensified in hot weather and low flow conditions due to the reduced capacity of water to retain dissolved oxygen.

Monitoring locations within the Garrison Creek watershed were prioritized according to their level of BOD impairment, which was judged by the percentage of exceedances of the five (5) mg/L "rule of thumb" for BOD at each site (Table 3-4).

Garrison Creek Watershed Management Plan

Table 3-4. BOD Monitoring Results; Percentage of Samples Exceeding 5 mg/L Rule of Thumb; Priority Ranking of Sites (1 = Least Impaired, 6 = Most Impaired)

| Garrison Creek Site # | % of Samples Exceeding WQS | Priority Ranking |
|-----------------------|----------------------------|------------------|
| GC # 1 | 17 | 2 |
| GC # 2 | 0 | 1 |
| GC # 3 | 0 | 1 |
| GC # 4 | 17 | 2 |
| GC # 5 | 0 | 1 |
| GC # 6 | 17 | 2 |

Nutrients

The term "nutrients" primarily refers to the two major plant macronutrients, phosphorus and nitrogen. These nutrients are common components of fertilizers, animal and human wastes, vegetation, and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources. Nutrients are beneficial to aquatic life in small amounts. However, in over abundance and under certain conditions, they can stimulate the occurrence of algal blooms and excessive plant growth in quiet waters or low flow conditions. Algae blooms and excessive plant growth often reduce the dissolved oxygen content of surface waters through plant respiration and the decomposition of dead algae and other plants (IDEM, 2002).

Nitrogen (Ammonia)

Within the Garrison Creek watershed, nonpoint source discharges of untreated septic effluent, decaying organisms and plant life, and bacterial decomposition of animal waste are the most likely sources of ammonia.

Water quality monitoring detected multiple ammonia violations at several locations in the watershed. Water quality standards for ammonia are derived using an equation that considers a sample's temperature and pH; therefore, there is not a single numerical ammonia standard. As illustrated in Table 3-5, monitoring locations were prioritized according to the level of ammonia impairment, which was judged by the percentage of exceedances of the calculated WQS for each sample. Note: This ranking is independent of the results from other parameters.

Table 3-5. Ammonia Monitoring Results; Percentage of Samples exceeding calculated WQS; Priority Ranking of Sites (1 = Least Impaired, 6 = Most Impaired)

| Garrison Creek Site # | % of Samples Exceeding WQS | Priority Ranking |
|-----------------------|----------------------------|------------------|
| GC # 1 | 17 | 2 |
| GC # 2 | 33 | 3 |
| GC # 3 | 33 | 3 |
| GC # 4 | 67 | 4 |
| GC # 5 | 0 | 1 |
| GC # 6 | 33 | 3 |

Siltation/Sedimentation

Sedimentation occurs when wind or water runoff causes erosion, carries soil particles from an area such as a farm field or stream bank, and transports them to a water body, such as a stream or lake. Excessive sedimentation clouds the water, which reduces the amount of sunlight reaching aquatic plants; covers fish spawning areas and food supplies; and clogs the gills of fish. In addition, other pollutants like nutrients, pesticides, *E.coli* and heavy metals are often attached to the soil particles and end up in waterbodies with the sediment.

Although there is currently not an ambient water quality standard for Total Suspended Solids (TSS), the Indiana Department of Natural Resource's Hoosier Riverwatch Program has published a "rule of thumb" for evaluating TSS concentrations in ambient water quality samples, as follows:

- 0-3 mg/L = Very clean water;
- 4-11 mg/L = Normal ambient concentrations of TSS;
- 12-16 mg/L = elevated concentrations of TSS w/ potential for stream impairments;
- 17 mg/L or above = high concentrations of TSS; Stream impairments likely present.

Sources of siltation/sedimentation within the watershed are linked to the agricultural land uses within the watershed; however, there were no significant problems documented within the watershed. Monitoring locations were prioritized according to the level of impairment, which was determined by the percentage of exceedances of eleven (11) mg/L "rule of thumb" for TSS at each site (Table 3-6). There were no dry weather exceedances of TSS in the Garrison Creek watershed.

Table 3-6. TSS Monitoring Results; Percentage of Samples Exceeding 11 mg/L Rule of Thumb; Priority Ranking of Sites (1 = Least Impaired, 6 = Most Impaired)

| Garrison Creek Site # | % of Samples Exceeding WQS | Priority Ranking |
|------------------------------|-----------------------------------|-------------------------|
| GC # 1 | 2 | 1 |
| GC # 2 | 2 | 1 |
| GC # 3 | 2 | 1 |
| GC # 4 | 2 | 1 |
| GC # 5 | 2 | 1 |
| GC # 6 | 2 | 1 |

Conclusions

In conclusion, Table 3-7 provides a summary of ranking scores for each monitoring parameter for each site. These rankings were used to generally identify the "best" and "worst" sites within the watershed. Monitoring sites have been evaluated and ranked in terms of overall water quality based upon chemical, biological, and habitat scores.

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Scores were totaled for each site and compared to the other sites within the watershed. The site with the lowest overall score received the best site ranking (1) and sites with the highest overall score received the worst site ranking (6). In situations where the total score was tied for two or more sites, a lower ranking score was given to the site with the best macroinvertebrate Pollution Tolerance Index (PTI) score. In addition, all data collected for this project has been summarized and interpreted in **Table 3-8**.

Table 3-7: Summary of Garrison Creek Ranking Scores; Priority Ranking of Sites (1 = Least Impaired, 6 = Most Impaired)

| Garrison Creek Watershed | | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Summary of Sampling Site Rankings | | | | | | |
| (Refer to Figure 3-1 for a map of Garrison Creek monitoring sites) | | | | | | |
| Sample Type | GC 1 | GC 2 | GC 3 | GC 4 | GC 5 | GC 6 |
| E.coli | 1 | 1 | 4 | 2 | 3 | 1 |
| BOD | 2 | 1 | 1 | 2 | 1 | 2 |
| Ammonia | 2 | 3 | 3 | 4 | 1 | 3 |
| Sediment | 1 | 1 | 1 | 1 | 1 | 1 |
| Macroinvertebrates | 3 | 2 | 1 | 2 | 4 | 3 |
| Habitat | 1 | 4 | 3 | 5 | 6 | 2 |
| Total | 10 | 12 | 13 | 16 | 16 | 12 |
| Ranking | 1 | 2 | 4 | 5 | 6 | 3 |

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Table 3-8: Summary of Garrison Creek Water Quality Monitoring Data (2002-2003)

| Garrison Creek Watershed Summary of Chemical Monitoring Results, Pollution Tolerance Index (PTI) Ratings and CQHEI Scores (Refer to Figure 3-1 for a map of Garrison Creek monitoring sites) | | | | | | |
|---|---|--|---|---|--|--|
| Sample Type | GC 1 | GC 2 | GC 3 | GC 4 | GC 5 | GC 6 |
| Chemical | <ul style="list-style-type: none"> • 50% of E. coli samples exceed WQS (733-2440) • 1 dry weather E. coli violation (1247 cfu) • NH3 levels consistent with minor spike in May 2003 • BOD level highest in August 2002 and April 2003 • Low TSS levels compared to other sites in spring | <ul style="list-style-type: none"> • 50% of E. coli samples exceed WQS (400-1680) • 1 dry weather E. coli violation (1320) • Significant NH3 spike in June 2002 • BOD levels disproportionally high in May • TSS levels consistent with other sites | <ul style="list-style-type: none"> • 83% of E. coli samples exceed WQS (280-3080) • 2 dry weather E. coli violations • NH3 levels consistent with other sites • BOD levels consistent with other sites • TSS levels elevated during wet weather events but consistent with other sites | <ul style="list-style-type: none"> • 66% of E. coli samples exceed WQS (533-2620) • 1 dry weather E. coli violation (1467) • Consistently higher NH3 levels compared to other sites (major spike in June 2002) • Consistently average BOD levels compared to other sites • Consistently average TSS levels compared to other sites | <ul style="list-style-type: none"> • 75% of E. coli samples exceed WQS (267-TMTC) • 1 dry weather E. coli violation (267) • Consistently low NH3 levels compared to other sites • Consistently low to average BOD levels compared to other sites • Consistently high TSS levels during dry weather • Creek bed dry August – October 2002 | <ul style="list-style-type: none"> • 50% of E. coli samples exceed WQS (380-TMTC) • 1 dry weather E. coli violation (380) • Consistently average NH3 levels compared to other sites • Consistently high BOD levels compared to other sites • Overall higher TSS levels compared to other sites during wet and dry weather |
| Macro* (Two sample average during 2002-2003) | 25, Excellent | 28, Excellent | 29, Excellent | 28, Excellent | 21.5, Good | 25, Excellent |
| Habitat (CQHEI) Scores (two sample average during 2002-2003) | 87.25 | 74.25 | 75 | 68 | 53.25 | 79.5 |
| Site Ranking** | 1 | 2 | 4 | 5 | 6 | 3 |

*100 specimens were not collected as a result of 3 kick samples; Samples were sorted for one hour.

** 1 = Best; 6 = Worst

The evaluation of water quality pollutants in the Garrison Creek watershed as well as other assessment results were further used to validate or deny the list of initial concerns development by watershed stakeholders. Table 3-9 summarizes those initial concerns, discusses the validity of the concern and identifies objectives for addressing the concerns.

Table 3-9: Verifying Stakeholder Concerns/ Developing Water Quality Objectives

| Concerns | Concern Verified/Explanation | Resulting Objective(s) |
|---|--|--|
| Failing or non-existent septic systems | <ul style="list-style-type: none"> The lack of centralized WWTP and elevated concentrations of E.coli bacteria suggests this to be a valid concern. Concern further validated by the number of homes built directly adjacent to streams. According to the USDA soil survey, it was determined that 63% of the soils within the watershed are not conducive to on-site wastewater treatment. In addition, the Fayette County Health Department commented that proper operation and maintenance of septic systems is not a widespread activity among Garrison Creek residents and as well as other rural residents within Fayette County. | <ul style="list-style-type: none"> Develop Septic System Action Strategy (Section 7): <ul style="list-style-type: none"> Educate residents on septic system O&M. Identify failing septic systems and straight pipe discharges. Establish process for ensuring new septic system installations are placed only where appropriate soils exist. |
| Improper management of livestock and manure | <ul style="list-style-type: none"> Elevated concentrations of E.coli bacteria and visual observations of cattle in streams at Sites 1 and 3 suggest this to be a valid concern. Cattle were also determined to have access to forested lands. Approximately 15 cattle were observed in a forested area, however, it is estimated that this number is much higher considering the amount of livestock in the watershed as well as the vast amounts of forest adjacent to obvious tracts of pasture. | <ul style="list-style-type: none"> Develop Agricultural Management Action Strategy (Section 6): <ul style="list-style-type: none"> Hire SWCD technician for providing tech services to farmers/ landowners re: manure management. Sponsor field days/ workshops focusing on manure management. Develop website to provide information to farmers Develop newsletters regarding manure and nutrient management. |

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| | | <ul style="list-style-type: none"> ○ Educate landowners regarding streambank stabilization methods. |
| Erosion and sedimentation from agricultural fields, pasture and wood lots | <ul style="list-style-type: none"> • 50% of the Garrison Creek watershed is used for agriculture purposes. Although numerous buffers/filters were observed via the windshield survey, elevated concentrations of TSS and nutrients were observed during rain events suggesting a need for complete stream corridor protection via buffers/ filters. Stakeholder concerns were also noted regarding the perceived contributions of fertilizers, herbicides and pesticides associated w/ sediment transport and runoff from agricultural fields. Although no components of this study were appropriate for evaluating validity of this concern, logical conclusions can be drawn regarding the direct connection between applications of agrichemicals and their introduction into the environment. | <ul style="list-style-type: none"> • Develop Agricultural Management Action Strategy (Section 6): <ul style="list-style-type: none"> ○ Establish riparian buffer/ filter strips. ○ Increase the utilization of conservation tillage. ○ Educate livestock producers about the water quality impacts of allowing livestock access to creeks and forest lands. ○ Educate landowners regarding streambank stabilization methods. ○ Educate landowners on the benefits of the WRP and WHIP programs. ○ Educate farmers on the economic and environmental benefits of pest management. ○ Develop “River Friendly Farmer” type Program. ○ Collect additional water quality data to determine the magnitude/ mass loadings of pesticides and other agrichemicals in the watershed. |
| Lack of forestry/ logging best management practices (BMPs) | <ul style="list-style-type: none"> • Although elevated concentrations of TSS and Nutrients were observed during rain events, logging was not an apparent as a significant land use activity or water quality impact but a concern none the less. | <ul style="list-style-type: none"> • Develop Forestry Management Action Strategy (Section 5): <ul style="list-style-type: none"> ○ Modify county zoning regulations to be consistent with natural resource protection strategies and smart growth. ○ Educate forest owners on the importance of |

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| | | <p>maintaining riparian forests.</p> <ul style="list-style-type: none"> ○ Educate forest owners on the importance of excluding livestock from forest lands. ○ Educate forest owners on the value of timber stand improvements. ○ Educate forest owners on the benefits of utilizing logging best management practices. ○ Initiate a tree planning program. ○ Increase enrollment in the Classified Forest Program. |
| <p>Lack of public knowledge and understanding regarding the link between land use activities and water quality</p> | <ul style="list-style-type: none"> • Not verifiable via water quality monitoring; however, significant litter/ dumping was noted at many water quality sampling sites. Solid waste management practices appeared to be lacking at some properties within the watershed during windshield survey. | <ul style="list-style-type: none"> • Develop Public Education Action Strategy (Section 4): <ul style="list-style-type: none"> ○ Educate residents on the impacts of fertilizers and pesticides on water quality. ○ Educate residents on the impacts of household hazardous wastes on water quality. ○ Educate residents on the impacts of solid wastes and runoff on water quality. ○ Educate residents on the impacts of pet wastes on water quality. ○ Educate residents on the need for monitoring the quality of drinking water wells and abandoning old wells. ○ Provide additional opportunities for community involvement in water quality improvement efforts. |

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| <p style="text-align: center;">Uncontrolled development in the watershed</p> | <ul style="list-style-type: none"> According to the Area Plan Commission (APC) and other members of the FCWI, zoning ordinances in Connersville/ Fayette County are not protective of water resources. Uncontrolled development in the watershed is considered to be a contributing factor to water quality degradation in the watershed due to lack of storm water ordinance, building in floodplains, etc. | <ul style="list-style-type: none"> Develop Local Government Action Strategy (Section 8): <ul style="list-style-type: none"> Hire an erosion and sediment control specialist to better control the impacts of construction/development projects. Provide training to local developers regarding the use of ESC best management practices. Educate political leaders, developers and landowners about the impacts of unchecked development. |
| <p style="text-align: center;">Nutrient and fertilizer runoff and infiltration</p> | <ul style="list-style-type: none"> The windshield survey noted the presence of some stream/ditch buffers throughout the watershed, but the survey did not adequately identify buffers from all stream segments. Aerial photography was used to identify potential areas in need of buffer or filter strips within the watershed. 50% of the watershed is in agricultural land uses. | <ul style="list-style-type: none"> Develop Agricultural Management Action Strategy (Section 6): <ul style="list-style-type: none"> Hire SWCD technician for providing tech services to farmers/ landowners re: manure management. Sponsor field days/ workshops focusing on manure management. Develop website to provide information to farmers. Develop newsletters regarding manure and nutrient management. Establish riparian buffer/ filter strips. Increase the utilization of conservation tillage. Educate landowners regarding streambank stabilization methods. Educate landowners on the benefits of the WRP and WHIP programs. Educate farmers on the |

| | | |
|--------------------|---|--|
| | | <p>economic and environmental benefits of pest management.</p> <ul style="list-style-type: none"> ○ Develop “River Friendly Farmer” type Program. ○ Collect additional water quality data to determine the magnitude/ mass loadings of pesticides and other agrichemicals in the watershed. |
| Streambank Erosion | <ul style="list-style-type: none"> • Significant streambank erosion observed during windshield survey, especially in the lower portions of the watershed. In particular, Site 5 suffers from erosion and sand deposition in front of the fords. County Highway department utilizes heavy equipment to push sand back upon the bank....come back annually to address the problem. | <ul style="list-style-type: none"> • Develop Agricultural Management Action Strategy (Section 6): <ul style="list-style-type: none"> ○ Establish riparian buffer/ filter strips. ○ Educate livestock producers about the water quality impacts of allowing livestock access to creeks and forest lands. ○ Educate landowners regarding streambank stabilization methods. ○ Develop “River Friendly Farmer” type Program. • Develop Forestry Management Action Strategy (Section 5): <ul style="list-style-type: none"> ○ Educate forest owners on the importance of maintaining riparian forests. ○ Educate forest owners on the benefits of utilizing logging best management practices. ○ Initiate a tree planning program. • Develop Public Education Action Strategy (Section 4): <ul style="list-style-type: none"> ○ Hire an erosion and sediment control (ESC) specialist to better |

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| | | <p>control the impacts of construction/development projects.</p> <ul style="list-style-type: none"> ○ Provide training to local developers regarding the use of ESC best management practices. ○ Educate political leaders, developers and landowners about the impacts of unchecked development (impervious surfaces). |
| Lack of water quality data or related information | <ul style="list-style-type: none"> • A review of IDEM, USGS and local water quality monitoring sources provided no historical water quality monitoring data for the watershed. Monitoring data collected by the project provided the only data available for assessing water quality conditions. Surveys results from residents suggested that the public is not aware of water quality issues within their community. | <ul style="list-style-type: none"> • Develop Public Education Action Strategy (Section 4): <ul style="list-style-type: none"> ○ Educate residents on the need for monitoring the quality of drinking water wells and abandoning old wells. ○ Provide additional opportunities for community involvement in water quality improvement efforts including monitoring. • Develop Agricultural Management Action Strategy (Section 6): <ul style="list-style-type: none"> ○ Collect additional water quality data to determine the magnitude/ mass loadings of pesticides and other agrichemicals in the watershed. |
| Impacts of flooding on water quality and erosion | <ul style="list-style-type: none"> • Although elevated concentrations of TSS and nutrients were observed during rain events, the sources of these pollutants can not be directly connected to flooding. However, flooding along the Whitewater River and its tributaries was a major issue of | <ul style="list-style-type: none"> • Develop Local Government Action Strategy (Section 8): <ul style="list-style-type: none"> ○ Implement planning tools to ensure protection of natural resources via floodplain protection/ management ordinance. ○ Increase coordination |

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| | <p>concern for stakeholders. According to the Fayette County Emergency Management Agency (EMA), flooding should be addressed through a variety of means, including mitigating structures within the floodways/floodplains and also through addressing the many log jams in the Whitewater and its tributaries.</p> | <p>between the surveyor and SWCD offices on stream maintenance issues.</p> |
| Lack of groundwater supplies | <ul style="list-style-type: none"> No components of this study were appropriate for evaluating validity of this concern. FCWI Steering Committees did suggest, however, that numerous residents within the watershed must haul water to their homes due to wells running dry. | <ul style="list-style-type: none"> Develop Local Government Action Strategy (Section 8): <ul style="list-style-type: none"> Implement planning tools to ensure protection of natural resources via septic system density requirements and water supply availability ordinance. |
| Flooding | <ul style="list-style-type: none"> Stakeholder comments suggested that logging may be contributing to increased flooding and erosion. Stakeholder concerns regarding unchecked development could be generating more impervious surfaces/ stormwater runoff. | <ul style="list-style-type: none"> Develop Local Government Action Strategy (Section 8): <ul style="list-style-type: none"> Implement planning tools to ensure protection of natural resources via floodplain protection/ management ordinance. Develop Agricultural Management Action Strategy (Section 6): <ul style="list-style-type: none"> Establish riparian buffer/ filter strips. Educate landowners regarding streambank stabilization methods. Develop Forestry Management Action Strategy (Section 5): <ul style="list-style-type: none"> Educate forest owners on the importance of maintaining riparian forests. Initiate a tree planning |

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| | | <p>program.</p> <ul style="list-style-type: none">• Develop Public Education Action Strategy (Section 4):<ul style="list-style-type: none">○ Hire an erosion and sediment control specialist to better control the impacts of construction/development projects.○ Educate political leaders, developers and landowners about the impacts of unchecked development (impervious surfaces). |
| Abandoned wells | <ul style="list-style-type: none">• No components of this study were appropriate for evaluating validity of this concern. However, according to the local SWCD and NRCS, there are a number of abandoned wells throughout the county and the need to close them is important for maintaining safe drinking water supplies. | <ul style="list-style-type: none">• Develop Local Government Action Strategy (Section 8):<ul style="list-style-type: none">○ Implement planning tools to ensure protection of natural resources via septic system density requirements, water supply availability and abandoned well closure ordinances. |

Problem statements

As required by the IDEM's watershed management plan checklist, the FCWI Steering Committee developed the following problem statements based upon a wide variety of information gathered during this process. The Steering Committee then incorporated these problem statements into the remaining sections of this plan.

1. E.coli bacteria concentrations within the Garrison Creek watershed exceed State water quality standards (during dry and wet weather) most likely due to the influences from failing septic systems or straight pipe discharges or animal wastes from livestock, domestic pets and wildlife.
1. The general public does not fully understand the influence they have upon water quality and the necessary actions they may take to minimize water quality impacts.
2. Biochemical Oxygen Demand (BOD) concentrations within the Garrison Creek watershed become elevated during wet weather conditions (stormwater runoff) most likely due to the introduction of organic wastes from failing septic systems or straight pipe discharges and animal wastes from livestock, domestic pets and wildlife.
3. Ammonia concentrations within the Garrison Creek watershed exceed State water quality standards (during dry and wet weather) most likely due to influences from failing septic systems or straight pipe discharges, animal wastes from livestock, domestic pets and wildlife, or inappropriate applications of agricultural nitrogen.
4. Total Suspended Solids (TSS) concentrations within the Garrison Creek watershed become elevated during wet weather conditions (stormwater runoff) most likely due to the lack of conservation tillage practices and resulting erosion on agricultural land uses and naturally occurring erosion from Highly Erodible Soils (HEL) within the watershed.
5. Habitat alterations at Site 5 in the Garrison Creek watershed resulted in decreased macroinvertebrate community scores as compared to other sites within the watershed.

Sections 4 through 8 contain objectives to address the different problem statements listed above. Given the need for water quality education and the ability of the FCWI, education was deemed the overall priority and the necessary first step in improving water quality conservation practices within the Garrison Creek watershed. While the sections themselves are not in order of priority, the different objectives within each of these sections are listed in order of priority as determined by the FCWI Steering Committee.

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IV. Public Education and Involvement

Managing pollution is often considered the job of local, state and federal government. Certainly, good planning and implementation by all of these entities is important to a successful water quality protection program, however, it is also important that individual homeowners understand their role in water quality protection and their impact on the larger community.

The FCWI Steering Committee felt that in order for conservation efforts to occur as a result of this plan, all members of the community need to fully understand water quality, how their day to day activities impact water quality and what measures are necessary to improve and protect water quality within the Garrison Creek watershed. The FCWI Steering Committee acknowledges the different agencies and organizations within Fayette County committed to environmental education but realized that an education program specific to the Garrison Creek watershed did not exist.

In an attempt to fill this gap, the Community Education Coalition (CEC) applied for a Section 319 Grant to obtain the necessary funding to implement the education components outlined in this watershed plan. The CEC's grant application for \$106,000 was approved and education activities are scheduled to begin in January of 2004. The CEC will hire or contract with an individual for a two-year position.

The Environmental Educator shall be responsible for working with a variety of organizations within Fayette County including: the FCSWCD Educator, the Three Rivers Solid Waste Management District, science teachers with the Connersville Public School System, 4-H Leaders, and Purdue Extension.

There are numerous potential pollution sources in and around every home within the Garrison Creek watershed that can affect the health of the household, the community, and the environment and which require an education campaign. Such sources include:

1. Fertilizers and Pesticides

If not applied or managed properly, fertilizers and pesticides can migrate into surface water and groundwater supplies. Via runoff and infiltration, these materials have the potential to cause algae blooms, fish kills, and human illnesses.

To limit the impacts fertilizers and pesticides have on water quality, residents should:

- ☐ Carefully follow product's application instructions and warnings.
- ☐ Apply fertilizer and pesticides only to target areas.
- ☐ Follow recommended watering practices and avoid excess watering after application
- ☐ Do not sprinkle product onto paved or other areas that drain into the stream or ditch.

- ❑ Avoid unnecessary pesticide, fertilizer, or water use by planting native vegetation that has adapted to the local area.
- ❑ Store fertilizers and pesticides in an area that minimizes the risk associated with an accidental spill.
- ❑ In the event of a fertilizer or pesticide spill, clean up immediately and do not dispose of the waste by dumping over the fencerow or by dumping the materials down the sink or toilet.
- ❑ Dispose of unused fertilizers and pesticides at the Three Rivers Solid Waste Management District's Tox-A-Way Day.
- ❑ Do not dispose of chemicals in sinks, toilets, storm drains, drainage ditches or anywhere else besides a licensed facility.

The monitoring and assessment activities conducted during this project could not confirm or deny that fertilizers and pesticides are a direct threat to the water quality of Lick Creek. Steering Committee members, however, felt that promoting proper fertilizer and pesticide management should be a focus of the FCWI based on their overarching goal of protecting water quality within the Lick Creek watershed.

2. Household Hazardous Wastes (HHW)

Many household products such as gasoline, motor oil, antifreeze, paints, preservatives, brush cleaners, and solvents can negatively impact surface and groundwater supplies if not utilized, stored, and disposed of properly. Via runoff and infiltration, these materials have the potential to cause fish kills and human illnesses. To minimize the impacts associated with these common household chemicals, homeowners should:

- ❑ Never pour chemicals down the drain since septic tanks do not treat these materials and these chemicals could lead to septic system failure.
- ❑ Buy products with the least amount of toxic material.
- ❑ Store materials in a fashion that allows for the containment of the material in the event there is an accidental spill.
- ❑ Clean up material spills immediately and properly.
- ❑ Dispose of unnecessary chemicals annually through the Three Rivers Solid Waste Management District's Tox-A-Way Day.

The monitoring and assessment activities conducted during this project could not confirm or deny that household hazardous wastes are a direct threat to Lick Creek. Steering Committee members felt that HHW should be a focus of the FCWI based on their overarching goal of protecting water quality within the Lick Creek watershed.

3. Solid Wastes

Some residents often accrue a wide variety of solid waste materials on their property. Disposal of solid waste in ravines and streams is not uncommon. Such items as tires, appliances, old vehicles and other items have the ability to contaminate surface and ground water supplies. Also, the accumulation of such materials is not aesthetically appealing and can pose other health risks.

Tires, buckets, and old drums, for instance, tend to accumulate water, which in turn provides prime habitat for mosquito reproduction. With the ever-increasing threat of diseases such as the West Nile Virus, homeowners should minimize the accumulation of these materials.

To minimize the water quality and health impacts associated with solid waste, homeowners should:

- ❑ Dispose annually of appliances and tires through the Three Rivers Solid Waste Management Districts Tox-A-Way day.
- ❑ If solid waste is stored, make sure there are no chemicals inside the items that could potentially leak from containers and drain to nearby streams or infiltrate to groundwater supplies.
- ❑ Store tires inside or cover them until they can be disposed of properly.
- ❑ Do not dispose of solid waste anywhere other than a sanitary landfill or a recycling facility.

Solid waste accumulation was identified at various residents throughout the watershed during the “windshield” assessment conducted by the watershed coordinator and is discussed in Table 3-9. Realizing the potential for water quality and health problems associated with such activities, the Steering Committee felt that education oriented towards the proper disposal of solid waste should be part of their efforts.

4. **Pet Wastes**

When people consider the impacts animals have on water quality, many do not think of pets. However, if pet wastes are disposed of incorrectly, they can cause water pollution. More than half of all U.S. households own a dog, cat, or other pet. Although each household only generates a small amount of pet waste, these small amounts can add up to a water quality problem (North Carolina State University, 2003).

Droppings from dogs and cats and other domesticated pets can cause two kinds of problems. First, pet wastes contain nutrients and bacteria that can promote the growth of algae and other waterborne diseases. Second, animal droppings are a source of pests and disease. Pets, children playing outside, and adults gardening are most at risk of contracting illnesses from some of the bacteria and parasites found in pet waste. Flies may also spread diseases from animal waste. Diseases that can be transmitted from pet waste to humans include leptospirosis, campylobacteriosis, salmonellosis, and toxoplasmosis (North Carolina State University, 2003).

To minimize the impacts associated with pet waste, homeowners within the Garrison Creek watershed should:

- ❑ Clean up waste in areas near water bodies and ditches.
- ❑ Do not allow pet waste to accumulate in pens.
- ❑ Do not leave pet waste on roads or driveways where it can be washed into streams or ditches.
- ❑ Always clean up after pets and dispose of the waste either in the toilet, in the trash, or in a composter.

Once again, pet wastes were not identified during any part of the assessment as a major problem or contributor of pollution to Lick Creek. However, realizing that pets can have a negative impact on water quality and the fact that the FCWI's overarching goal of protecting water quality within the Lick Creek watershed, this objective was developed as part of the overall education campaign.

Residential Goals and Decisions

Recognizing the water quality problems associated with common household activities, the FCWI Steering Committee developed the following objectives. The following objectives are in order of priority as determined by the FCWI Steering Committee.

Objective 4-1: *By 2007, educate 100% of the Garrison Creek residents on the impacts fertilizers and pesticides can have on water quality and the proper measures they can take to minimize those impacts.*



Actions Necessary to Achieve Objective 4-1:

- Develop and disseminate a series of newsletters and newspaper articles regarding proper fertilizer and pesticide use, storage and disposal.
- Conduct presentations to local schools, civic groups, churches, and other interested groups regarding proper fertilizer and pesticide use, storage and disposal.
- Create annually a display regarding household water quality protection practices and present at the Fayette County Free Fair and other local events.
- Partner and assist the Three Rivers SWMD with the promotion of the Annual Tox-A-Way event.

Objective 4-2: *By 2007, educate 100% of the Garrison Creek residents on the impacts household hazardous wastes can have on water quality and the proper measures they can take to minimize those impacts.*



Actions Necessary to Achieve Objective 4-2:

- Partner with the Three Rivers SWMD to develop and disseminate a series of newsletters and newspaper articles regarding proper storage and disposal of HHW.
- Partner with the Three Rivers SWMD to conduct presentations to local schools, civic groups, churches, and other interested groups regarding proper storage and disposal of HHW.
- Partner with the Three Rivers SWMD to annually create a display regarding household water quality protection practices and present at the Fayette County Free Fair and other local events
- Partner with and assist the Three Rivers SWMD with the promotion of the Annual Tox-A-Way event.

Objective 4-3: *By 2007, educate 100% of the Garrison Creek residents on the impacts the accumulation of solid wastes can have on water quality and the proper measures they can take to minimize those impacts.*



Actions Necessary to Achieve Objective 4-3:

- Partner with the Three Rivers SWMD to develop and disseminate a series of newsletters and newspaper articles regarding the importance of proper solid waste disposal and recycling opportunities within Fayette County.
- Partner with the Three Rivers SWMD to conduct presentations to local schools, civic groups, churches, and other interested groups regarding the proper disposal of solid waste and the local laws that prohibit such activities.
- Partner with the Three Rivers SWMD to annually create a display regarding proper solid waste disposal and recycling opportunities within Fayette County practices and present at the Fayette County Free Fair and other local events
- Partner and assist the Three Rivers SWMD with the promotion of the Annual Tox-A-Way event.

Objective 4-4: *By 2007, educate 100% of the Garrison Creek residents on the importance of annually monitoring the water quality of functioning drinking water wells and properly closing abandoned wells.*



Due to the fact that all of the residents within the Garrison Creek watershed rely upon private drinking water wells, it is the opinion of the FCWI that these residents be familiar with the methods and resources available for monitoring the quality of their wells as well as plugging those wells once they are no longer in operation. Wells not plugged create an opportunity for direct contamination to the groundwater supply.

Actions Necessary to Achieve Objective 4-4:

- Develop and disseminate a series of newsletters and newspaper articles regarding how to monitor and the importance of monitoring well water quality.
- Develop and disseminate a series of newsletters and newspaper articles regarding the importance of plugging abandoned wells.
- Conduct presentations to local schools, civic groups, churches, and other interested groups highlighting how to and the importance of monitoring well water quality and plugging abandoned wells.
- Create annually a display regarding how to and the importance of monitoring well water quality and plugging abandoned wells.
- Continue the Fayette County SWCD cost-share program for plugging abandoned wells.

Objective 4-5: *By 2007, provide a variety of opportunities for residents to become involved in community efforts to address water quality/natural resource issues.*



Actions Necessary to Achieve Objective 4-5:

- Coordinate a Garrison Creek stream cleanup event in cooperation with the Three Rivers SWMD.
- Organize and host an IDNR Hoosier Riverwatch Program within the Garrison Creek watershed.
- Expand the CEC's Hoosier Riverwatch Program to encourage residents to become actively involved in stream monitoring.
- Promote the IDNR's Adopt –A-Stream program and solicit residents and community groups to adopt and maintain different sections of Garrison Creek.

Objective 4-6: *By 2007, educate 100% of the Garrison Creek residents on the impacts pet waste can have on water quality and the proper measures pet owners can take to minimize those impacts.*



Actions Necessary to Achieve Objective 4-6:

- Develop and disseminate a series of newsletters and newspaper articles regarding the importance of proper pet waste disposal.
- Conduct presentations to local schools, civic groups, churches, and other interested groups highlighting the importance of proper disposal of pet wastes.
- Create annually a display regarding proper pet waste disposal and present at the Fayette County Free Fair and other local events.

Responsible Parties for Implementing Objectives 4-1 thru 4-6:

The CEC's Environmental Educator has been deemed the responsible party for achieving Objectives 4-1 thru 4-6. However, it is essential that the Environmental Educator work closely with the FCSWCD, the Three Rivers SWMD, the Fayette County Health Department, the Indiana Department of Natural Resources, and the Connersville News Examiner and other local organizations in order to fulfill these objectives.

Measuring the Success of Objectives 4-1 thru 4-6:

In order to measure the progress of Objectives 4-1 thru 4-6, the CEC Environmental Educator shall:

- ❑ Document all "residential conservation" related to newsletter and newspaper articles published and disseminated by the CEC Environmental Educator.
- ❑ Document all public presentations regarding household conservation and the total number of residents in attendance.

- ❑ Document attendance at stream clean-up events, water quality monitoring events, and make record of those individuals and organizations that agree to participate in IDNR's Adopt-A-Stream program.
- ❑ Document and track, when possible, the number of active wells monitored and the total abandoned wells plugged on a quarterly basis.
- ❑ Document the total tonnage of waste generated through the Garrison Creek Clean-Up and the total number of participants involved.
- ❑ Begin tracking, by watershed, the total number of participants who participate in the annual Three Rivers SWMD Tox-A-Way event.

Critical Residential Areas

Educating all residents within the Garrison Creek watershed is a major priority of FCWI Steering Committee. The Steering Committee realizes that in order for conservation to occur as a result of this plan, **all** residents need to better understand water quality and how their daily activities impact water quality. Also, all residents shall have the opportunity to get involved in community activities to improve and protect water quality.

All residents shall have access to all educational literature developed by the CEC's Environmental Educator and be made aware of events such as the "stream clean-up" and stream monitoring. The segment of stream in which the clean-up will take place has yet to be determined and will be decided upon through outreach efforts to local residents.

Funding Necessary to Implement Objectives 4-1 thru 4-6:

The Section 319 Grant acquired by the CEC to fund the Environmental Education Coordinator should provide the necessary funds to implement the majority of the actions listed above.

The Three Rivers SWMD has agreed to provide the necessary funds from their operating budget to assist the FCWI in the Garrison Creek Stream Clean-Up.

At the time this watershed plan was being developed, the Fayette County SWCD was providing cost-share funds to residents and landowners to plug abandoned wells. The FCSWCD had acquired those funds from the Indiana Association of Soil and Water Conservation District's Clean Water Indiana program. It is a possibility that the FCSWCD could obtain additional funds from that organization or other similar entities. Additional funding needs will be assessed as implementation occurs.

V. Forested Land in the Garrison Creek Watershed

According to the U.S. Forest Service inventory data, Fayette County is approximately 20% to 25% forested with virtually all of that acreage being owned by private landowners. The bulk of the forests are located in the southern half of the county in Orange, Columbia, and Jackson Townships. The Garrison Creek watershed, located in Columbia Township, is comprised of approximately 8,409 acres of deciduous forest and approximately 24 acres of coniferous forest according to GAP Land Use Data (Figure 5-1). Combined, forestland makes up nearly 51% of the watershed.

Benefits of Forested Land

Forests provide a wide variety of benefits to the Garrison Creek community:

- ❑ Timber Production – Properly managed forests can provide significant financial returns to a forest owner.
- ❑ Wildlife – Properly managed forests provide the necessary habitat for the many plants and animals of the watershed helping maintain biodiversity and healthy biological communities.
- ❑ Watershed Protection - Forested land does a better job of protecting surface water quality than do most other land conditions and uses. The leaf canopy in forests help absorb the energy of heavy rain, slowing the erosive effects of direct rain on bare soil. Root structures in the soil also help control erosion from the forest. Leaf litter and decaying wood help build a healthy soil where erosion-controlling plant life and well-balanced nutrients can better serve a healthy ecosystem and shade provided by trees helps maintain water temperatures necessary for aquatic life.
- ❑ Flood Control – Forests have a tremendous value as a regulator of water flow by increasing the time rainwater takes to move through a drainage system minimizing runoff and consequential erosion. By minimizing erosion, forests inhibit sedimentation, which can otherwise reduce the storage capacity of a stream. Streams, which have succumb to extensive sedimentation, can often flood after significant rain events.
- ❑ Recreation and Aesthetics - Hunting, camping, bird watching, and hiking are just a few of the almost limitless recreational activities forests provide.
- ❑ Social Values – Undoubtedly, human lives are enhanced by the solitude and beauty the woods provide. Being renewable, the use of wood products in our daily lives will lessen our use of nonrenewable resources - an ecologically desirable consequence.

Forestry Issues in the Garrison Creek Watershed per IDNR District Forester

Jayson Waterman, District Forester with the Indiana Department of Natural Resources (IDNR), presented a document to the FCWI Steering Committee highlighting Fayette County's forestry issues. Those issues include:

- ❑ *Lack of Forest Knowledge*

The Garrison Creek watershed is similar to the rest of the state in terms of forest management. Most landowners make forest management decisions with little or no knowledge of the resource they own. Consequently, bad decisions are made, and it can take the forest decades to recover. Even when drastic mistakes are avoided, most forests are still not managed such that they can reach their potential. Hence, one of the major problems is the lack of landowners' general forestry knowledge.

- ❑ *Suboptimal Species Composition*

As a consequence of that lack of knowledge and past use, much of the watershed's forests are choked with vines, and have suboptimal species composition. These factors contribute to many forests' poor health. Utilizing the services of a professional forester can remedy many of these problems through selective, improvement timber harvests and timber stand improvements (TSI).

- ❑ *Grazing Factors*

Many forests in the county, including many acres in the Garrison Creek watershed, are subject to grazing by livestock herds, primarily cattle. Cattle hooves crush, chop and destroy the duff layer and leaf litter on the forest floor, increasing the likelihood of it washing away in heavy rain. Without these layers of organic matter, soils are highly vulnerable to erosion. The reduction of soil exposes tree roots, allowing hooves to damage root surfaces. These "open wounds" invite invasions of fungi, insects and bacteria that can damage tree health and greatly reduce the market value of the timber (Missouri Conservationist, 2003).

- ❑ *Highly Erodible Lands*

Many highly erodible sites within the Garrison Creek watershed are in row crop production. These areas, however, are best suited for growing trees, which could reduce soil erosion and sedimentation and improve wildlife habitat. Such sites could be planted to trees for long-term protection of these sensitive areas.

Forestry Goals and Decisions

The ultimate forestry goals of the FCWI are to improve upon the issues identified by the IDNR District Forester. In addition, the FCWI Steering Committee hopes to encourage the modification of zoning regulations within Fayette County to better manage growth in rural areas such as the Garrison Creek watershed and, in turn, maintain the vast acres of highly productive forestlands within the watershed.

Overall, the FCWI hopes to boost the community's knowledge and understanding of the economic and environmental benefits forested lands provide which will in turn provide benefit to the water quality conditions of Garrison Creek. To achieve this, the FCWI

Steering Committee developed the following objectives for forestry. The following objectives are in order of priority as determined by the FCWI Steering Committee

Objective 5-1: By 2005, modify county zoning regulations consistent with natural resource protection and smart growth.

Current Fayette County zoning regulations require an individual to own a minimum of one (1) acre in order to construct a home upon what has been classified as “non-prime agricultural lands.” A minimum of three (3) acres are required to construct a home upon what has been classified as “prime agricultural lands. Only Posey Township in the far northwest portion of the county is considered to possess prime agricultural lands.

The Steering Committee feels that a substantial amount of prime agricultural lands exist outside of Posey Township. The Steering Committee also feels that woodlots should be considered prime agricultural lands and therefore subject to the same zoning regulations. Also, the Steering Committee feels that in order to better protect prime agricultural and forested lands in the watershed, the minimum acreage requirements for development should be increased to 10 acres and 40 acres respectively.

Actions Necessary to Achieve Objective 5-1

- ❑ Identify prime woodlots in the watershed.
- ❑ Amend zoning ordinance to include special development restrictions to preserve significant woodlands.

Objective 5-2: *By 2005, educate 100% of forest owners on the importance of maintaining/establishing riparian forests.*

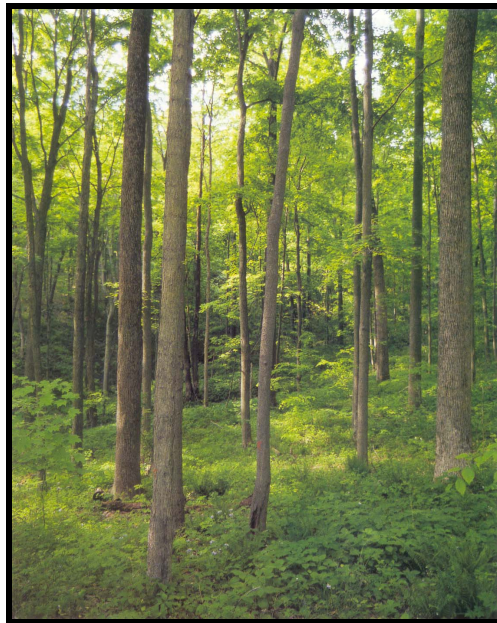


Riparian Forests are natural or re-established streamside forests made up of tree, shrub, and grass plantings. They buffer non-point source pollution of waterways from adjacent land, reduce bank erosion, protect aquatic environments, enhance wildlife, and increase biodiversity.

Actions Necessary to Achieve Objective 5-2

- ❑ Identify and contact landowners with property adjacent to the creek and make them aware of practices and funds available to establish/maintain riparian forests.
- ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the value of riparian forests.
- ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the value and importance of riparian forests.
- ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of riparian forests.
- ❑ Annually develop a display and provide literature at the Fayette County Free Fair on the value and importance of riparian forests.
- ❑ Market conservation easement programs available to permanently establish and maintain riparian forests.

Objective 5-3: *By 2005, educate 100% of forest owners on the value of timber stand improvements (TSI)*



What is TSI?

There are circumstances when a forested area can be improved upon by doing more than just allowing the trees to grow. One such circumstance would be if an area had a timber harvest in which only the most desirable mature trees were taken out and mostly inferior trees—lower value species, or damaged or diseased trees—were left to occupy the forest canopy (a practice called "high grading"). Another case would be where a very dense stand of young trees needed to be thinned in order to optimize tree health and production of fruits and timber. In situations like these, timber stand improvement (TSI) can be applied to make the most of the species and number of trees present for wildlife and timber production. TSI involves actively managing a stand of trees to improve its species composition, structure, health, and growth (Kentucky Department of Fish and Wildlife, 2003).

In many cases TSI involves cutting down or deadening trees that are considered to be of poorer species or quality to improve the growing conditions for the remaining trees. Thus the term TSI is applied to "crop tree release" or "thinning" operations, because some trees in an existing stand are removed or thinned out to favor selected trees ("crop trees") that should yield increased fruit or timber as a result of the improvement work.

Benefits of TSI

Whereas trees in a dense stand tend to put most of their energy into vertical growth to obtain sunlight, trees that have been released from intense competition through TSI put more of their energy into crown and basal growth. Increased crown growth in turn yields increased fruit production while increased trunk growth yields more timber. TSI can also reduce the time needed for crop trees to reach maturity and optimal fruit production; sapling and pole-sized trees that have more freedom to grow produce much sooner than crowded trees (Kentucky Department of Fish and Wildlife, 2003).

Another benefit of TSI is increased timber production. With more sunlight, nutrients, and moisture going to fewer trees after TSI, released trees can put on more diameter—meaning increased timber volume, quality, and potential revenue for the landowner. Other benefits of TSI include the option of using culled trees for firewood, using the culled trees to create snags or brush piles for wildlife cover, and putting woody material on the forest floor. The latter benefits a number of wildlife species, such as ruffed grouse (that use downed logs from which to attract mates), white-footed mice and eastern cottontails (that may hide under logs or treetops), and pileated woodpeckers (that feed on termites and grubs in decaying logs). This also creates more open canopies, which allow more light to penetrate the ground. This improves habitat for some wildlife species (Kentucky Department of Fish and Wildlife, 2003).

Actions Necessary to Achieve Objective 5-3

- ❑ Conduct a forestry field day within the watershed and provide the necessary information to local forest owners on the value and importance of TSI.

- ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the importance of TSI.
- ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of TSI.
- ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of TSI.

Objective 5-4: *Develop a “Tree Planting Initiative” within the watershed to plant 100 acres of new trees by 2006.*



Recognizing the economic, environmental and social benefits of planting trees, the FCWI Steering Committee felt that a “Tree Planting Initiative” would be a great component of this watershed management plan. Such a program would not only provide environmental/educational benefits to the public but also provide an immediate opportunity for individuals and community groups to get involved in the efforts of the FCWI.

Actions necessary to achieve Objective 5-4

- ❑ Through close cooperation with the FCSWCD and the IDNR District Forester, conduct an annual tree sale event in accordance with Arbor Day.
- ❑ Identify a suitable site and a willing landowner in the watershed to host a tree-planting event.
- ❑ Develop newsletter and newspaper articles pertaining to the Tree Planting Initiative as well as the date, time, and location of the tree-planting event.
- ❑ Organize and conduct a tree-planting event by 2006.
- ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of planting trees.

Objective 5-5: *Increase enrollment in the IDNR's Classified Forest Program from 1500 acres (18%) to 3000 acres (36%) by 2007.*



The Classified Forest program is specifically designed to help keep Indiana's private forests intact. It allows landowners with at least 10 acres of forest to set it aside and to remain as forest. In return for meeting program guidelines landowners receive property tax breaks, forestry literature and periodic free inspections by a professional forester while the forest is enrolled in the program.

The Indiana Classified Forest program is one of the most successful and longest running forest stewardship programs in the United States. Currently over 8,300 pieces of property, covering nearly 410,000 acres, are enrolled in this voluntary set aside program. The program is growing in excess of 10,000 acres per year (IDNR, 2003).

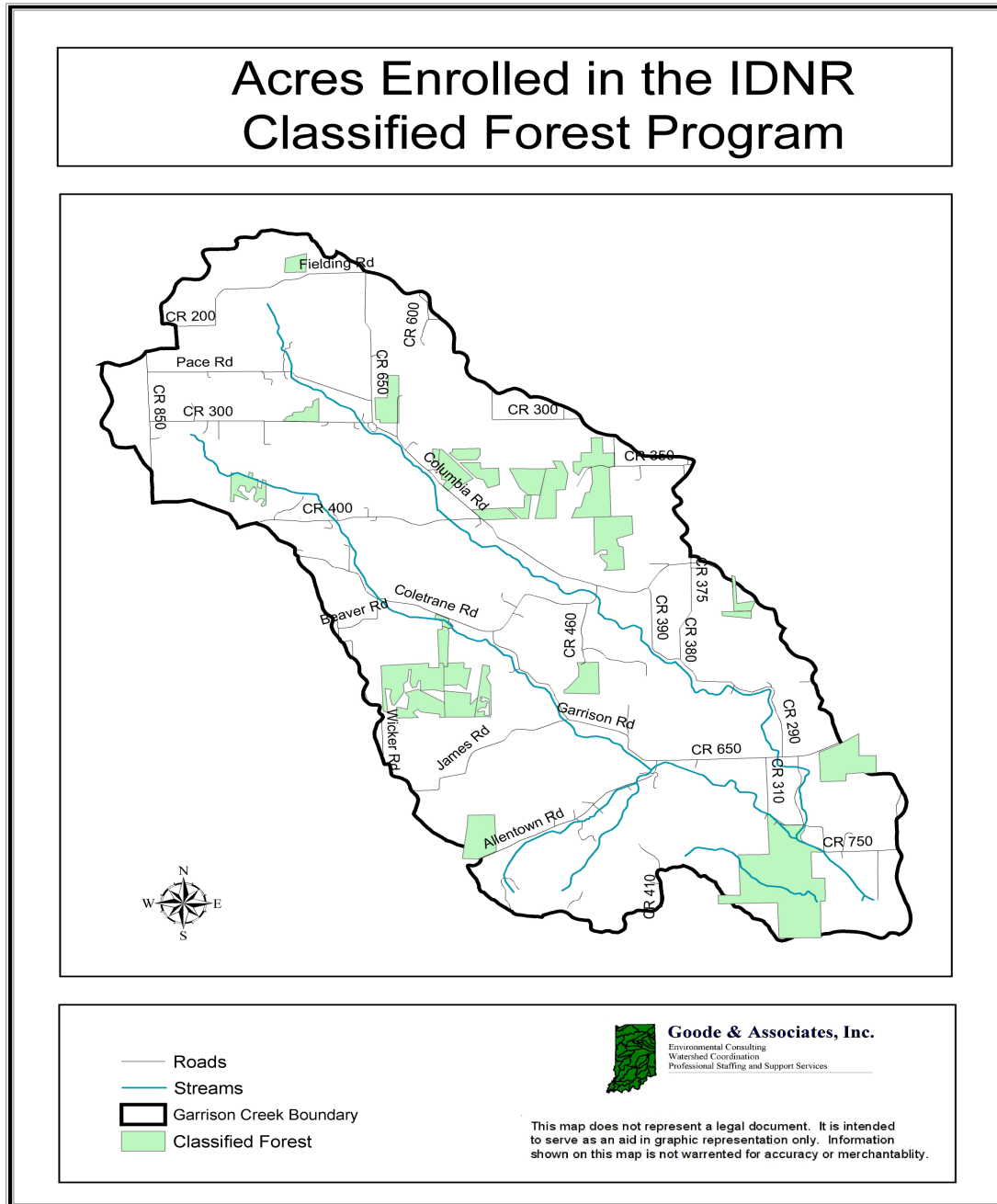
Utilizing the District Forester's Classified Forest Program database, the Watershed Coordination Team incorporated Garrison Creek's current Classified Forest enrollment into GIS. There are currently 1500 acres enrolled in the Classified Forest Program within the watershed (Figure 5-2).

Actions necessary to achieve Objective 5-5

- ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the benefits of the Classified Forest Program.
- ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the Classified Forest Program.
- ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the Classified Forest Program

- Develop annually a display and provide literature at the Fayette County Free Fair on the Classified Forest Program.

Figure 5-2: Classified Forest in the Garrison Creek Watershed



Objective 5-6: *Increase enrollment in the IDNR's Classified Wildlife Program from 703 acres (8%) to 1400 acres (16%) by 2007.*



The Classified Wildlife Habitat Program was created to address Title 6-1.1-6.5 of the Indiana Code, entitled “*Assessment of Certain Wildlife Habitats*,” administered by the Indiana Department of Natural Resources, Division of Fish and Wildlife. The goal of the program is to encourage landowners to develop, save and maintain quality wildlife habitat (IDNR, 2003).

Wildlife habitat loss is the single greatest threat to the survival of all wildlife species. Intensive agriculture, urban sprawl and industrial development are removing wildlife habitat at an alarming rate around the nation. By classifying lands as wildlife habitat, landowners make a commitment to set aside land for wildlife and to maintain the habitat in a condition suitable for the intended wildlife species. The incentives for landowners to classify land and maintain quality wildlife habitat are:

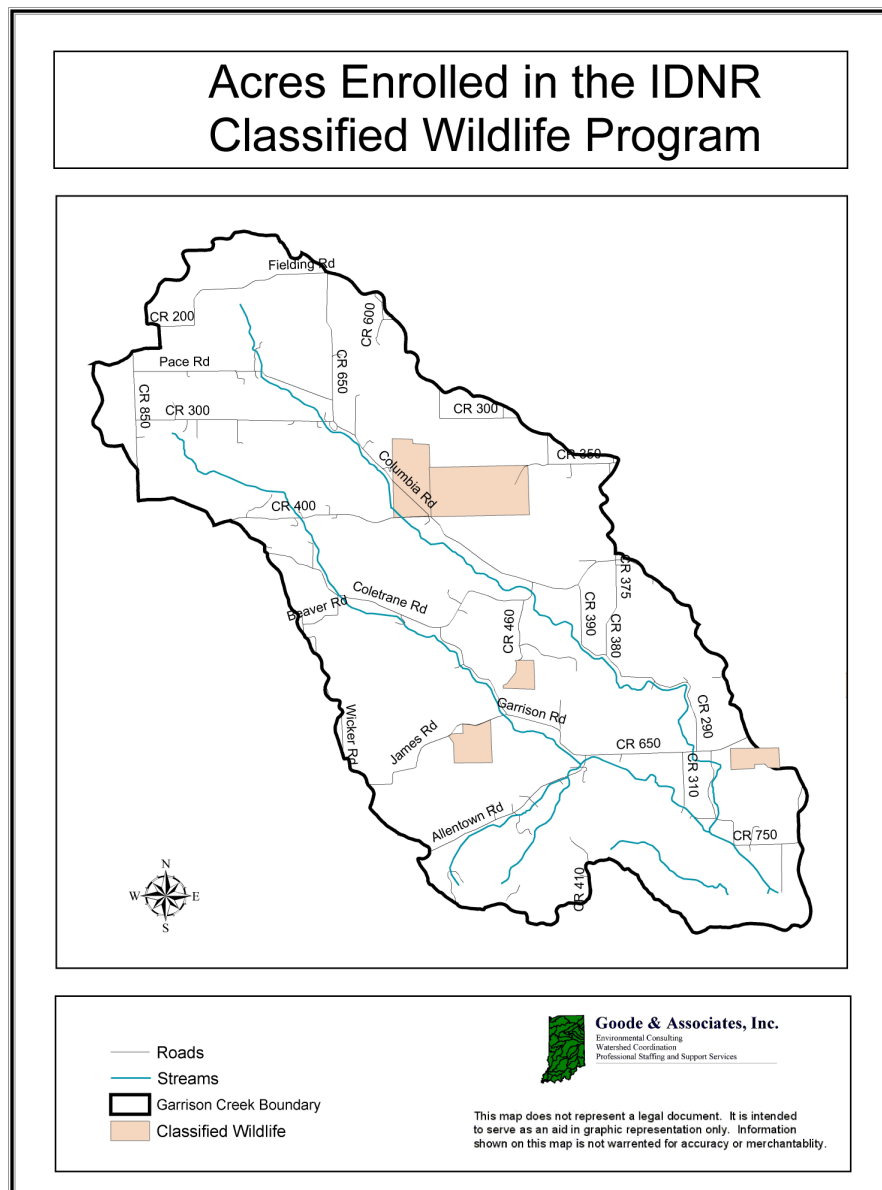
1. The reduction of the assessed value of classified lands to \$1 per acre for property tax purposes,
2. The development of a wildlife management plan specifically tailored to meet the habitat and management needs of the wildlife species of interest, and;
3. Free technical advice and assistance.

The owner of classified lands does not relinquish ownership or control of his property, and the Division of Fish and Wildlife does not become connected in any way with the ownership of the land. Classified lands are assessed at \$1 per acre for property tax purposes, and property taxes are paid on that assessment. Ditch assessment, because of legal drain status, must be paid in full.

Classified lands must be protected from fire, cropping, mowing, and grazing by domestic livestock. These practices may be used on classified areas for the purpose of maintaining wildlife habitat if specifically detailed in the wildlife management plan or specified in a special permit issued by the Division of Fish and Wildlife (IDNR, 2003)

Utilizing the District Wildlife Biologist's Classified Forest Program database, the Watershed Coordination Team incorporated Garrison Creek's current Classified Wildlife enrollment into GIS. There are approximately 703 acres enrolled in the Classified Wildlife Program within the watershed (Figure 5-3).

Figure 5-3: Classified Wildlife Acres in the Garrison Creek Watershed



Actions necessary to achieve Objective 5-6

- ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the benefits of the Classified Wildlife Program.
- ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the Classified Wildlife Program.
- ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the Classified Wildlife Program
- ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the Classified Wildlife Program.

Objective 5-7: *By 2005, educate 100% of forest owners on the importance of excluding livestock from woodlands.*



Excluding livestock from forestland helps preserve the integrity of the land. Cattle hooves crush, chop and destroy the duff layer and leaf litter on the forest floor, increasing the likelihood of it washing away in heavy rain. Without these layers of organic matter, soils are highly vulnerable to erosion. The reduction of soil exposes tree roots, allowing hooves to damage root surfaces. These "open wounds" invite invasions of fungi, insects and bacteria that can damage tree health and greatly reduce the market value of the timber (Missouri Conservationist, 2003).

Actions Necessary to Achieve Objective 5-7

- ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the value and importance of excluding livestock from forested lands.
- ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the importance excluding livestock from forested lands.
- ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of excluding livestock from forested lands.
- ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of excluding livestock from forested lands.

- Promote available funding programs to exclude cattle from woodlands.

Objective 5-8: *By 2005, educate 100% of forest owners on the economic and environmental benefits of utilizing best management practices during logging activities.*



Logging best management practices, or BMPs, are voluntary measures designed to reduce erosion and runoff from timber harvest operations.

Very little erosion occurs in a healthy forest. The crowns of trees, the foliage and stems of shrubs and herbaceous plants, ground-level woody debris and leaf litter absorb much of the force of falling raindrops. In addition, forest soils are porous and easily absorb rainwater once it hits the ground.

Erosion and water quality impacts heighten, however, when a logging operation moves into the woods. Logging itself results in little erosion. Vegetative cover and leaf litter are still largely intact once a tree is cut down. The majority of sediment flowing from a timber harvest area comes from soil exposed on skid trails, haul roads and log landings. BMPs help soften the impact by reducing erosion and runoff during and after a logging operation. BMPs also shorten the time it takes for the forest to return to pre-harvest conditions (Missouri Conservationist, 2003).

Nearly 90% of the erosion from logging operations comes from roads laid down for access to the harvest area. Proper planning, placement and maintenance of roads are vital to prevent erosion and runoff. Before laying out roads, the landowner and the hired logging crew should study a topographic map and a soil survey for locating the best places for logging roads and skid trails. Remember that some topographic features and soil types can support a logging operation better than others. Build your roads with proper drainage in mind, and avoid wet areas if possible. Take care to install culverts, drainage ditches and turnouts where needed (Missouri Conservationist, 2003).

Actions Necessary to Achieve Objective 5-8

- ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on and logging professionals on the benefits of utilizing BMPs while harvesting timber.
- ❑ Conduct a training course for logging professionals on the utilization of BMPs.
- ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the importance of utilizing BMPs while harvesting timber.
- ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of utilizing BMPs while harvesting timber.
- ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of utilizing BMPs while harvesting timber.

Responsible Parties for Implementing Objectives 5-1 thru 5-8

The CEC's Environmental Educator will work closely with the IDNR District Forester and the FCSWCD staff on fulfilling Objectives 5-2 thru 5-8. The Environmental Educator will be responsible for developing newsletters and newspaper articles, conducting presentations to civic groups, organizing the forestry field day and the tree planting event, and working with the FCSWCD on orchestrating a Tree Sale. The Environmental Educator will be expected to solicit as much participation from other community groups and organizations as possible to foster the necessary partnerships essential to the success of the FCWI.

Objective 5-1 will require participation and collaboration of a variety of entities including the Fayette County Commissioners, the Fayette County Council and the Area Plan Commission. Modifying zoning regulations, though supported by the Fayette County Watershed Initiative goes above and beyond what the FCWI Steering Committee is capable of accomplishing without support and action from a variety of agencies.

Measuring the Success of Objectives 5-1 thru 5-8

The CEC's Environmental Educator will work closely with the IDNR District Forester and the FCSWCD staff to measure the progress of the Objectives 5-2 thru 5-8. The Environmental Educator will perform the following activities and present a summary of his/her activities at the FCWI quarterly meetings:

- ❑ Document the number of participants at forestry field day and tree planting events,
- ❑ Document new acres enrolled in the IDNR Classified Forest Program and Classified Wildlife Program,
- ❑ Document and make available all forestry related newsletter and newspaper articles published and disseminated,
- ❑ Develop and maintain a monthly log of forestry related activities specific to the Garrison Creek watershed and make available to the FCWI Steering Committee,
- ❑ Document, when available, landowners actively participating in TSI as a result of this project.

Critical Forest Areas

Due to the vast amount of existing forested lands in the watershed, the FCWI Steering Committee has deemed the protection of those lands a priority. The FCWI would like to see all forested lands eventually enrolled in a protection program such as the IDNR's Classified Forest Program and Classified Wildlife Program. Secondly, the FCWI Steering Committee would like to see landowners establish streamside forests in an effort to minimize the water quality impacts associated with adjacent land uses.

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VI. Agriculture in the Garrison Creek Watershed

Agriculture is a dominant and vital land use within Fayette County and makes up approximately half of the total acres within the Garrison Creek watershed. According to the 1997 Indiana Agricultural Census, approximately 78% or 106,700 acres of land within Fayette County are used for crop and livestock production. Six-percent (6%) of those agricultural acres lie within the Garrison Creek watershed. The Garrison Creek watershed encompasses 16,583 acres, 49% or 8,073 acres of which are in agricultural production (Table 6-1). The primary agricultural practices within the watershed include grain production (corn and soybeans) and livestock production (beef and milk cows).

Table 6-1: Garrison Creek Land Use

| Land Use Types (GAP Datum) | Garrison Creek (05080003040100) | |
|-----------------------------------|--|----------|
| | <u>ACRES</u> | <u>%</u> |
| Pasture | 2688 | 16.2 |
| Row Crop | 5385 | 32.5 |
| Deciduous Forest | 8,409 | 50.7 |
| Coniferous Forest | 24 | .1 |
| Open Water | 0 | 0 |
| Urban High Density | 0 | 0 |
| Urban Low Density | 0 | .02 |
| Wetland | 77 | .5 |
| Total Acres: | 16,583 | |

Agriculture and Local Economics

Agriculture is an important economic partner in Fayette County and the Garrison Creek watershed; however, county census data reveal that a diminishing percentage of the work force is directly involved in agricultural production. In 1992 there were 252 farm operators who considered farming to be their principal occupation. In 1997, the number of full-time producers fell 21% to 199. Also, the 1997 Fayette County Agriculture Census indicates that while farmland decreased 4% from 111,500 acres in 1992 to 106,737 acres in 1997, the average size of farms increased 4% from 245 acres in 1992 to 254 acres in 1997 (Table 6-2).

Table 6-2: 1992 and 1997 Fayette County Agriculture Statistics

| Year | Land in Farms (acres) | Average Size of Farms (acres) | Full Time Farmers |
|----------|-----------------------|-------------------------------|-------------------|
| 1992 | 111,500 | 245 | 252 |
| 1997 | 106,737 | 254 | 199 |
| % Change | -4% | + 4% | -21% |

The above statistics reflect the dramatic trend away from the family farm towards increasing farm operation size and mechanization. As economic and technology trends promote larger farming operations, the challenge associated with proper management of soil and water resources increases.

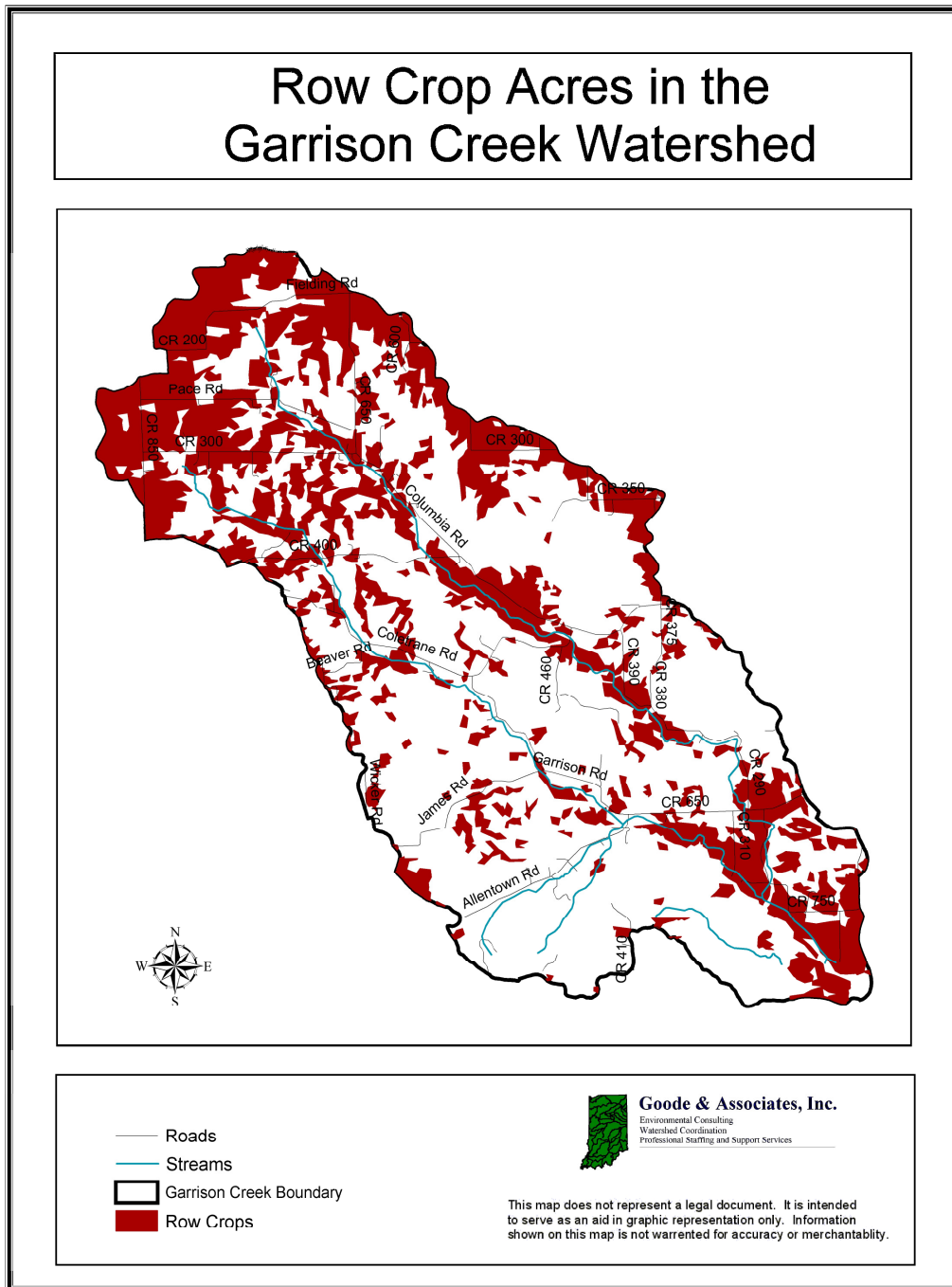
Row Crop Production

According to the Indiana Agricultural Statistics Service, corn and soybeans dominate the row crops grown in Fayette County. In 2001, Fayette County farmers planted 39,000 acres of corn, 33,300 acres of soybeans, 7,200 acres of hay, less than 1,000 acres of wheat, and an undetermined and minimal amount of tobacco. In 2001, Fayette County ranked 64th of the 92 Indiana Counties in corn production (total acreage) and 65th in soybean production (total acreage).

Row crops, primarily corn and soybeans, are less prevalent in the Garrison Creek watershed when compared to other areas of Fayette County. This is primarily due to the steep slopes that dominate the landscape. The row crop acres that do exist in the watershed, as depicted in Figure 6-1, are concentrated in two primary areas:

- 1.) The Garrison Creek bottoms and,
- 2.) the northwestern and southeastern portions of the watershed, which are flat to gently rolling

Figure 6-1: Row Crops in the Garrison Creek Watershed



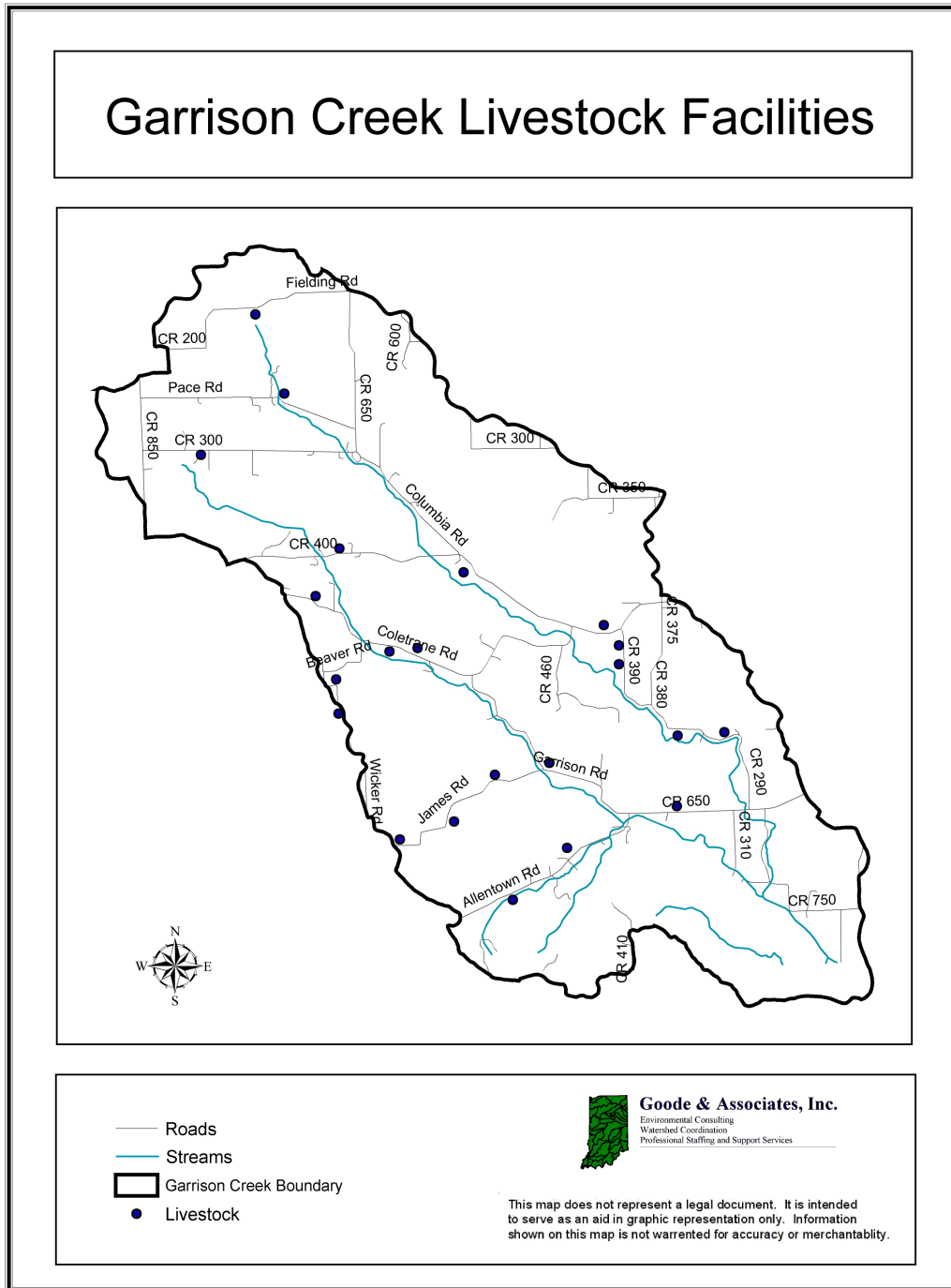
Livestock Production

According to the Indiana Agricultural Statistics Service, in 2002 Fayette County ranked 44th among the 92 Indiana counties in annual cattle production (total population). Based upon a windshield survey conducted by the watershed coordinator, there are approximately twenty-one (21) cattle operations scattered throughout the Garrison Creek watershed. According to the Indiana Department of Environmental Management (IDEM), none of the cattle facilities within the Garrison Creek watershed are regulated. Cattle operations in excess of 300 head are required, by IAC 16-2-6, to obtain a Confined Animal Feeding Operation (CAFO) permit from the Office of Land Quality at the Indiana Department of Environmental Management.

In 1994 Fayette County ranked 27th among the 92 Indiana Counties in annual hog production (total population). The hog populations in the county dramatically declined in the late 1990's due to the poor economic conditions of the hog market. According to the Indiana Department of Environmental Management's (IDEM) database, none of the hog facilities within the Garrison Creek watershed are regulated. Hog operations in excess of 600 head are required, by IAC 16-2-6, to obtain a CAFO permit from the Office of Land Quality at the Indiana Department of Environmental Management.

The Watershed coordinator conducted a "windshield survey" of the watershed in an effort to identify the approximate location of all livestock facilities within the watershed. Figure 6-2 indicates the present location of the livestock facilities within the Garrison Creek watershed. The majority of the livestock facilities identified are small cattle operations.

Figure 6-2: Livestock Facilities in the Garrison Creek Watershed



Agriculture on Highly Erodible Soils

According to the Fayette County Soil Survey, approximately 46% of the agricultural lands within the watershed are located on soils considered to be highly erodible. The highly erodible soils, identified in the soil survey as Highly Erodible Lands (HEL), found within the Garrison Creek watershed are identified below in Table 6-3.

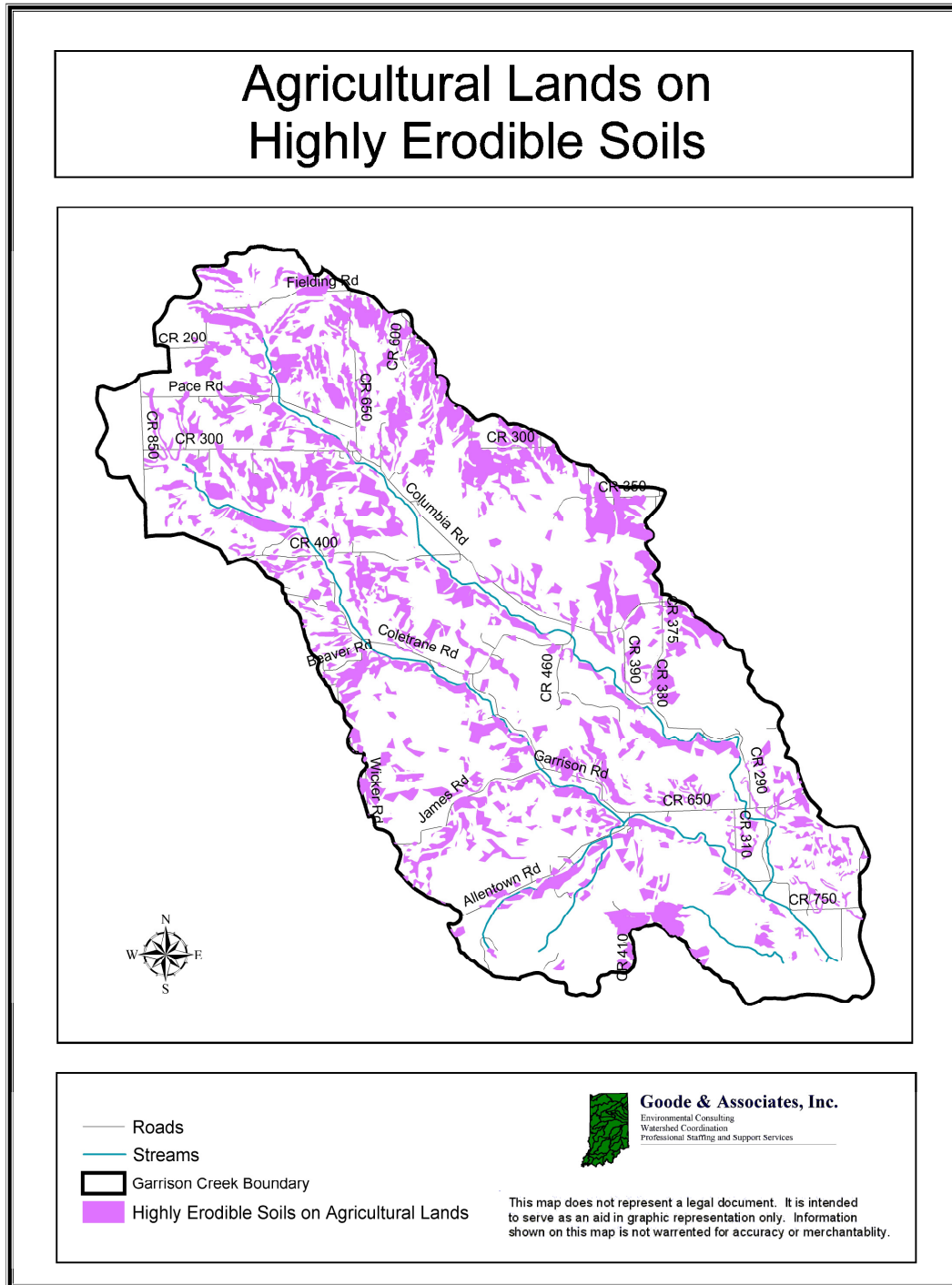
Table 6-3: Highly Erodible Lands (HEL)
in the Fayette County Garrison Creek Watershed

| Map Unit Symbol | Soil Name | % Slope |
|------------------------|------------------|----------------|
| CcC1 | Cincinnati | 8 |
| CcC2 | Cincinnati | 9 |
| CcD1 | Cincinnati | 14 |
| CcD2 | Cincinnati | 15 |
| CcE1 | Cincinnati | 22 |
| CcE2 | Cincinnati | 22 |
| CcF2 | Cincinnati | 30 |
| CnC3 | Cincinnati | 8 |
| CdD3 | Cincinnati | 14 |
| CnE3 | Cincinnati | 20 |
| FaB | Fairmount | 4 |
| FaC | Fairmount | 8 |
| FaD | Fairmount | 15 |
| FaE | Fairmount | 22 |
| FaF | Fairmount | 30 |
| FaG | Fairmount | 45 |
| FmC2 | Fox | 8 |
| FnC2 | Fox | 8 |
| FnD1 | Fox | 14 |
| FnD2 | Fox | 15 |
| FoC2 | Fox | 8 |
| FpC3 | Fox | 8 |
| FrC3 | Fox | 8 |
| FsD2 | Fox/Rodman | 15 |
| FtD2 | Fox/Rodman | 15 |
| FtE2 | Fox/Rodman | 22 |
| FvD3 | Fox/Rodman | 15 |
| FxD3 | Fox/Rodman | 15 |
| HeF1 | Hennepin | 30 |
| HeF2 | Hennepin | 30 |
| HeG1 | Hennepin | 40 |
| HeG2 | Hennepin | 40 |
| McC2 | Martinsville | 8 |
| McD2 | Martinsville | 14 |
| MmC1 | Miami | 8 |
| MmC2 | Miami | 8 |

Garrison Creek Watershed Management Plan

| | | |
|------|---------------|----|
| MmD1 | Miami | 15 |
| MmD2 | Miami | 15 |
| MmE1 | Miami | 21 |
| MmE2 | Miami | 21 |
| MsC3 | Miami | 8 |
| MsD3 | Miami | 15 |
| MsE3 | Miami | 20 |
| OcC2 | Ockley | 8 |
| OkC3 | Ockley | 8 |
| RgD2 | Russell | 15 |
| RgE1 | Russell | 20 |
| RgE2 | Russell | 20 |
| RgF2 | Russell | 30 |
| RsC1 | Russell | 8 |
| RsC2 | Russell | 8 |
| RsD1 | Russell | 15 |
| RsD2 | Russell | 15 |
| RsE1 | Russell | 22 |
| RsE2 | Russell | 22 |
| RtC3 | Russell | 8 |
| RtD3 | Russell | 15 |
| RtE3 | Russell | 22 |
| RuC1 | Russell/Miami | 8 |
| RuC2 | Russell/Miami | 8 |
| RvC3 | Russell/Miami | 8 |
| WnC2 | Wynn | 8 |
| WnD2 | Wynn | 18 |
| WyC3 | Wynn | 8 |

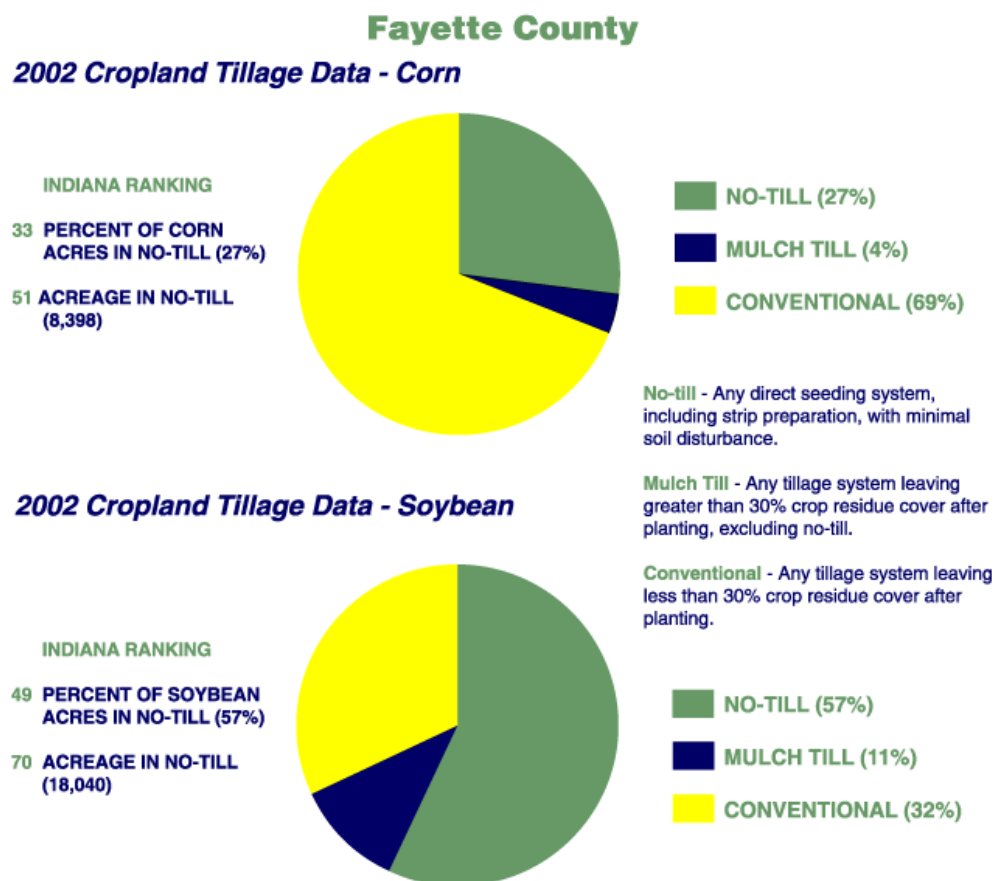
Figure 6-3: Highly Erodible Soils on Agricultural Lands



Fayette County Tillage Practices

According to the IDNR County Tillage Report, 31% of the corn and 68% of the soybeans grown in Fayette County are grown utilizing a conservation tillage system (Figure 6-4). Conservation tillage is defined as any tillage system leaving greater than 30% crop residue cover after planting.

Figure 6-4: 2002 Tillage Statistics for Fayette County



Assuming the countywide statistics above are representative of the Garrison Creek watershed, it is estimated that 1831 acres of soybeans and 835 acres of corn are annually planted utilizing a conservation tillage system.

Agriculture and Water Quality

Generally speaking, agriculture has been identified as one of the major contributors of nonpoint source pollution in rural landscapes around the United States. In 1997, the National Water Quality Inventory (NWQI), sponsored by the US EPA reported that agricultural nonpoint source (NPS) pollution is the leading source of water quality impacts to surveyed rivers and lakes, the third largest source of impairments to surveyed estuaries, and a major contributor to ground water contamination and wetlands degradation (EPA, 2000).

Potential NPS pollutants stemming from agriculture in the Garrison Creek watershed include nutrients, chemicals, sediment, and bacteria (see Table 6-4). Such pollutants can migrate from agricultural lands to surface and groundwater through processes including surface runoff, erosion, infiltration, direct deposit, and drainage tile outlet.

Table 6-4: NPS and Agriculture

| Pollutants | Agriculture Sources |
|-------------------|---|
| Nutrients | commercial fertilizers and manure |
| Chemicals | herbicides, insecticides, fungicides |
| Sediment | sheet, rill, gully, and stream bank erosion |
| Bacteria | manure |

Nutrients

In the Garrison Creek watershed, nutrients such as phosphorus (P) and nitrogen (N) in the form of commercial fertilizers and manure are applied to enhance crop production. In small amounts, N and P are beneficial to aquatic life, however, too much P and N can stimulate the occurrence of algal blooms and excessive plant growth in receiving waters (see Figure 6-7). Algal blooms and excessive plant growth often reduce the dissolved oxygen content of surface waters through plant respiration and decomposition of dead algae and other plants. This situation can be accelerated in hot weather and low flow conditions because of the reduced capacity of the water to retain dissolved oxygen. Since fish and aquatic insects need the oxygen that is dissolved in water to live, when decaying algae uses up that oxygen, fish kills can result. It is important to note that there are no documented occurrences of fish kills within Garrison Creek.

Figure 6-5: Ammonia/Nitrogen Application



Figure 6-6: Livestock in Garrison Creek



Figure 6-7: Algal Bloom in Garrison Creek



The impact that nutrients (commercial fertilizers and manure) have on water quality is directly related to the nutrient management measures implemented on each individual farm field and pasture. For instance, if commercial fertilizers or manure are applied with little regard to the true needs of the soils or are applied close to drainage tiles, streams, or wellheads, the potential for runoff and contamination to surface and groundwater is elevated. Also, if livestock are granted uncontrolled access to the streams, their wastes can be directly deposited to the stream leading to elevated nutrient levels. However, if farmers manage the true needs of their soils and take the appropriate measures to minimize the risk of runoff of manure and/or chemical fertilizers, the impacts of nutrients can be greatly minimized (IDEM, WRAS 2002).

Pesticides

Pesticides include a broad array of chemicals used to control plant growth (herbicides), insects (insecticides), and fungi (fungicides). These chemicals have the potential to enter and contaminate water through direct application, runoff, wind transport, and atmospheric deposition. If applied in a sporadic manner, pesticides can kill fish and wildlife, contaminate food and drinking water sources, and destroy the habitat that animals use for protective cover.

While some pesticides undergo biological degradation by soil and water bacteria, others are very resistant to degradation. Such non-biodegradable compounds may become "fixed" or bound to clay particles and organic matter in the soil, making them less available. However, many pesticides are not permanently fixed by the soil. Instead, they collect on plant surfaces and enter the food chain, eventually accumulating in wildlife such as fish and birds.

Many pesticides have been found to negatively affect both humans and wildlife by damaging the nervous, endocrine, and reproductive systems or causing cancer (IDEM WRAS, 2002).

Figure 6-8: Pesticide Application



Source: USDA/NRCS, 2003

Erosion and Sedimentation

Sedimentation occurs when wind or water runoff carries soil particles from an area, such as a farm field or stream bank, and transports them to a water body, such as Garrison Creek. Excessive sedimentation clouds the water which covers fish spawning areas and food supplies; and clogs the gills of fish. In addition, other pollutants like phosphorus, pathogens, and heavy metals are often attached to the soil particles and wind up in the water with the sediment. Common field erosion in the Garrison Creek watershed occurs in the following forms: gully erosion, sheet erosion, and rill erosion (see Figure 6-9)

Figure 6-9: Sheet Erosion



If livestock are allowed uncontrolled access to streams, severe bank erosion can result (Figure 6-10). This can lead to loss of topsoil, sediment-laden waters, as well as an increase of livestock fecal matter in water sources.

Figure 6-10: Streambank Erosion resulting from livestock



Source: USDA/NRCS, 2003

Bacteria

Livestock production has been identified nationwide as a major contributor of Escheri Coli (*E. coli*) to surface and groundwater supplies for obvious reasons (Figure 6-11). *E. coli* bacteria live within the intestinal tract of warm-blooded animals. *E. coli* is widely used as an indicator of sewage pollution, which may harbor additional waterborne disease causing (pathogenic) bacteria, protozoa, and viruses.

Figure 6-11: Cattle in Garrison Creek



E. coli is also used as an indicator because it is easier and less costly to monitor and detect than the actual pathogenic organisms, such as *Giardia*, *Cryptosporidium*, and *Shigella*, which require special sampling protocols and very sophisticated laboratory techniques. The presence of these waterborne disease-causing organisms can cause outbreaks of diseases, such as typhoid fever, dysentery, cholera, and cryptosporidiosis.

Water quality standards (WQS), established by the Indiana Department of Environmental Management, for *E.coli* have been established in order to ensure safe use of waters for drinking water supplies and recreation. Indiana Code, 327 IAC 2-1-6 Section 6(d), states that *E.coli* bacteria, using membrane filter count (MF), shall not exceed 125 per 100 milliliters as a geometric mean based on not less than five samples equally spaced over a 30 day period nor exceed 235 per 100 mL in any one sample in a 30-day period.

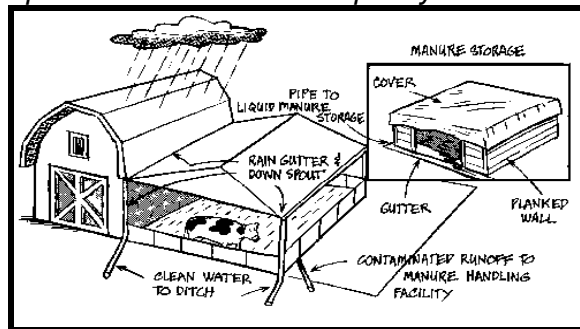
As discussed in Section III, *E.coli* monitoring by the FCWI Watershed coordinator identified several locations within Garrison Creek where the water quality standard for *E.coli* was violated during this project. As stated, livestock facilities in the watershed may be contributing to *E. coli* contamination within the watershed.

Agricultural Goals and Decisions

The ultimate goal of the FCWI Steering Committee, from an agricultural perspective, is to increase the utilization of Best Management Practices (BMPs) on all agricultural lands. The FCWI Steering Committee recognizes and values the agricultural community of the Garrison Creek watershed and has no intention or desire to create any hardship to the agricultural community or any individual farmer. The Steering Committee also realizes that the sources of pollution stemming from agriculture identified above are not specific to the Garrison Creek watershed or Fayette County but that they are issues that arise with all farming operation around the nation.

In an attempt to boost conservation and the utilization of best management practices (BMPs) on agricultural lands, the FCWI Steering Committee developed the following objectives. The following objectives are in order of priority as determined by the FCWI Steering Committee.

Objective 6-1: *By 2007, minimize E. coli levels resulting from livestock facilities in an attempt to meet state water quality standards.*



Manure typically contains high concentrations of bacteria (*E. coli*), nutrients and organic matter. Good farm management keeps manure away from surface water and groundwater, and uses it as an effective fertilizer.

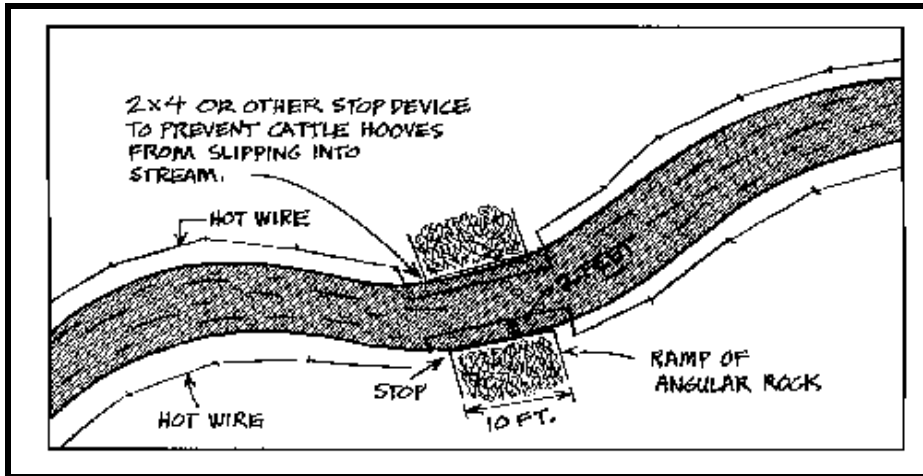
To properly manage manure, farmers should focus on the following:

- Test soil to determine how much manure to apply
- Locate barnyards, stockyards, feeding and watering areas well away from surface waters, to prevent runoff from reaching them.
- Collect manure regularly during periods of confinement.
- Cover stored manure to keep rainwater from seeping through it. Divert roof runoff from the storage area with gutters and downspouts.
- Apply manure evenly as a fertilizer to pastures, fields and gardens.
- Apply only as much as your crop or pasture can use. Excess manure will wash off into surface waters or leach into groundwater systems. Your conservation district representative or cooperative extension agent will have additional information.
- Till manure evenly into soil whenever possible to maximize nutrient use and minimize runoff.
- Do not apply manure when soils are frozen or saturated, or when plants will not use the nutrients.
- Leave an adequate buffer strip between manure application sites and surface waters.

Actions Necessary to Achieve Objective 6-1:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for livestock and manure management.
- Heavily market all cost-share programs available to implement livestock and manure management projects such as the Environmental Quality Incentive Program (EQIP), Lake and River Enhancement (LARE), etc.
- Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on livestock and manure management as well as other best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding livestock and manure management.
- Promote annually livestock and manure management at the County Free Fair and other local events.
- Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County.

Objective 6-2: *By 2007, educate all (100%) of livestock producers of the water quality impacts associated with granting livestock unlimited access to the creek.*



Actions Necessary to Objective 6-2:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Conduct a series of field days and workshops in the Garrison Creek watershed focusing on livestock management.
- Develop and disseminate newsletters to farmers within the watershed regarding livestock management and the available cost-share dollars to implement livestock management practices.
- Provide technical assistance to agriculture producers on the economic and environmental benefits of livestock management.
- Promote annually livestock management at the County Free Fair and other local events.
- Apply for Lake and River Enhancement (LARE) funding to provide cost-share for livestock management.

Objective 6-3: *By 2007, educate all (100%) of livestock producers on the economic and environmental benefits of pasture management.*



Pasture management leads to better weed control, better soil structure, increased productivity over longer periods of time, and healthier animals. It helps the soil absorb excess water, manure, nutrients and other pollutants and ultimately protects water quality by reducing the amount and improving the quality of runoff.

Pastures can be grazed intensively during peak periods of growth, but they need regular attention. For longevity, pastures require regular rest and re-growth periods for root systems to recover and absorb nutrients. Rest periods are critical to proper pasture growth. A grazing rotation that allows 21 to 28 days of re-growth between grazing periods is usually best. For best results, pasture should be divided into separate units (paddocks) if possible. Four or more equal-sized paddocks are recommended for starting a rotational grazing system.

Pasturing too many animals on a given parcel of land or allowing them to graze for too long in the same area reduces plant vigor and compacts soils, reducing absorption capacity and pasture recovery. Overgrazing can lead to additional runoff and a poorer quality of runoff (Washington State Department of Ecology, 2003).

Actions Necessary to Achieve Objective 6-3:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for pasture management.
- Market heavily all cost-share programs available to implement pasture management such as EQIP, LARE, etc.

- Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on pasture management and other best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding pasture management and the available cost-share dollars to implement pasture management.
- Promote annually pasture management at the County Free Fair and other local events.

Objective 6-4: *By 2007, increase the utilization of conservation tillage by 50%*

- ❑ Soybeans: 1831 acres (68%) to 2693 acres (100%)
- ❑ Corn: 835 acres (31%) to 1252 acres (46%)



Source: USDA/NRCS, 2003

According to the Conservation Tillage Information Center (CTIC), there are numerous economic and environmental benefits that conservation tillage offers that conventional tillage systems cannot match. The top benefits of conservation tillage as identified by the CTIC website (www.ctic.purdue.edu) are as follows:

- ❑ Reduces labor, saves time
As little as one trip for planting compared to two or more tillage operations means fewer hours on a tractor and fewer labor hours to pay ... or more acres to farm. For instance, on 500 acres the time savings can be as much as 225 hours per year. That's almost four 60-hour weeks.
- ❑ Saves fuel
Save an average 3.5 gallons an acre or 1,750 gallons on a 500-acre farm.

- ❑ Reduces machinery wear
Fewer trips save an estimated \$5 per acre on machinery wear and maintenance costs—a \$2,500 savings on a 500-acre farm.
- ❑ Improves soil tilth
A continuous no-till system increases soil particle aggregation (small soil clumps) making it easier for plants to establish roots. Improved soil tilth also can minimize compaction. Of course, reducing trips across the field also reduces compaction.
- ❑ Increases organic matter
The latest research shows that the more soil is tilled, the more carbon is released to the air and the less carbon is available to build organic matter for future crops. In fact, carbon accounts for about half of organic matter.
- ❑ Traps soil moisture to improve water availability
Keeping crop residue on the surface traps water in the soil by providing shade. The shade reduces water evaporation. In addition, residue acts as tiny dams slowing runoff and increasing the opportunity for water to soak into the soil. Another way infiltration increases is by the channels (macropores) created by earthworms and old plant roots. In fact, continuous no-till can result in as much as two additional inches of water available to plants in late summer.
- ❑ Reduces soil erosion
Crop residues on the soil surface reduce erosion by water and wind. Depending on the amount of residues present, soil erosion can be reduced by up to 90% compared to an unprotected, intensively tilled field.
- ❑ Improves water quality
Crop residue helps hold soil along with associated nutrients (particularly phosphorous) and pesticides on the field to reduce runoff into surface water. In fact, residue can cut herbicide runoff rates in half. Additionally, microbes that live in carbon-rich soils quickly degrade pesticides and utilize nutrients to protect groundwater quality.
- ❑ Increases wildlife
Crop residues provide shelter and food for wildlife, such as game birds and small animals.
- ❑ Improves air quality
Crop residue left on the surface improves air quality because it: Reduces wind erosion, thus it reduces the amount of dust in the air; Reduces fossil fuel emissions from tractors by making fewer trips across the field; and Reduces the release of carbon dioxide into the atmosphere by tying up more carbon in organic matter.

The IDEM's Load Reduction Workbook was utilized to calculate/estimate the pollutant load reductions associated with achieving this objective. The Load Reduction Workbook uses the "Pollutants Controlled Calculation and Documentation for Section 319 Watershed Training Manual (Michigan Department of Environmental Quality, June 1999) to provide a gross estimate of sediment and nutrient load reductions associated with the implementation of agricultural conservation practices. This workbook uses

many simplifying assumptions to provide a general ***estimate*** of pollutant load reductions (IDEM, 2003).

Estimated Load Reductions associated with Objective 6-2 are as follows:

Sediment Load Reduction: 11,788 tons/year

Phosphorus Load Reduction: 10,294 lbs/year

Nitrogen Load Reduction: 20,567 lbs/year

Actions Necessary to Achieve Objective 6-4:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for conservation tillage.
- Heavily market all cost-share programs available to implement conservation tillage such as EQIP, LARE, etc.
- Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on conservation tillage as well as other agricultural best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding conservation tillage.
- Annually promote conservation tillage at the County Free Fair and other local events.
- Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County.

Objective 6-5: *By 2007, establish a minimum of 6,676 linear feet of riparian buffer strips within the Garrison Creek Watershed*



Conservation buffers are small areas or strips of land in permanent vegetation, designed to slow water runoff, provide shelter and stabilize riparian areas. Strategically placed buffer strips in the agricultural landscape can effectively mitigate the movement of sediment, nutrients, and pesticides within farm fields and from farm fields. Buffers include: contour buffer strips, field borders, filter strips, grassed waterways, living snow fences, riparian buffers, shelterbelts/windbreaks (grass, shrubs and trees), and wetlands. The small amount of land taken out of production helps producers meet environmental and economic goals.

Benefits of Conservation Buffers

The economic and environmental benefits of conservation buffers, as identified by the CTIC, are as follows:

- ❑ Reduces up to 80% of sediment from runoff.
- ❑ Reduces 40% (on average) of phosphorous from runoff.
- ❑ Removes a significant amount of nitrate from runoff.
- ❑ Removes up to 60% of pathogens from runoff.
- ❑ Provides a source of food, nesting cover and shelter for wildlife.
- ❑ Improves fish habitat.
- ❑ Reduces wind erosion.
- ❑ Slows water runoff.
- ❑ Reduces downstream flooding.
- ❑ Stabilizes streambanks.
- ❑ Establish natural vegetation.
- ❑ Adds visual aesthetics to the landscape.
- ❑ Protects soil in vulnerable areas.

The Watershed coordinator, utilizing 1998 aerial photography and GIS software, identified 17,803 feet of potential buffer projects within the Garrison Creek watershed (Figure 6-13). Realizing that there is a margin of error with the method used to identify these sites, the FCWI Steering Committee realized that an agricultural conservation specialist needs to visit each site identified to determine the true needs of each site.

The IDEM's Load Reduction Workbook was utilized to calculate/estimate the pollutant load reductions associated with achieving the buffer objective assuming that the buffer strips installed were, at a minimum, 20 feet wide. The Load Reduction Workbook uses the "Pollutants Controlled Calculation and Documentation for Section 319 Watershed Training Manual (Michigan Department of Environmental Quality, June 1999) to provide a gross estimate of sediment and nutrient load reductions associated with the implementation of agricultural conservation practices. This workbook uses many simplifying assumptions to provide a general **estimate** of pollutant load reductions (IDEM, 2003).

Estimated Load Reductions associated with Objective 6-3 are as follows:

Sediment Load Reduction: 31 ton/year

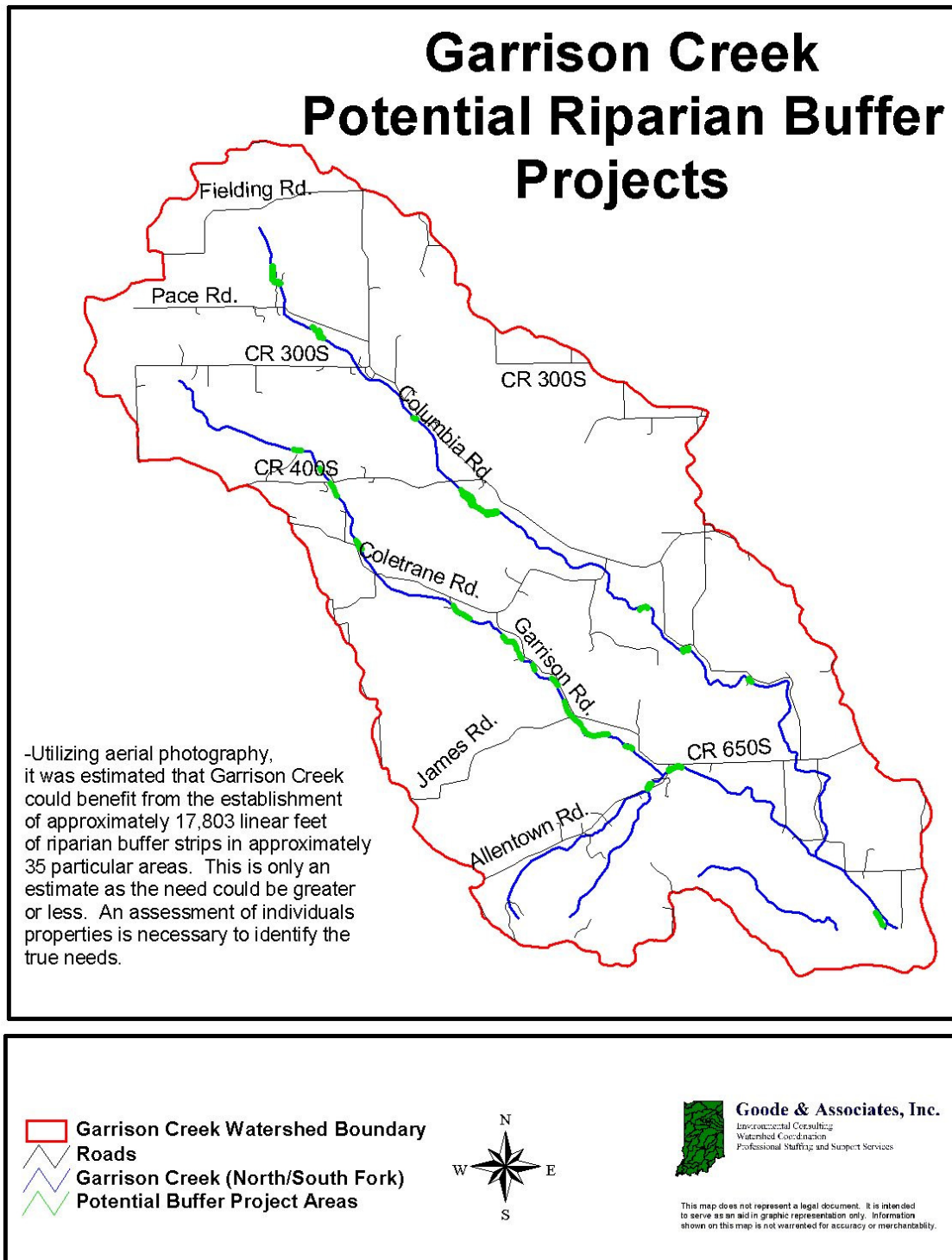
Phosphorus Load Reduction: 26 lbs/year

Nitrogen Load Reduction: 51 lbs/year

Actions Necessary to Achieve Objective 6-5:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for conservation buffer projects.
- Heavily market all cost-share programs available to implement livestock and manure management projects such as EQIP, CRP, WHIP, LARE, etc.
- Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on conservation buffers as well as other best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding conservation buffers.
- Annually promote conservation buffers at the County Free Fair and other local events.
- Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County.

Figure 6-13: Potential Buffer Projects



Objective 6-6: *By 2007, educate 100% of farmers within the watershed on the economic and environmental benefits of nutrient management.*



Source: USDA/NRCS, 2003

Nutrient management is another important component to a sound on-farm management system to minimize the impacts that fertilizers and manure have on water quality. According to the Conservation Tillage Information Center at Purdue University, there are ten fundamental components of a Crop Nutrient Management Plan. Each component is critical to helping a farmer analyze each field and improve nutrient efficiency for the crops grown while protecting water quality. The following components were derived from CTIC web site (www.ctic.purdue.edu):

- **Field map.** For improved planning purposes, field maps should include general reference points such as streams, residences, wellheads, number of acres, soil types, etc.
- **Soil test.** Soil tests should be conducted on a consistent schedule to analyze the true nutrient needs of individual fields. The photo in Objective 6-4 shows a farmer testing his soils and marking his sample points utilizing a Global Positioning System (GPS).
- **Crop sequence.** The crops grown and the management practices utilized in the past should all be considered when making nutrient management related decisions.
- **Estimated yield.** Historic yields are important in developing yield estimates for next year. Accurate yield estimates can dramatically improve nutrient use efficiency.
- **Sources and forms.** The sources and forms of available nutrients can vary from farm-to-farm and even field-to-field (manure, legumes, etc.).
- **Sensitive areas.** The physical characteristics of the field should be considered when developing a nutrient management plan. One should pay considerable attention to whether or not there are conditions present

that could increase or decrease the risk of nutrient loading to water bodies (streams, lakes, drainage ditches, sandy soils, wellheads, buffer strips)

- **Recommended rates.** Recommended rates involve the proper amount and location of applied fertilizer.
- **Recommended timing.** There are numerous variables involved with the proper timing of fertilizer application (temperature, moisture, tillage practice, whether or not a starter fertilizer will be used, etc. Taking all variables into consideration will provide a benefit to your nutrient management program.
- **Recommended methods.** There are different methods to properly apply fertilizer and manure. Slope, rainfall patterns, soil type, crop rotation and many other factors affect which method is best for optimizing nutrient efficiency. These things should all be considered on a field-by-field basis.
- **Annual review and update.** Keeping good notes throughout the season and annually reviewing the nutrient program can provide great benefit to an operation. Documenting the weather patterns, crop diseases, yields, what fertilizer was applied and how much fertilizer was applied can help a farmer understand how his/her soils respond under different conditions.

Actions Necessary to Achieve Objective 6-6:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for nutrient management.
- Market heavily all cost-share programs available to implement nutrient management such as EQIP, LARE, etc.
- Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on nutrient management as well as other best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding nutrient management.
- Promote annually nutrient management at the County Free Fair and other local events.
- Develop an FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County.

Objective 6-7: *By 2007, educate 100% of farmers within the watershed on the economic and environmental benefits of pest management.*



Source: USDA/NRCS, 2003

As defined by the CTIC, pest management is a comprehensive approach to fine tuning on-farm management of harmful weeds and pests including management strategies that allow for better control with minimum risk to the environment. Resistant plants, cultural controls, soil amendments, beneficial insects, natural enemies, barriers, physical treatments, behavioral disruptors, biological and conventional pesticides are some of these management strategies (CTIC, 2003).

Weed and pest management results in fewer herbicide applications, at reduced rates, using the safest and most effective formulations. This minimizes risk associated with the application including accidents, drift, and any potential toxic effects on non-target species. Scouting helps avoid unexpected pest outbreaks, which can cause heavy losses if not caught and treated (CTIC, 2003).

By using mechanical cultivation, pesticides, fertilizers and tillage only when necessary, growers protect the environment by reducing sediment and polluted runoff from entering our lakes, streams and rivers. Utilizing scouting and selecting the appropriate control for the weed or pest identified, benefits the biological integrity of local surface waters (CTIC, 2003).

Actions Necessary to Achieve Objective 6-7:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for pest management.
- Heavily market all cost-share programs available to implement pest management projects such as EQIP, LARE, etc.
- Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on pest management as well as other best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding pest management.
- Annually promote pest management at the County Free Fair and other local events.
- Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County.

Objective 6-8: *By 2007, educate 100% of the landowners who own creek-side property on the different methods of stabilizing streambanks and the permits and actions necessary to conduct stabilization efforts.*



Streambank erosion is an issue within the Garrison Creek watershed due to the gravelly nature of the soils along the creek channel. The FCWI Steering Committee understands that there are correct and incorrect methods of addressing streambank erosion and feel that educating landowners and governmental agencies is a necessity for addressing the streambank erosion problem within the watershed.

Actions Necessary to Achieve Objective 6-8:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for stream stabilization projects.
- Market heavily all cost-share programs available to implement stream stabilization projects such as CRP, LARE, etc.
- In 2005, organize and conduct a tour of stabilized streambanks in neighboring counties where good examples exist.
- Develop and disseminate newsletters to farmers within the watershed regarding proper streambank stabilization and the laws and regulations involved with streambank stabilization.
- Promote annually proper streambank protection at the County Free Fair and other local events.
- Develop an FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County.

Objective 6-9: *By 2007, educate 100% of farmers and landowners on the USDA Wetland Reserve Program (WRP) and the Wildlife Habitat Incentive Program (WHIP) and the value of protecting wildlife habitat.*



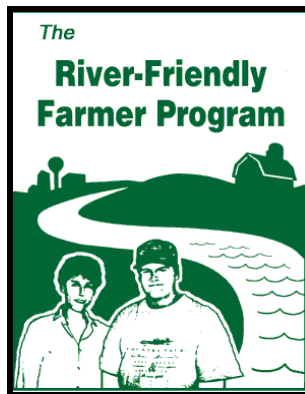
Wildlife habitats, including wetlands, support an abundant and diverse population of plant and animal species, many of which are currently rare or endangered. Through their unique soils and vegetation, wetlands and other vegetated habitats help to improve water quality by absorbing and trapping nutrients, sediments and chemical compounds.

Wetlands and other vegetated areas can also assist in addressing water quantity issues due to their ability to absorb floodwaters and slowly release them into nearby streams.

Actions Necessary to Achieve Objective 6-9:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for wildlife habitat improvements and wetland restoration projects.
- Market heavily all cost-share programs available to implement wildlife habitat improvements and wetland restoration projects such as WRP, WHIP, CRP, LARE, etc.
- Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on wildlife habitat improvements, wetland restoration and other best management practices.
- Advertise actively the availability of the FCSWCD no-till drill to the community through newsletters, newspaper articles, the Fayette County Free Fair, and by having the drill on display and in use at field days and workshops.
- Develop and disseminate newsletters to farmers within the watershed regarding wildlife habitat improvements and wetland restoration.
- Promote annually wildlife habitat improvements and wetland restoration at the County Free Fair and other local events.

Objective 6-10: *By 2004, initiate a program such as or similar to the River-Friendly Farmer Program to recognize a local farmer for his or her conservation practices.*



Source: IASWCD, 2003

The FCWI Steering Committee feels that those farmers who are actively participating in conservation efforts should be recognized for their efforts. The FCWI Steering Committee feels that the local SWCD Annual Dinner is the prime opportunity to acknowledge those farmers who have been good stewards of the land.

Actions Necessary to Achieve Objective 6-10:

- Develop the criteria for which a farmer must satisfy to be eligible for the award.
- Develop a team or committee to review nominations for this award
- Advertise the program through Fayette County Farm Bureau, the Connersville News Examiner, FCSWCD Newsletters and other local means.
- Purchase and present the award at the Annual FCSWCD Meetings.

Trampling by livestock erodes streambanks. Runoff carrying manure can contribute to the pollution of surface and groundwater. To minimize the impacts livestock may have on water quality a livestock farmer should consider the following:

- Restrict livestock and barnyard animals from streamside areas with fencing. Hedges are attractive living fences that attract wild birds and other beneficial wildlife.
- Establish watering and feeding areas for animals away from slopes leading to waterbodies.
- Avoid excessive runoff through proper pasture management and land-clearing practices.
- If animals must be watered at streamside, use a ramp-fence system (see diagram above).

Objective 6-11: *Educate all (100%) of livestock producers of the water quality/forest impacts related to granting livestock access to forestland.*



Source: USDA/NRCS, 2003

Excluding livestock from forestland helps preserve the integrity of woodlands. Cattle hooves crush, chop and destroy the duff layer and leaf litter on the forest floor, increasing the likelihood of erosion during periods of heavy rain. The reduction of soil exposes tree roots, allowing hooves to damage root surfaces. These "open wounds" invite invasions of fungi, insects and bacteria that can damage tree health and greatly reduce the market value of the timber (Missouri Conservationist, 2003).

Actions Necessary to Achieve Objective 6-11:

- Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners.
- Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for livestock management.
- Market heavily all cost-share programs available to implement livestock management practices such as EQIP, LARE, etc.
- Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on livestock management and other best management practices.
- Develop and disseminate newsletters to farmers within the watershed regarding livestock management and the available cost-share dollars to implement pasture management.
- Promote annually pasture management at the County Free Fair and other local events.

Objective 6-12: *Collect additional water quality data to determine the levels of pesticides, primarily Atrazine, in Garrison Creek.*



The Earlham College Biology Department has obtained \$60K to conduct a study of Atrazine and its impact upon amphibians, primarily frogs. Gary Breitenbach, a FCWI Steering Committee member and a Garrison Creek resident, and his colleagues at Earlham College will conduct this study beginning in 2003 through 2005.

Actions Necessary to Achieve Objective 6-12:

Staff and students at Earlham College will be responsible for conducting this study at Sampling Sites 1 thru 6 as outlined in Section III of this plan. The FCWI will not play a significant role in this effort but will value the efforts and results of the study. Once the data become available, the results will be incorporated into the Garrison Creek watershed management plan and, if necessary, goals and actions pertaining to the data will be developed.

Responsible Partners for Implementing Objectives 6-1 thru 6-12:

Because they play a direct role in agricultural issues, the FCSWCD and the NRCS have been deemed as the responsible partners for implementing the agricultural related measures discussed in this section. The FCSWCD and the NRCS, however, should rely upon a variety of organizations and agencies for assistance in implementing the agricultural component of this plan. Such parties include: Fayette County Farm Bureau, Purdue Extension, IDNR Division of Soil Conservation, Fayette County 4-H, Future Farmers of America (FFA), the Connersville High School Agriculture Teacher, the Community Education Coalition, the Earlham College Biology Department, and IU East.

Measuring the Success of Objectives 6-1 thru 6-12:

In order to measure the progress of Objectives 6-1 thru 6-12, staff from the FCSWCD and NRCS will conduct the following activities:

- ❑ Document all interaction with Garrison Creek farmers.
- ❑ Document the attendance at field days and workshops.
- ❑ Utilize GIS to document the location and other specifics of BMP's implemented in the Garrison Creek watershed.
- ❑ Where applicable, utilize the IDEM's Load Reduction Workbook to estimate the load reduction benefits of BMPs implemented.
- ❑ Develop and maintain a monthly log of progress and make available at the FCWI Quarterly Meetings.
- ❑ Develop a FCSWCD website as a means of providing information to local farmers regarding agriculture and watershed protection.

Critical Agricultural Areas

Critical agricultural areas are those target areas within the watershed where the major stressors or potential major stresses originate. The FCWI Steering Committee has identified the following as critical areas or priority areas of the Lick Creek watershed:

- ❑ All Livestock Facilities within the watershed due to the significant E. coli problems Lick Creek is experiencing (Figure 6-2)
- ❑ Agricultural operations upon HEL (Figure 6-3)
- ❑ Potential buffer project areas (Figure 6-13)
- ❑ Row Crop acres not under a conservation tillage program
- ❑ All wetlands adjacent to agricultural lands

Funding Necessary to Achieve Objectives 6-1 thru 6-12:

There are a wide variety of state and federal funding programs available to implement agricultural conservation practices. The FCWI Steering Committee, in cooperation with the FCSWCD, will explore and promote all funding mechanisms available in an attempt to increase agricultural conservation practices within the watershed. Such funding mechanisms include:

Environmental Quality Incentives Program

Administered: USDA/NRCS

Summary: Funding for projects to treat identified soil, water and related natural resource concerns on eligible land. Technical, financial and educational support are available. Half of which is targeted towards livestock related concerns and half of it toward general conservation.

Eligibility: Non-federal landowners engaged in livestock operations or agricultural productions.

How Much: Up to \$10,000 per person per year and up to \$50,000 over the length of a contract. Federal cost share support of up to 75%.

Web Pages/Links: <http://www.nrcs.usda.gov/programs/eqip/>

Conservation Reserve Program

Administered: USDA/ Indiana Farm Service Agency

Summary: Funding for projects to control soil erosion. The goal of the program is to give farmers incentives to convert highly erodible land or other sensitive areas into vegetative cover such as native grasses, trees, and riparian buffers.

Eligibility: Agricultural land owners

How Much: Annual rental payments for the term of a multi year contract of up to \$50,000 per fiscal year. Funds are also available for up to 50% of cost of establishing vegetative cover.

Web Pages/Links: <http://www.fsa.usda.gov/dafp/cepd/crp.htm>

Wetland Reserve Program

Administered: USDA/NRCS

Summary: Program provides technical and financial assistance to land owners restoring marginal agricultural land to wetland. Easements range from 10-30 years. Landowners retain ownership.

Eligibility: Land owners who have owned their land for at least 12 months.

How Much: NRCS easement and restoration payments range from 75% - 100%

Web pages and Links: <http://www.nhq.nrcs.usda.gov/PROGRAMS/wrp/>

Wildlife Habitat Incentive Program

Administered: USDA/NRCS

Summary: Cost share and technical assistance to develop and improve wildlife habitat on private land.

Eligibility: Private landowners who are agricultural producers are eligible

How Much: 75% Federal Cost Share

Web Pages/Links: <http://www.nhq.nrcs.usda.gov/PROGRAMS/whip/>

Lake and River Enhancement Program

Administered: Indiana DNR

Summary: Funding to reduce inflow of sediments and nutrients into lakes and rivers. Eligible projects include water quality monitoring and watershed projects.

Eligibility: Local entities, land planners, and development organizations.

How Much: Financial assistance of up to \$100,000 is available. Program also provides up to 80% cost share of approved watershed land treatment practices.

Web Pages and Links: <http://www.in.gov/dnr/soilcons/pdfs/lare.pdf>
<http://www.in.gov/dnr/soilcons>

Non Point Source Implementation Grants (319)

Administered: EPA/IDEM

Summary: Projects to control nonpoint source pollution are eligible. Funds can be used for TMDL development and implementation, watershed management plans, education programs and more.

Eligibility: Non-profit groups, universities, municipalities, etc.

How Much: Twenty Five percent match with a maximum award of \$112,500.

Web Pages/Links: <http://www.in.gov/idem/water/planbr/wsm/index.html>

The FCSWCD shall apply for a Section 319 Grant in October of 2004 to obtain funding to hire a watershed technician to provide technical services to local farmers. In addition, the FCSWCD in February 2003 applied for a LARE grant to obtain \$60K in cost-share to implement conservation practices upon agricultural lands within the Garrison Creek watershed. The result of the LARE grant application is uncertain at this time.

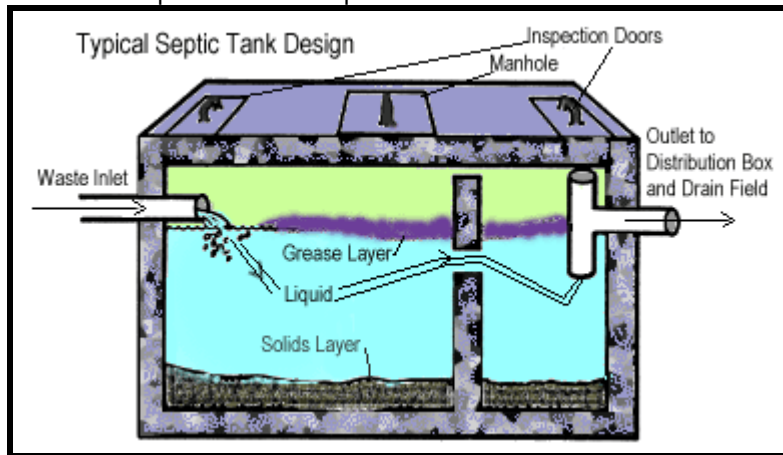
VII. Septic Systems in the Garrison Creek Watershed

Due to the rural nature of the Garrison Creek watershed, 100% of the Garrison Creek residents rely upon septic systems for on-site wastewater treatment. Properly functioning septic systems provide a natural method of treatment and disposal of household wastes for those homeowners who are not connected to a municipal sewage system. However, a faulty or improperly installed septic system has the potential to create serious groundwater and surface water problems.

How Septic Systems Work

The septic tank is the first step of the wastewater treatment process. The septic tank is a solid tank designed specifically to accept all wastewater from the home. A septic system works by allowing wastewater to separate into layers and begin the process of decomposition while being contained within the septic tank (Figure 7-1). Bacteria, which are naturally present in all functioning septic systems, begin to digest the solids that have settled to the bottom of the tank transforming up to 50 percent of these solids into liquids and gases. When liquids within the tank rise to the level of an outflow pipe, they enter the drainage system. This outflow, or effluent, is then distributed throughout a drain field and a series of subsurface pipes. Final treatment of the effluent occurs here as the soil absorbs and filters the liquid and microbes break down the rest of the waste into harmless material (Septic Seep, 2003).

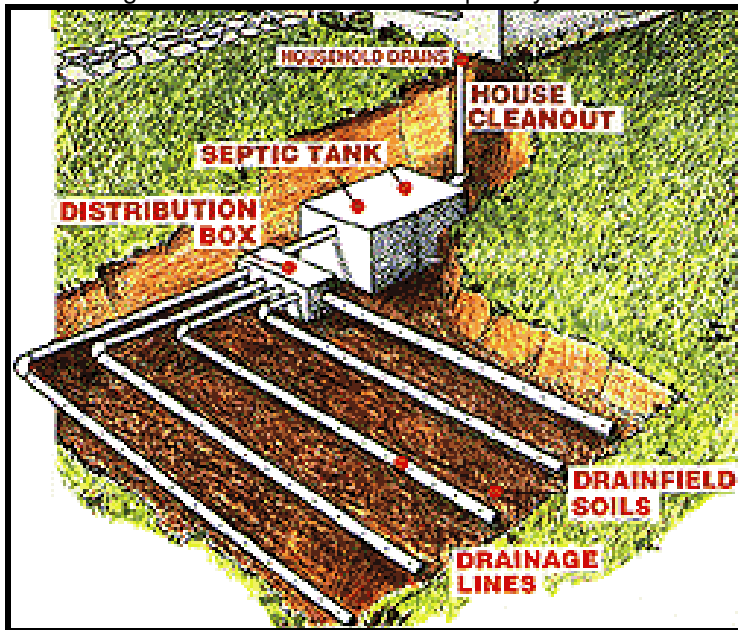
Figure 7-1: Components of a Septic Tank



Source: Septic Seep, 2003

In the soil treatment portion of the system (drain field), bacteria and viruses in the sewage are destroyed by the soil and naturally-occurring microscopic organisms (Figure 7-2). Nutrients are absorbed by soil particles or taken up by plants (Septic Seep, 2003).

Figure 7-2: Drain Field of a Septic System



Source: Septic Seep, 2003

Water Quality and Septic Systems

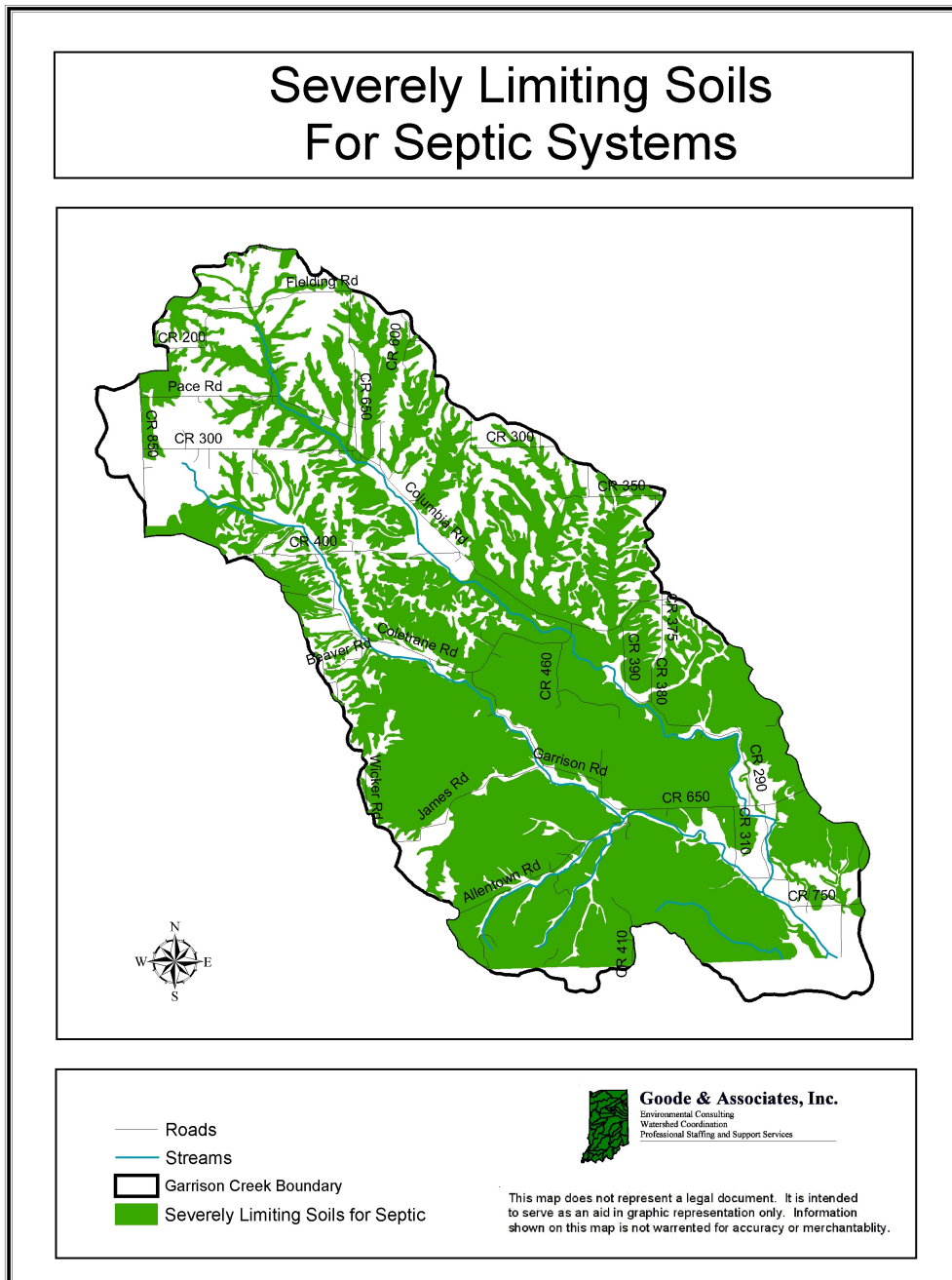
5. Along with livestock, septic systems have been identified as a major contributor of *E. coli* in the Garrison Creek watershed (see Section 3). However, failing septic systems are not an issue unique to the Garrison Creek watershed or to Fayette County. Septic systems tend to be a major problem throughout Indiana and the nation.

Septic tanks/systems can act as sources of nitrogen, phosphorus, organic matter and bacterial (*E. coli*) and viral pathogens for reasons related to:

- Inappropriate installation: This often involves improper site selection for the system due to inadequate separation from groundwater, inadequate absorption area, fractured bedrock, sandy soils, and inadequate soil permeability. Inappropriate installation can also result the smearing of trench bottoms during construction, compaction of the soil bed by heavy equipment, and improperly performed percolation tests (North Carolina State University, 2003).

According to the 1960 Fayette County Soil Survey, there are numerous soils within Fayette County and the Garrison Creek watershed that are not conducive to on-site wastewater treatment. The Watershed Coordination team utilized the Fayette County Soil Survey to develop Figure 7-3 to illustrate which soils in the Garrison Creek watershed are considered to be “severely limited” for wastewater treatment. Approximately 66.4% (11,007 acres) of the soils within the watershed fit this category.

Figure 7-3: Severely Limiting Soils for Septic Systems



- Lack of Maintenance: It is estimated that as many as 75 percent of all system failures have been attributed to hydraulic overloading (Storm Water Center, 2003). Regular inspections and maintenance are necessary for maintaining the functionality of the system and too often this does not occur.

In addition to regular maintenance, septic systems, depending on their size, must be purged of all solids that have settled to the bottom of the tank. Pumping frequency depends on the size of the tank and the number of individuals utilizing the system (Objective 7-1).

Exhausted lifetime: Septic systems are not designed to last forever but are rarely replaced until well after they have begun to fail.

Indiana State Code defines system failure as all or any of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures.
 2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters.
 3. Effluent is discharged from the system causing contamination of a potable water supply, groundwater, or surface waters.
- Straight Pipes: The term “septic system” refers to a septic tank with the appropriate drain field as described above. However, septic tanks are often installed with a pipe leading directly from the tank to either a drain tile or a stream. This term is often referred to as a “straight pipe” discharge. Essentially, straight pipe systems only provide primary treatment and then release severely polluted wastewater directly to a stream. Straight pipes are a violation of state law and an unhealthy circumstance affecting many streams around that nation. Based upon conversations with the Fayette County Health Department and other stakeholders, it is believed that numerous straight pipes exist within the Garrison Creek watershed.

Septic System Goals and Decisions

Recognizing the water quality problems associated with failing or inadequate septic systems, the FCWI Steering Committee developed the following objectives. The objectives are listed in order of priority as determined by the FCWI Steering Committee.

Objective 7-1: *By 2007, educate 100% of the Garrison Creek residents on how to properly operate and maintain a septic system.*

Table 8-1: Pumping Frequency of a Septic Tank (years)

| Tank size* (Gallons) | Household Size (number of people) | | | | | |
|-------------------------|-----------------------------------|------|------|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 500 | 5.8 | 2.6 | 1.3 | 1.0 | 0.7 | 0.4 |
| 750 | 9.1 | 4.2 | 2.6 | 1.8 | 1.3 | 1.0 |
| 900 | 11.0 | 5.2 | 3.3 | 2.3 | 1.7 | 1.3 |
| 1000 | 12.4 | 5.9 | 3.7 | 2.6 | 2.0 | 1.3 |
| 1250 | 15.6 | 7.5 | 4.8 | 3.4 | 2.6 | 2.0 |
| 1500 | 18.9 | 9.1 | 5.9 | 4.2 | 3.3 | 2.6 |
| 1750 | 22.1 | 10.7 | 6.9 | 5.0 | 3.9 | 3.1 |
| 2000 | 25.4 | 12.4 | 8.0 | 5.9 | 4.5 | 3.7 |
| 2250 | 28.6 | 14.0 | 9.1 | 6.7 | 5.2 | 4.2 |
| 2500 | 31.9 | 15.6 | 10.2 | 7.5 | 5.9 | 4.8 |

Source: Montana University, 2003

Actions Necessary to Achieve Objective 7-1:

- Develop a series of newsletters and newspaper articles highlighting the importance of proper operation and maintenance of septic systems.
- Conduct presentation to civic groups within the watershed highlighting the importance of proper operation and maintenance of septic systems.
- Work with Fayette County government to provide financial incentives for proper operation and maintenance of septic systems.
- Identify and pursue available funding opportunities for homeowners interested in updating their septic system.
- Annually promote septic system maintenance at the Fayette County Free Fair and other local events.

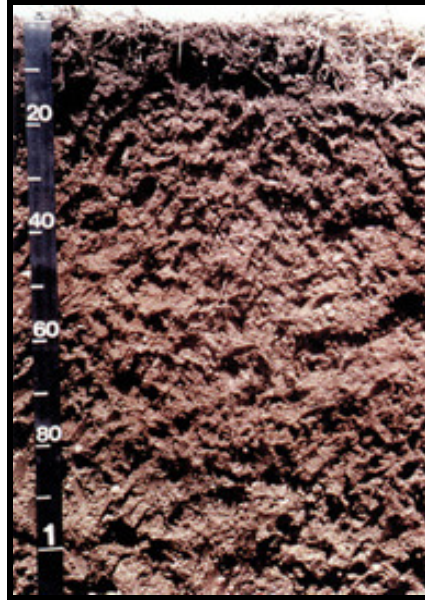
Objective 7-2: *By 2007, initiate a county-wide program to improve the identification of and replacement of failing septic systems and straight pipes*



Actions Necessary to Achieve Objective 7-2:

- Work with the Fayette County Commissioners and the Fayette County Health Department to develop and implement a water quality-monitoring program that identifies illicit septic discharges (straight pipes) and encourages repair.
- Develop a series of newsletters and newspaper articles and conduct presentations to civic groups highlighting the symptoms of a failing septic system.
- Work with Fayette County government to provide financial incentives for proper operation and maintenance of septic systems.
- Identify funding opportunities for homeowners interested in updating their septic system.

Objective 7-3: *By 2007, ensure that all new septic systems are installed only within soils proven to be conducive to onsite wastewater treatment*



Source: USDA/NRCS, 2003

Actions Necessary to Achieve Objective 7-3:

- Modify local zoning ordinance and building code language to inhibit septic system installation on “severely limiting” soils and enforce such codes.
- Update and digitize the Fayette County Soil Survey in order to simplify the process of identifying “severely limiting” soils and make this data available to developers, the FCSWCD, and other relevant parties.
- Require, through zoning ordinances and building codes, alternative septic system installation upon “severely limiting” soils.

Responsible Parties for Implementing Objectives 7-1 thru 7-3:

The CEC’s Environmental Educator, the Fayette County Health Department, and the Area Plan Commission have been deemed the responsible parties for achieving Objectives 7-1 thru 7-3. There is no doubt, however, that these agencies will require support and participation from other governmental agencies within Fayette County, including but not limited to, the Fayette County Commissioners and the Fayette County Council, for implementing these actions

Measuring the Success of Objectives 7-1 thru 7-3:

In order to measure the progress of Objectives 7-1 thru 7-3, staff from the CEC, the Fayette County Health Department, and the Area Plan Commission will conduct the following activities:

- ❑ Document all associated actions on behalf of the Fayette County Health Department, the Area Plan Commission, the Fayette County Commissioners and the Fayette County Council as they pertain to septic systems, water quality monitoring, economic incentives, and other relevant topics.
- ❑ Document and make available all septic system related newsletter and newspaper articles published and disseminated by the CEC Environmental Educator to the FCWI Steering Committee at quarterly meetings.
- ❑ Document all public presentations and the number of residents in attendance, and make this information available to the FCWI Steering Committee at quarterly meetings.
- ❑ Develop and maintain a monthly log of Fayette County Health Department activities involving septic systems in the Garrison Creek watershed, including septic system failures, septic system repairs, and septic system replacement.

Funding Necessary to Achieve Objectives 7-1 thru 7-3:

Septic systems are an ongoing problem around the state due to a lack of state and federal funding programs available to address the problem.

The Section 319 Grant received by the CEC will fund the education components outline in Objectives 7-1 thru 7-3. However, the other strategies listed above would require county appropriations and collaboration from a variety of governmental offices.

Critical Septic System Areas

Due to the fact that all households within the Garrison Creek watershed rely upon onsite wastewater treatment and the fact that E. coli has been identified as a problem according to the water quality data collected during the development of this plan, each and every resident (septic system) in the watershed has been deemed a priority.

VIII. Local Government and Watershed Management

Numerous local governmental agencies directly or indirectly affect the water quality and natural resources of Garrison Creek. Such agencies include:

- ❑ Fayette County Soil and Water Conservation District (FCSWCD)
- ❑ Fayette County Health Department (FCHD)
- ❑ Area Plan Commission (APC)
- ❑ Fayette County Highway Department
- ❑ Fayette County Surveyor
- ❑ Fayette County Park Board
- ❑ Fayette County Council
- ❑ Fayette County Commissioners

Because of the valuable role each government entity plays directly or indirectly in watershed management, the FCWI Steering Committee felt it necessary to identify these groups, briefly discuss the role each entity plays regarding water quality/natural resources protection and discuss broad and specific actions each entity may take to improve and protect the natural resources of the Garrison Creek watershed while furthering the evolution of the Fayette County Watershed Initiative. Many of the needs and objectives discussed below are reiterations of earlier sections but deemed necessary by the FCWI Steering Committee in order for the reader to fully understand the overall complexity of watershed management. Also, many of the needs and objectives discussed below are lofty in the sense that fiscal and political barriers must be overcome to fully satisfy them.

Because of the fiscal and political barriers involved, the support and participation of the Fayette County Council and the Fayette County Commissioners are essential for the success of the FCWI. Though not all of the objectives listed below will require substantial appropriations to complete, many of the agencies will need direction and approval from the council and commissioners in order to act upon those objectives.

Fayette County Soil and Water Conservation District (FCSWCD)

As discussed previously, the FCSWCD is the agency responsible for the development of this watershed management plan. The FCSWCD, a subdivision of the Indiana Department of Natural Resources (IDNR), is led by a five (5) member Board of Supervisors which manage the day to day activities of one (1) full-time staff member who serves as Administrator and Environmental Educator. Such positions are vital to the functionality of the FCSWCD, however, it is the opinion of the FCWI Steering Committee that the FCSWCD is in need of additional staff with the necessary technical expertise to conduct a wide-variety of activities including: agricultural conservation, urban conservation, and erosion and sediment control. Compared to many SWCDs throughout Indiana, the FCSWCD is insufficiently funded at the county level and consequentially under staffed and under utilized.

Objective 8-1: *By 2006, acquire the necessary funding to hire technical SWCD staff including an agricultural specialist and an erosion and sediment control specialist.*

Objective 8-2: *Provide training for local developers, SWCD Supervisors, and other relevant entities on the utilization of erosion and sediment control practices for development projects.*

Objective 8-3: *Educate developers, politicians, and landowners regarding the impacts of unchecked rural development on water quality.*

Objective 8-4: *Develop and maintain a water quality/quantity dialogue between relevant county and city staff by 2006.*

Fayette County Health Department

The Fayette County Health Department (FCHD) is dedicated to protecting the health and wellness of county citizens and safe guarding the environment for use by community members. The FCHD issues permits for residential septic systems and conducts stream and private well monitoring. Monitoring activities are, unfortunately, complaint driven only. Ensuring that septic systems are properly installed is crucial to the quality of local water resources; however, many health departments around the state are also involved in proactive stream and well monitoring to identify specific areas experiencing contamination from septic systems and/or other land use activities. It is the desire of the FCWI Steering Committee that the FCHD develop a proactive stream and well monitoring program while, at the same time, initiating the development of a tax-based incentive program to encourage homeowners to maintain and update their septic systems. The FCWI feels that these two measures combined would lead Fayette County citizens to be more proactive about maintaining and repairing their systems.

Objective 8-5: *By 2006, acquire the necessary funding to develop a stream and well monitoring program to proactively identify and address the streams of Fayette County suffering from septic system failure and other sources of pollution.*

Objective 8-6: *By 2006, develop an incentive program by which residents are encouraged to maintain, repair and or replace failing or faulty septic systems.*

Objective 8-7: *Create sewer and septic districts for non-sewered communities where feasible.*

Objective 8-8: *Promote or require the utilization of alternative septic system technologies for developments that occur where soils are non-conductive to wastewater treatment.*

Area Plan Commission (APC)

The Area Plan Commission is the local body of government authorized to enforce the Planning and Zoning Codes of Fayette County and Connersville, Indiana. The Executive Director of the APC also serves as the Fayette County Building Inspector. The Executive Director of the APC enforces the codes outlined in the 1993 document titled, "Fayette County, Indiana/City of Connersville, Indiana Area Zoning Code, Area

Subdivision Control Code, Area Thoroughfare Plan Resolution, Area Comprehensive Plan Resolution, Building Code.”

From a water quality perspective, the FCWI Steering Committee has the following desires relating to the APC:

- ❑ Guide growth and development in Fayette County so it enhances and improves water quality.
- ❑ Consider the impact land use has on water quality in all planning and zoning decisions.
- ❑ It is the opinion of the FCWI that the above document is not sufficient in providing water quality protection nor are the measures of this document appropriately enforced. The FCWI Steering Committee expressed their concerns regarding Fayette County’s approach to development as well as the lack of exercise and enforcement of many of the regulations under county code.

Objective 8-9: *Hire a full-time Building Inspector to evaluate and monitor erosion and sediment control activities in developing areas.*

Objective 8-10: *Update and digitize Fayette County’s soil survey by 2007.*

Objective 8-11: *By 2007, develop and begin utilizing a county-wide GIS system to identify natural areas, sensitive areas, prime agricultural lands (including forested land), non-prime agricultural lands, soils suitable for on-site septic systems, floodplains, etc.*

Objective 8-12: *Increase acreage requirements for development in agriculture district A1 from 3 acres to 40 acres and A2 from 1 acre to 10 acres for all of Fayette County*

Objective 8-13: *Implement planning tools to ensure protection and enhancement of natural resources and water quality.*

Fayette County Surveyor

The Fayette County Surveyor is responsible for recording all section corners throughout the county. The Surveyor is also charged with reconstruction and maintenance of drains and ditches; issuing drainage related permits; and calculating drainage assessments. All regulated drains have a direct impact on water quality, as they are the main conveyance by which rain and storm water flow into local rivers and streams. The Surveyor is a great source for identifying areas along Garrison Creek and any of its tributary ditches in need of repair and could prove valuable information to the FCSWCD and the Natural Resource Conservation Service (NRCS) in the prioritization of stream and ditch segments in need of attention. Often stream and ditch banks and the adjacent land could benefit from the establishment of vegetated buffer strips to address a variety of water quality and water quantity issues. Such land involved in agriculture would be eligible for cost-share assistance from numerous NRCS conservation programs. Increasing the communication of these three entities could prove valuable

and lead to an increase in the utilization of conservation buffer strips along stream and ditch segments.

Objective 8-14: *By 2004, increase communication and collaboration between the Fayette County Surveyor, the FCSWCD and the NRCS to identify and address stream and ditch segments contributing to water quality degradation.*

Objective 8-15: *Develop a countywide stream maintenance program to address logjams and other factors that could impact flooding frequency and severity.*

Fayette County Highway Department

The County Highway Department is responsible for the construction and maintenance of county bridges, fords and roads. The FCWI Steering Committee expressed concerns regarding the County Highway Department's approach to dealing with a gravel accumulation problem at the "twin fords" at the intersections of Garrison Creek and Twin Dry Ford Rd (Figure 9-1). Gravel accumulates to the point that the pipes under the ford become clogged causing the stream to swell and flow over the ford. In response, the highway department uses heavy equipment to push the gravel back upon the banks (Figure 9-2). Over time, rain and gravity pulls the gravel back into the streambed while additional gravel is washed from upstream increasing the problem over time and creating the need for additional heavy equipment to be placed within the stream. Recognizing the potential negative impacts of operating heavy machinery within a natural stream, the FCWI requests that the highway department address the issue in a different fashion. The FCWI Steering Committee would ultimately like to see a bridge constructed to take the place of the ford so the gravel could pass through alleviating the need for heavy equipment.

Figure 8-1: Twin Dry Ford Rd. (pre-maintenance)



Figure 8-2: Twin Dry Ford Rd. (post-maintenance)



Objective 8-16: *By 2006, identify and implement an alternative method of addressing the gravel accumulation problem within Garrison Fork along Twin Dry Fork Rd.*

Fayette County Park Board

The Fayette County Park Board was established in 2003. The board is comprised of five (5) appointed members charged with managing park properties and programs, and is granted the authority to acquire new park facilities. Parks provide numerous quality of life and natural resource benefits to Fayette County citizens including, preservation of green space, minimization of impervious surfaces, and opportunities to recreate.

The Fayette County Parks Board is currently developing their Master Plan which will identify their 5-year goals and objectives. The FCWI, recognizing the benefits a park board could provide to the Garrison Creek watershed, requests that the Fayette County Parks Master Plan include language to establish park grounds in rural areas such as the

the Garrison Creek watershed. The FCWI Steering Committee realizes that the park board may, in the beginning, focus their efforts along areas of the Whitewater River and fully supports their efforts but simply requests rural areas such as Garrison Creek be included in the park board's Master Plan.

Objective 8-17: *By 2004, develop a County Park Master Plan that includes strategies to develop parks within rural areas such as the Garrison Creek watershed.*

IX. Plan Implementation

The FCWI Steering Committee will continue meeting monthly in order to fully implement the Garrison Creek Watershed Management Plan. All meetings will be held on the third Wednesday of the month at the Community Education Coalition. Gary Breitenbach, Garrison Creek resident and a Professor of Biology at Earlham College, has been elected as the Chairman of the FCWI.

The FCWI will continue to solicit input and participation from all of the different individuals and agencies identified in this plan with the intent of increasing the membership of the FCWI as well as identifying the necessary means to implementing the various objectives. With the assistance of the CEC's Environmental Educator, all meetings will be advertised in the Connersville News Examiner, FCWI Newsletters, at public events, and during public presentations.

The FCWI Steering Committee will utilize the following tables as guides for implementing the plan. The following tables identify each objective mentioned in this plan, the actions necessary to satisfy the objectives and the different organizations and individuals necessary to fulfill each objective.

The FCWI Steering Committee has determined that education and outreach are their priorities, but wish to facilitate, however possible, the achievement of the other objectives outlined in this plan.

Below are the Action Strategies necessary for implementing the objectives found throughout this plan:

Public Education and Involvement Action Strategy

| Objectives | Necessary Actions | Responsible FCWI Partners | Cost and/or Funding Mechanism |
|---|---|--|--|
| <p>Objective 4-1: By 2007, educate 100% of the Garrison Creek residents on the impacts fertilizers and pesticides can have on water quality and the proper measures they can take to minimize those impacts.</p> | <ul style="list-style-type: none"> • Develop and disseminate a series of newsletters and newspaper articles regarding proper fertilizer and pesticide use, storage and disposal. • Conduct presentations to local schools, civic groups, churches, and other interested groups regarding proper fertilizer and pesticide use, storage and disposal. • Create annually a display regarding household water quality protection practices and present at the Fayette County Free Fair and other local events. • Partner and assist the Three Rivers SWMD with the promotion of the Annual Tox-A-Way event. | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Fayette County Health Department • Fayette County SWCD • NRCS • Purdue Extension • Fayette County Farm Bureau • Area Plan Commission • Connersville News Examiner • Connersville City TV • Local Civic Groups | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |
| <p>Objective 4-2: By 2007, educate 100% of the Garrison Creek residents on the impacts household hazardous wastes can have on water quality and the proper measures they can take to minimize those impacts.</p> | <ul style="list-style-type: none"> • Partner with the Three Rivers SWMD to develop and disseminate a series of newsletters and newspaper articles regarding proper storage and disposal of HHW. • Partner with the Three Rivers SWMD to conduct presentations to local schools, civic groups, churches, and other interested groups regarding proper storage and disposal of HHW. • Partner with the Three Rivers SWMD to annually create a display regarding | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Three Rivers SWMD • Fayette County Health Department • Fayette County SWCD • NRCS • Purdue Extension • Fayette County Farm Bureau • Area Plan Commission • Connersville News | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

Garrison Creek Watershed Management Plan

| | | | |
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| | <p>household water quality protection practices and present at the Fayette County Free Fair and other local events</p> <ul style="list-style-type: none"> • Partner with and assist the Three Rivers SWMD with the promotion of the Annual Tox-A-Way event. | <p>Examiner</p> <ul style="list-style-type: none"> • Connersville City TV • Local Civic Groups | |
| <p>Objective 4-3: By 2007, educate 100% of the Garrison Creek residents on the impacts the accumulation of solid wastes can have on water quality and the proper measures they can take to minimize those impacts.</p> | <ul style="list-style-type: none"> • Partner with the Three Rivers SWMD to develop and disseminate a series of newsletters and newspaper articles regarding the importance of proper solid waste disposal and recycling opportunities within Fayette County. • Partner with the Three Rivers SWMD to conduct presentations to local schools, civic groups, churches, and other interested groups regarding proper the proper disposal of solid waste and the local laws that prohibit such activities. • Partner with the Three Rivers SWMD to annually create a display regarding proper solid waste disposal and recycling opportunities within Fayette County practices and present at the Fayette County Free Fair and other local events | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Three Rivers SWMD • Fayette County Health Department • Fayette County SWCD • Area Plan Commission • Connersville News Examiner • Connersville City TV • Local Civic Groups | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |
| <p>Objective 4-4: By 2007, educate 100% of the Garrison Creek residents on the importance of annually monitoring the water quality of functioning drinking water wells and properly closing abandoned wells.</p> | <ul style="list-style-type: none"> • Develop and disseminate a series of newsletters and newspaper articles regarding how to and the importance of monitoring well water quality and plugging abandoned wells. • Conduct presentations to local | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Fayette County Health Department • Fayette County SWCD • Connersville News | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

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| | <p>schools, civic groups, churches, and other interested groups highlighting how to and the importance of monitoring well water quality and plugging abandoned wells.</p> <ul style="list-style-type: none"> • Create annually a display regarding how to and the importance of monitoring well water quality and plugging abandoned wells. • Continue the Fayette County SWCD cost-share program for plugging abandoned wells. | <p>Examiner</p> <ul style="list-style-type: none"> • Connersville City TV • Local Civic Groups | |
| <p>Objective 4-5: By 2007, provide ample opportunities for residents to become involved in community efforts to address water quality/natural resource issues.</p> | <ul style="list-style-type: none"> • Coordinate a Garrison Creek stream cleanup event in cooperation with the Three Rivers SWMD. • Host a IDNR Hoosier Riverwatch Program within the Garrison Creek watershed. • Expand the CEC's Hoosier Riverwatch Program to encourage residents to become actively involved in stream monitoring. • Promote the IDNR's Adopt –A-Stream program and solicit residents and community groups to adopt different sections of Garrison Creek. | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Three Rivers SWMD • Fayette County Health Department • Fayette County SWCD • Connersville News Examiner • Connersville City TV • Local Civic Groups | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |
| <p>Objective 4-6: By 2007, educate 100% of the Garrison Creek residents on the impacts pet waste can have on water quality and the proper measures pet owners can take to minimize those impacts.</p> | <ul style="list-style-type: none"> • Develop and disseminate a series of newsletters and newspaper articles regarding the importance of proper pet waste disposal. • Conduct presentations to local schools, civic groups, churches, and other interested groups highlighting the importance of properly disposing | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Three Rivers SWMD • Fayette County Health Department • Fayette County SWCD • Connersville News Examiner | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

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| | <p>of pet wastes.</p> <ul style="list-style-type: none">• Create annually a display regarding proper pet waste disposal and present at the Fayette County Free Fair and other local events. | <ul style="list-style-type: none">• Connersville City TV• Local Civic Groups | |
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Forestry Action Strategy

| Objectives | Necessary Actions | Responsible FCWI Partners | Cost and/ or Funding Mechanism |
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| Objective 5-1: By 2005, modify county zoning regulations consistent with natural resource protection and smart growth. | <ul style="list-style-type: none"> ❑ Identify prime wood lots within the watershed. ❑ Amend zoning ordinances to include development restrictions to preserve significant forests ❑ Amend zoning ordinance to increase minimum lot size for development in wood areas (10 acres for non-prime, 40 acres for prime). | Area Plan Commission, in cooperation with: <ul style="list-style-type: none"> • Fayette County Commissioners • Fayette County Council | County appropriations, cost N/A. |
| Objective 5-2: By 2005, educate 100% of forest owners on the importance of maintaining and establishing riparian forests. | <ul style="list-style-type: none"> ❑ Identify and contact landowners with property adjacent to the creek regarding the value of riparian forests. ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the value of riparian forests. ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the value and importance of riparian forests. ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of riparian forests. ❑ Annually develop a display and provide literature at the Fayette County Free Fair on the value and importance of riparian forests. ❑ Establish Conservation easement along waterways to protect riparian corridors. | The CEC's Environmental Educator, in cooperation with: <ul style="list-style-type: none"> • FCWI Steering Committee • IDNR District Forester • IDNR District Wildlife Biologist • SWCD Educator • NRCS District Conservationist • Purdue Extension • Fayette County Farm Bureau • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

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| <p>Objective 5-3: By 2005, educate 100% of forest owners on the value of timber stand improvements (TSI)</p> | <ul style="list-style-type: none"> ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the value and importance of TSI. ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the importance of TSI. ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of TSI. ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of TSI. | <p>The CEC's Environmental Educator, in cooperation with:</p> <ul style="list-style-type: none"> • IDNR District Forester • IDNR District Wildlife Biologist • FCWI Steering Committee • SWCD Educator • NRCS District Conservationist • Purdue Extension • Fayette County Farm Bureau • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |
| <p>Objective 5-4: Develop a "Tree Planting Initiative" within the watershed to plant 100 acres of new trees by 2007.</p> | <ul style="list-style-type: none"> ❑ Through close cooperation with the FCSWCD and the IDNR District Forester, conduct an annual tree sale event in accordance with Arbor Day. ❑ Identify a suitable site and a willing landowner in the watershed to host a tree-planting event. ❑ Develop newsletter and newspaper articles pertaining to the Tree Planting Initiative as well as the date, time, and location of the tree-planting event. ❑ Organize and conduct a tree-planting | <p>The CEC's Environmental Educator, in cooperation with:</p> <ul style="list-style-type: none"> • IDNR District Forester • IDNR District Wildlife Biologist • FCWI Steering Committee • SWCD Educator • NRCS District Conservationist • Purdue Extension | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

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| | <p>event in 2004.</p> <ul style="list-style-type: none"> ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of planting trees. | <ul style="list-style-type: none"> • Fayette County Farm Bureau • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | |
| <p>Objective 5-5: Increase enrollment in the IDNR's Classified Forest Program from 1500 acres (18%) to 3000 acres (36%) by 2007.</p> | <ul style="list-style-type: none"> ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the benefits of the Classified Forest Program. ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the Classified Forest Program. ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the Classified Forest Program. ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the Classified Forest Program. | <p>The CEC's Environmental Educator, in cooperation with:</p> <ul style="list-style-type: none"> • IDNR District Forester • IDNR District Wildlife Biologist • FCWI Steering Committee • SWCD Educator • NRCS District Conservationist • Purdue Extension • Fayette County Farm Bureau • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

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| <p>Objective 5-6: Increase enrollment in the IDNR's Classified Wildlife Program from 703 acres to 1400 acres by 2007.</p> | <ul style="list-style-type: none"> ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the benefits of the Classified Wildlife Program. ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the Classified Wildlife Program. ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the Classified Wildlife Program. ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the Classified Wildlife Program. | <p>The CEC's Environmental Educator, in cooperation with:</p> <ul style="list-style-type: none"> • IDNR District Forester • IDNR District Wildlife Biologist • FCWI Steering Committee • SWCD Educator • NRCS District Conservationist • Purdue Extension • Fayette County Farm Bureau • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | <ul style="list-style-type: none"> • CEC's Section 319 Grant |
| <p>Objective 5-7: By 2005, educate 100% of forest owners on the importance of excluding livestock from woodlands.</p> | <ul style="list-style-type: none"> ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on the value and importance of excluding livestock from forested lands. ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the importance excluding livestock from forested lands. ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of excluding livestock from forested | <p>The CEC's Environmental Educator, in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee IDNR District Forester • IDNR District Wildlife Biologist • SWCD Educator • NRCS District Conservationist • Purdue Extension • Fayette County Farm | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

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| | <p>lands.</p> <ul style="list-style-type: none"> ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of excluding livestock from forested lands. ❑ Promote available funding programs to exclude cattle from woodlands. | <p>Bureau</p> <ul style="list-style-type: none"> • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | |
| <p>Objective 5-8: By 2005, educate 100% of forest owners on the economic and environmental benefits of utilizing best management practices during logging activities.</p> | <ul style="list-style-type: none"> ❑ Conduct a forestry field day within the watershed to provide the necessary information to local forest owners on and logging professionals on the benefits of utilizing BMPs while harvesting timber. ❑ Conduct a training course for logging professionals on the utilization of BMPs. ❑ Develop and disseminate a series of newsletters and newspaper articles highlighting the importance of utilizing BMPs while harvesting timber. ❑ Conduct presentations to local civic groups within Fayette County and the watershed highlighting the importance of utilizing BMPs while harvesting timber. ❑ Develop annually a display and provide literature at the Fayette County Free Fair on the value and importance of utilizing BMPs while harvesting timber. | <p>The CEC's Environmental Educator, in cooperation with:</p> <ul style="list-style-type: none"> • IDNR District Forester • IDNR District Wildlife Biologist • FCWI Steering Committee • SWCD Educator • NRCS District Conservationist • Purdue Extension • Fayette County Farm Bureau • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • St. Gabriel School • Temple Christian School | <ul style="list-style-type: none"> • CEC's Section 319 Grant (portion of \$106,000) |

Agricultural Management Action Strategy

| Objective | Actions/Strategies | Responsible Partners | Cost and/or Funding Mechanism |
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| <p>Objective 6-1: By 2007, minimize E. coli levels resulting from livestock facilities in an attempt to meet state water quality standards.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for livestock and manure management. • Heavily market all cost-share programs available to implement livestock and manure management projects such as the Environmental Quality Incentive Program (EQIP), Lake and River Enhancement (LARE), etc. • Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on livestock and manure management as well as other best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding livestock and manure management. • Promote annually livestock and manure management at the County Free Fair and other local events. • Develop an FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • LARE cost-share dollars, (minimum \$30K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site (\$5K/year) |

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| | the rest of Fayette County. | | |
| <p>Objective 6-2: By 2007, educate all (100%) of livestock producers of the water quality impacts associated with granting livestock unlimited access to the creek.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Conduct a series of field days and workshops in the Garrison Creek watershed focusing on livestock management. • Develop and disseminate newsletters to farmers within the watershed regarding livestock management and the available cost-share dollars to implement livestock management practices. • Provide technical assistance to agriculture producers on the economic and environmental benefits of livestock management. • Promote annually livestock management at the County Free Fair and other local events. • Apply for Lake and River Enhancement (LARE) funding to provide cost-share for livestock management. | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |
| <p>Objective 6-3: By 2007, educate all (100%) of livestock producers on the economic and environmental benefits of pasture management.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for pasture management. • Market heavily all cost-share programs | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |

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| | <p>available to implement pasture management such as EQIP, LARE, etc.</p> <ul style="list-style-type: none"> • Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on pasture management and other best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding pasture management and the available cost-share dollars to implement pasture management. • Promote annually pasture management at the County Free Fair and other local events. | <p>Examiner</p> <ul style="list-style-type: none"> • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | |
| <p>Objective 6-4: By 2007, increase the utilization of conservation tillage by 50%</p> <ul style="list-style-type: none"> ❑ Soybeans: 1831acres (68%) to 2693 acres (100%) ❑ Corn: 835 acres (31%) to 1252 acres (46%) | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for conservation tillage. • Heavily market all cost-share programs available to implement conservation tillage such as EQIP, LARE, etc. • Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on conservation tillage as well as other agricultural best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • LARE and USDA cost-share dollars, (\$26K total based upon \$20/acre) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |

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| | <p>conservation tillage.</p> <ul style="list-style-type: none"> • Annually promote conservation tillage at the County Free Fair and other local events. • Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County. | | |
| <p>Objective 6-5: By 2007, establish 6,676 linear feet of riparian buffer strips within the Garrison Creek Watershed</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for conservation buffer projects. • Heavily market all cost-share programs available to implement livestock and manure management projects such as EQIP, CRP, WHIP, LARE, etc. • Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on conservation buffers as well as other best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding conservation buffers. • Annually promote conservation buffers at the County Free Fair and other local events. | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • LARE and USDA cost-share dollars(\$150/acre trees and \$450/acres grass) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |

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| | <ul style="list-style-type: none"> • Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County. | | |
| <p>Objective 6-6: By 2007, educate 100% of farmers within the watershed on the economic and environmental benefits of nutrient management.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for nutrient management. • Market heavily all cost-share programs available to implement nutrient management such as EQIP, LARE, etc. • Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on nutrient management as well as other best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding nutrient management. • Promote annually nutrient management at the County Free Fair and other local events. • Develop an FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County. | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |

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| <p>Objective 6-7: By 2007, educate 100% of farmers within the watershed on the economic and environmental benefits of pest management.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for pest management. • Heavily market all cost-share programs available to implement pest management projects such as EQIP, LARE, etc. • Annually conduct a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on pest management as well as other best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding pest management. • Annually promote pest management at the County Free Fair and other local events. • Develop a FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County. | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |
| <p>Objective 6-8: By 2007, educate 100% of the landowners who own creek-side property on the different methods of stabilizing streambanks and the permits and actions necessary to conduct stabilization efforts.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for stream | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share |

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| | <p>stabilization projects.</p> <ul style="list-style-type: none"> • Market heavily all cost-share programs available to implement stream stabilization projects such as CRP, LARE, etc. • In 2005, organize and conduct a tour of stabilized streambanks in neighboring counties where good examples exist. • Develop and disseminate newsletters to farmers within the watershed regarding proper streambank stabilization and the laws and regulations involved with streambank stabilization. • Promote annually proper streambank protection at the County Free Fair and other local events. • Develop an FCSWCD website as a means of providing agricultural conservation information to farmers within the Garrison Creek watershed and the rest of Fayette County. • | <p>Educator</p> <ul style="list-style-type: none"> • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | <p>programs via newsletters, field days, and web site</p> |
| <p>Objective 6-9: By 2007, educate 100% of farmers and landowners on the USDA Wetland Reserve Program (WRP) and the Wildlife Habitat Incentive Program (WHIP) and the value of protecting wildlife habitat.</p> | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for wildlife habitat improvements and wetland restoration projects. • Market heavily all cost-share programs available to implement wildlife habitat improvements and wetland restoration | <p>FCSWCD and NRCS staff shall spearhead agricultural efforts associated with this objective. They shall, however, work closely with the following:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |

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| | <p>projects such as WRP, WHIP, CRP, LARE, etc.</p> <ul style="list-style-type: none"> • Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on wildlife habitat improvements, wetland restoration and other best management practices. • Advertise actively the availability of the FCSWCD no-till drill to the community through newsletters, newspaper articles, the Fayette County Free Fair, and by having the drill on display and in use at field days and workshops. • Develop and disseminate newsletters to farmers within the watershed regarding wildlife habitat improvements and wetland restoration. • Promote annually wildlife habitat improvements and wetland restoration at the County Free Fair and other local events. | <p>Examiner</p> <ul style="list-style-type: none"> • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H | |
| <p>Objective 6-10: By 2004, initiate a program such as or similar to the River-Friendly Farmer Program to recognize a local farmer for his or her conservation practices.</p> | <ul style="list-style-type: none"> • Develop the criteria for which a farmer must satisfy to be eligible for the award. • Develop a team or committee to review nominations for this award • Advertise the program through Fayette County Farm Bureau, the Connersville News Examiner, FCSWCD Newsletters and other local means. • Purchase and present the award at the Annual FCSWCD Meetings. | <p>Fayette County SWCD and NRCS staff in cooperation with:</p> <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School | <ul style="list-style-type: none"> • SWCD general operating funds (\$200 maximum cost) |

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| | | Corporation <ul style="list-style-type: none"> • Future Farmers of America (FFA) • 4-H | |
| Objective 6-11: Educate all (100%) of livestock producers of the water quality/forest impacts related to granting livestock access to forestland. | <ul style="list-style-type: none"> • Apply for Section 319 funding in October 2004 to hire a SWCD technician to provide technical services to farmers and landowners. • Apply for IDNR Lake and River Enhancement (LARE) funding to provide cost-share for livestock management. • Market heavily all cost-share programs available to implement livestock management practices such as EQIP, LARE, etc. • Conduct annually a series of field days and workshops in the Garrison Creek watershed and other areas within Fayette County focusing on livestock management and other best management practices. • Develop and disseminate newsletters to farmers within the watershed regarding livestock management and the available cost-share dollars to implement pasture management. • Promote annually pasture management at the County Free Fair and other local events. | Fayette County SWCD and NRCS staff in cooperation with: <ul style="list-style-type: none"> • FCWI Steering Committee • Purdue Extension • Fayette County Farm Bureau • IDNR District Forester • CEC Environmental Educator • Connersville News Examiner • Connersville City TV • Fayette County School Corporation • Future Farmers of America (FFA) • 4-H (FFA) • 4-H | <ul style="list-style-type: none"> • Section 319 Grant or County appropriations for SWCD technician (\$40K/year) • SWCD general operating funds to market all available cost-share programs via newsletters, field days, and web site |
| Objective 6-12: Collect additional water quality data to determine the levels of pesticides, primarily Atrazine, in Garrison Creek | Staff and students at Earlham College will be responsible for conducting this study at Sampling Sites 1 thru 6 as outlined in Section III of this plan. The FCWI will not play a | Staff and students at Earlham College will be responsible for conducting this study at Sampling Sites 1 thru 6 as outlined in Section | <ul style="list-style-type: none"> • N/A |

Garrison Creek Watershed Management Plan

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| | significant role in this effort but will value the efforts and results of the study. Once the data become available, the results will be incorporated into the Garrison Creek watershed management plan and, if necessary, goals and actions pertaining to the data will be developed. | III of this plan. The FCWI will not play a significant role in this effort but will value the efforts and results of the study. Once the data become available, the results will be incorporated into the Garrison Creek watershed management plan and, if necessary, goals and actions pertaining to the data will be developed. | |
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Septic System Action Strategy

| Objective | Actions/Strategies | Responsible FCWI Partners | Cost and/or Funding Mechanism |
|--|--|--|--|
| <p>Objective 7-1: By 2007, educate 100% of the Garrison Creek residents on how to properly operate and maintain a septic system.</p> | <ul style="list-style-type: none"> • Develop a series of newsletters and newspaper articles highlighting the importance of proper operation and maintenance of septic systems. • Conduct presentation to civic groups within the watershed highlighting the importance of proper operation and maintenance of septic systems. • Work with Fayette County government to provide financial incentives for proper operation and maintenance of septic systems. • Identify and pursue available funding opportunities for homeowners interested in updating their septic system. • Annually promote septic system maintenance at the Fayette County Free Fair and other local events. | <p>The CEC's Environmental Educator in cooperation with:</p> <ul style="list-style-type: none"> • Fayette County Health Department • Fayette County SWCD • Purdue Extension • Fayette County Farm Bureau • Area Plan Commission • Connersville News Examiner • Connersville City TV • Local Civic Groups | <ul style="list-style-type: none"> • CEC's Section 319 Grant (2003) |
| <p>Objective 7-2: By 2007, initiate a county-wide program to improve the identification of and replacement of failing septic systems and straight pipes</p> | <ul style="list-style-type: none"> • Work with the Fayette County Commissioners, the Fayette County Council and the Fayette County Health Department to develop and implement a water quality-monitoring program to identify illicit septic discharges (straight pipes) and encourage repair. • Develop a series of newsletters and newspaper articles and conduct presentations to civic groups highlighting the symptoms of a failing septic system. | <p>Fayette County Health Department in cooperation with:</p> <ul style="list-style-type: none"> • Fayette County Health Department • Fayette County Commissioners • Fayette County Council • FCWI Steering Committee • Indiana State Department of Health | <ul style="list-style-type: none"> • Fayette County Health Department (\$15K/year) • Laboratory analysis to be provided by the Indiana State Department of Health Laboratory in Indianapolis |

Garrison Creek Watershed Management Plan

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| | <ul style="list-style-type: none"> • Work with Fayette County government to provide financial incentives for proper operation and maintenance of septic systems. • Identify funding opportunities for homeowners interested in updating their septic system. • | | |
| Objective 7-3: By 2007, ensure that all new septic systems are installed only within soils proven to be conducive to onsite wastewater treatment | <ul style="list-style-type: none"> • Modify local zoning ordinance and building code language to inhibit septic system installation on “severely limiting” soils and enforce such codes. • Update and digitize the Fayette County Soil Survey in order to simplify the process of identifying “severely limiting” soils and make this data available to developers, the FCSWCD, and other relevant parties. • Require, through zoning ordinances and building codes, alternative septic system installation upon “severely limiting” soils. | Area Plan Commission in cooperation with: <ul style="list-style-type: none"> • Fayette County Health Department • Area Plan Commission • Fayette County Council • Fayette County Surveyor • Fayette County SWCD | <ul style="list-style-type: none"> • Fayette County Health Department and Area Plan Commission budgets • Cost N/A |

Local Government Action Strategy

| Objective | Action/Strategies | Responsible Partners | |
|---|--|---|--|
| Objective 8-1: By 2006, acquire the necessary funding to hire technical SWCD staff including an agricultural specialist and an erosion and sediment control specialist. | Apply for a Section 319 Grant to hire an erosion control specialist or utilize county/city funding. | Fayette County SWCD in cooperation with: <ul style="list-style-type: none"> • Area Plan Commission • Fayette County Commissioners/Council • FCWI Steering Committee | Section 319 Grant or County Appropriations (\$40K/ year) |
| Objective 8-2: Provide training for local developers, SWCD Supervisors, and other relevant entities on the utilization of erosion and sediment control practices for development projects. | Conduct a series of field days/workshops on the proper use of erosion and sediment control best management practices | Fayette County SWCD in cooperation with <ul style="list-style-type: none"> • IDNR Storm Water Specialist • Fayette County Building Inspector • Fayette County Surveyor | SWCD Funds or County/City Appropriations (\$5K total) |
| Objective 8-3: Educate developers, politicians, and landowners regarding the impacts of unchecked rural development on water quality. | <ul style="list-style-type: none"> • Emphasize SWCD, APC, Drainage Board coordination during plan review process • Strengthen project development review committee • Utilize SWCD technician on project development review committee. | Fayette County SWCD in cooperation with: <ul style="list-style-type: none"> • IDNR Storm Water Specialist • Area Plan Commission | N/A |
| Objective 8-4: Develop and maintain a water quality/quantity dialogue between relevant county and city staff by 2006. | Develop a county-wide watershed team to discuss water quality and water quantity issues consisting of: <ol style="list-style-type: none"> 1. Area Plan Commission staff 2. Soil and Water Conservation District staff | FCWI Steering Committee in cooperation with: <ul style="list-style-type: none"> • Fayette County Building Inspector • Fayette County Health | N/A |

Garrison Creek Watershed Management Plan

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| | <ol style="list-style-type: none"> 3. Health Department staff 4. County and City Engineers 5. County Surveyor 6. Drainage Board Members 7. City Street Department staff 8. County Highway Department staff 9. Connersville MS4 Operator | <p>Department staff</p> <ul style="list-style-type: none"> • Fayette County Engineer • Fayette County Surveyor • Drainage Board Members • Fayette County Highway staff | |
| <p>Objective 8-5: By 2006, acquire the necessary funding to develop a stream and well monitoring program to proactively identify and address the streams of Fayette County suffering from septic system failure and other sources of pollution.</p> | <ul style="list-style-type: none"> • Work with the Fayette County Commissioners, the Fayette County Council and the Fayette County Health Department to develop and implement a water quality-monitoring program to identify illicit septic discharges (straight pipes) and encourage repair. • Develop a series of newsletters and newspaper articles and conduct presentations to civic groups highlighting the symptoms of a failing septic system. • Work with Fayette County government to provide financial incentives for proper operation and maintenance of septic systems. • Identify funding opportunities for homeowners interested in updating their septic system. | <p>Fayette County Health Department in cooperation with:</p> <ul style="list-style-type: none"> • Fayette County Commissioners • Fayette County Council • FCWI Steering Committee • Indiana State Department of Health | <ul style="list-style-type: none"> • Fayette County Health Department (\$15K/year) • Laboratory analysis to be provided by the Indiana State Department of Health Laboratory in Indianapolis |
| <p>Objective 8-6: By 2006, develop an incentive program by which residents are encouraged to maintain, repair and or replace failing or faulty septic systems.</p> | <ul style="list-style-type: none"> • Modify local zoning ordinance and building code language to inhibit septic system installation on “severely limiting” soils and enforce such codes. • Update and digitize the Fayette County Soil Survey in order to simplify the process of identifying “severely limiting” | <p>Area Plan Commission in cooperation with:</p> <ul style="list-style-type: none"> • Fayette County Health Department • Area Plan Commission • Fayette County Commissioners/ Council | <ul style="list-style-type: none"> • Fayette County Health Department and Area Plan Commission budgets • Cost N/A |

Garrison Creek Watershed Management Plan

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| | <p>soils and make this data available to developers, the FCSWCD, and other relevant parties.</p> <ul style="list-style-type: none"> Require, through zoning ordinances and building codes, alternative septic system installation upon “severely limiting” soils. | <ul style="list-style-type: none"> Fayette County SWCD | |
| Objective 8-7: Create sewer and septic districts for non-sewered communities where feasible. | <ul style="list-style-type: none"> Hold a series of public meeting between residents, the health department, the Indiana Department of Environmental Management, and locally elected officials to discuss the creation of new sewer and septic districts. | <p>Fayette County Health Department in cooperation with:</p> <ul style="list-style-type: none"> Area Plan Commission Fayette County Commissioners/Council | N/A |
| Objective 8-8: Promote or require the utilization of alternative septic system technologies for developments that occur where soils are non-conductive to wastewater treatment. | <ul style="list-style-type: none"> Provide incentives for or require developers to utilize alternative septic systems such as: mound systems, re-circulating sand filters, etc. where conventional systems are not suitable Require developers to install cluster septic systems for multi-home developments | <p>Fayette County Health Department in cooperation with:</p> <ul style="list-style-type: none"> Area Plan Commission Fayette County Commissioners/Council | N/A |
| Objective 8-9: Hire a full-time Building Inspector to evaluate and monitor erosion and sediment control activities in developing areas. | <ul style="list-style-type: none"> Develop more stringent reviews of new construction and remodeling activities Require septic inspections for remodels and new construction Require erosion/sediment control plan prior to issuing building permits Enforce erosion/sediment control regulations | <p>Area Planning in cooperation with:</p> <ul style="list-style-type: none"> Fayette County Commissioners/Council IDNR Storm water Specialist Fayette County SWCD | County Appropriations (\$40K/year) |
| Objective 8-10: Update and digitize Fayette County’s soil survey by 2007. | <ul style="list-style-type: none"> Update and digitize the Fayette County soil survey and make available to farmers, developers, local agency staff, and other interested individuals and | <p>Fayette County/Connersville Government in cooperation with:</p> <ul style="list-style-type: none"> SWCD/NRCS | County Appropriations (cost N/A) |

Garrison Creek Watershed Management Plan

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| | entities. | <ul style="list-style-type: none"> Area Plan Commission | |
| Objective 8-11: By 2007, develop and begin utilizing a county-wide GIS system to identify natural areas, sensitive areas, prime agricultural lands (including forested land), non-prime agricultural lands, soils suitable for on-site septic systems, floodplains, etc. | <ul style="list-style-type: none"> Develop countywide GIS and make available to the public. Utilize GIS to identify and protect environmentally sensitive areas. | Area Plan Commission in cooperation with: <ul style="list-style-type: none"> Fayette County/Connersville Government SWCD/NRCS | County Appropriations (cost N/A) |
| Objective 8-12: Increase acreage requirements for development in agriculture district A1 from 3 acres to 40 acres and A2 from 1 acre to 10 acres for all of Fayette County | <ul style="list-style-type: none"> Utilize digitized soil survey to determine which areas of Fayette County are “prime” agricultural lands. Recognize forestlands as “prime” agricultural lands when updating the zoning classifications. Increase the acreage requirements for development: <ul style="list-style-type: none"> A1: 3 acres to 40 acres A2: 1 acre to 10 acres | Area Plan Commission in cooperation with: <ul style="list-style-type: none"> Fayette County SWCD/NRCS IDNR, District Forester Fayette County Commissioners/Council | County Appropriations (cost N/A) |
| Objective 8-13: Implement planning tools to ensure protection and enhancement of natural resources and water quality. | <ul style="list-style-type: none"> Develop ordinance which requires new developments to satisfy the following criteria: <ul style="list-style-type: none"> stream setbacks floodplain protection/management wetland/tree conservation requirements impervious surface minimization open space preservation conservation design septic density requirements water supply availability | Area Plan Commission in cooperation with: <ul style="list-style-type: none"> City/County Elected Officials Health Department Fayette County SWCD IDNR District Forester Fayette County Park Board | County Appropriations (cost N/A) |

Garrison Creek Watershed Management Plan

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| Objective 8-14: By 2004, increase communication and collaboration between the Fayette County Surveyor, the FCSWCD and the NRCS to identify and address stream and ditch segments contributing to water quality degradation. | Organize and conduct a meeting with relevant parties to discuss the feasibility of this objective. | Fayette County Drainage Board: <ul style="list-style-type: none"> • Fayette County Surveyor • Fayette County SWCD • NRCS • Fayette County Commissioners/Council | County Appropriations (cost N/A) |
| Objective 8-15: Develop a countywide stream maintenance program to address logjams and other factors that could impact flooding frequency and severity. | Hold a series of public meeting between residents, the health department, the Indiana Department of Environmental Management, and locally elected officials to discuss the creation of new sewer and septic districts. | Fayette County Drainage Board in cooperation with: <ul style="list-style-type: none"> • Fayette County Surveyor • Fayette County Commissioners/Council • Area Plan Commission • NRCS • FCWI Steering Committee | County Appropriations (cost N/A) |
| Objective 8-16: By 2006, identify and implement an alternative method of addressing the gravel accumulation problem within Garrison Fork along Twin Dry Fork Rd. | Conduct a meeting in cooperation with the Fayette County Highway Department and discuss the issues at Twin Dry Ford Rd. | Fayette County Highway Department in cooperation with: <ul style="list-style-type: none"> • Fayette County Commissioners • FCWI Steering Committee | County Appropriations, cost N/A |
| Objective 8-17: By 2004, develop a County Park Master Plan that includes strategies to develop parks within rural areas such as the Garrison Creek watershed. | <ul style="list-style-type: none"> • Contact the County Park Board and invite them to attend an FCWI meeting. • Discuss with the Park Board the mission of the FCWI and identify ways to work together. | <ul style="list-style-type: none"> • Fayette County Park Board in cooperation with the FCWI Steering Committee | N/A |

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Garrison Creek Watershed Management Plan

Appendix-Raw Water Quality Data

| Sample Date | Watershed | Site ID | PH (su) | Temp.(C) | Ammonia (mg/L) | TSS (mg/L) | BOD (mg/L) | E. Coli (CFU/100ml) |
|-------------|----------------|---------|---------|----------|----------------|------------|------------|---------------------|
| 6/2/2002 | Garrison Creek | GC1 | 8.3 | 15.6 | 0.131 | 1 | 0.6 | 182 |
| 8/7/2002 | Garrison Creek | GC1 | 7.85 | 18 | 0.07 | 0.4 | 7.4 | 1247 |
| 10/31/2002 | Garrison Creek | GC1 | 7.9 | 8.1 | 0.072 | 4 | 0.4 | 93 |
| 4/30/2003 | Garrison Creek | GC1 | 8 | 13 | 0.108 | 0.6 | 2.3 | 47 |
| 5/15/2003 | Garrison Creek | GC1 | 8.2 | 12 | 0.197 | 21.6 | 1.7 | 2440 |
| 5/21/2003 | Garrison Creek | GC1 | 7.9 | 7 | 0.074 | 28 | 0.8 | 733 |
| 6/2/2002 | Garrison Creek | GC2 | 8.6 | 15.6 | 0.88 | 4.4 | 0.7 | 213 |
| 8/7/2002 | Garrison Creek | GC2 | 8.4 | 20 | 0.07 | 1.2 | 5 | 1320 |
| 10/31/2002 | Garrison Creek | GC2 | 8.4 | 7.3 | 0.074 | 2 | 0.3 | 93 |
| 4/30/2003 | Garrison Creek | GC2 | 8.3 | 14 | 0.083 | 1.2 | 1.2 | 47 |
| 5/15/2003 | Garrison Creek | GC2 | 8.2 | 9 | 0.25 | 18.9 | 4.2 | 1680 |
| 5/21/2003 | Garrison Creek | GC2 | 7.8 | 7 | 0.072 | 58 | 0.8 | 400 |
| 6/2/2002 | Garrison Creek | GC3 | 8.4 | 16.1 | 0.066 | 1.4 | 0.5 | 1200 |
| 8/7/2002 | Garrison Creek | GC3 | 7.84 | 20 | 0.06 | 1.2 | 5.6 | 107 |
| 10/31/2002 | Garrison Creek | GC3 | 8.2 | 8.1 | 0.113 | 6 | 0.4 | 400 |
| 4/30/2003 | Garrison Creek | GC3 | 8.1 | 13 | 0.107 | 1.6 | 1.4 | 280 |
| 5/15/2003 | Garrison Creek | GC3 | 8.2 | 12.5 | 0.186 | 47 | 2.2 | 3080 |
| 5/21/2003 | Garrison Creek | GC3 | 8.2 | 10 | 0.06 | 74 | 0.5 | 700 |
| 6/2/2002 | Garrison Creek | GC4 | 8.6 | 18.3 | 0.214 | 1.6 | 0.9 | 1467 |
| 8/7/2002 | Garrison Creek | GC4 | 8.21 | 22.77 | 0.06 | 1.2 | 6 | 180 |
| 10/31/2002 | Garrison Creek | GC4 | 8.3 | 7.1 | 0.092 | 5 | 0.4 | 600 |
| 4/30/2003 | Garrison Creek | GC4 | 8.4 | 15 | 0.241 | 2.1 | 1.2 | 107 |
| 5/15/2003 | Garrison Creek | GC4 | 8.3 | 9 | 0.24 | 50.8 | 2.1 | 2620 |
| 5/21/2003 | Garrison Creek | GC4 | 8.2 | 8 | 0.061 | 53 | 0.7 | 533 |
| 6/2/2002 | Garrison Creek | GC5 | 8.4 | 17.2 | 0.098 | 1.4 | 0.5 | 267 |
| 8/7/2002 | Garrison Creek | GC5 | Dry | Dry | Dry | Dry | Dry | Dry |
| 10/31/2002 | Garrison Creek | GC5 | Dry | Dry | Dry | Dry | Dry | Dry |
| 4/30/2003 | Garrison Creek | GC5 | 8.3 | 14 | 0.107 | 0.7 | 1.3 | 127 |
| 5/15/2003 | Garrison Creek | GC5 | 8.2 | 10 | 0.104 | 58 | 2.2 | 8000 |
| 5/21/2003 | Garrison Creek | GC5 | 8.2 | 10 | 0.062 | 56 | 0.5 | 483 |
| 6/2/2002 | Garrison Creek | GC6 | 8.3 | 17.2 | 0.104 | 2.8 | 0.8 | 380 |
| 8/7/2002 | Garrison Creek | GC6 | 8.09 | 21.11 | 0.05 | 4.8 | 6.7 | 60 |
| 10/31/2002 | Garrison Creek | GC6 | 8 | 7 | 0.072 | 6 | 0.3 | 200 |
| 4/30/2003 | Garrison Creek | GC6 | 8.3 | 15 | 0.183 | 1.1 | 1.2 | 40 |
| 5/15/2003 | Garrison Creek | GC6 | 8.3 | 9 | 0.146 | 74 | 2.4 | 8000 |
| 5/21/2003 | Garrison Creek | GC6 | 8.2 | 11 | 0.065 | 140 | 1 | 400 |

Garrison Creek Watershed Management Plan

**Garrison Creek
Macroinvertebrate Community and Habitat Scores
June 5, 2002**

| Tolerance to Pollution | Species | GC1 | GC2 | GC3 | GC4 | GC5 | GC6 |
|----------------------------------|-------------------|------------|------------|------------|------------|------------|------------|
| Intolerant | Stonefly Nymph | 3 | 9 | 3 | 8 | 1 | 15 |
| | Mayfly Nymph | 4 | 5 | 4 | 7 | | 14 |
| | Caddis Fly Larvae | 1 | 4 | 1 | 2 | 1 | 5 |
| | Dobsonfly Larvae | | | | | | 1 |
| | Riffle Beatle | 6 | 13 | 32 | 10 | 2 | 6 |
| | Water Penny | | 4 | | | | 2 |
| | Rt. Handed Snail | | | | 1 | | |
| Moderately Intolerant | Damselfly Nymph | 5 | | 3 | 2 | | |
| | Clams/Mussels | | 2 | 1 | | 1 | 4 |
| | Crane Fly Larvae | | 1 | 2 | | | |
| Fairly Intolerant | Midges | | 4 | | 7 | | 2 |
| | Planaria | | 2 | | | | |
| Very Tolerant | Left Handed Snail | | | 1 | | | |
| | Aquatic Worms | | | | | | 5 |
| # of Individuals | | 19 | 44 | 47 | 37 | 5 | 54 |
| Pollution Tolerance Index | | 19 | 28 | 26 | 25 | 15 | 30 |
| Biological Condition | | Good | Excellent | Excellent | Excellent | Fair | Excellent |
| CQHEI | | 92.5/110 | 75.5/110 | 81/110 | 66/110 | 41.5/110 | 86/110 |

Garrison Creek Watershed Management Plan

**Garrison Creek
Macroinvertebrate Community and Habitat Scores
May 30, 2003**

| Tolerance to Pollution | Species | GC1 | GC2 | GC3 | GC4 | GC5 | GC6 |
|---------------------------|-------------------|-----------|-----------|-----------|-----------|-----------|--------|
| Intolerant | Stonefly Nymph | 10 | 5 | 6 | 11 | 12 | 22 |
| | Mayfly Nymph | 13 | 11 | 6 | 5 | 7 | 11 |
| | Caddis Fly Larvae | 12 | 10 | 23 | 7 | 8 | 16 |
| | Dobsonfly Larvae | 0 | 0 | 2 | 1 | 1 | 0 |
| | Riffle Beatle | 14 | 20 | 21 | 4 | 14 | 5 |
| | Water Penny | 6 | 4 | 0 | 0 | 0 | 0 |
| | Rt. Handed Snail | 0 | 0 | 4 | 0 | 0 | 0 |
| | Sow Bag | 0 | 0 | 0 | 2 | 0 | 0 |
| | Scud | 2 | 0 | 1 | 0 | 1 | 4 |
| | Crane Fly Larvae | 5 | 1 | 2 | 3 | 0 | 0 |
| Fairly Intolerant | Midges | 15 | 32 | 15 | 10 | 21 | 15 |
| | Black Fly Larvae | 15 | 6 | 11 | 13 | 12 | 3 |
| | Planaria | 0 | 2 | 0 | 0 | 0 | 0 |
| | Leech | 0 | 0 | 1 | 0 | 0 | 0 |
| Very Tolerant | Left Handed Snail | | 5 | 1 | 0 | 0 | 0 |
| | Blood Midge | 8 | 0 | 4 | 0 | 0 | 0 |
| | Aquatic Worms | 0 | 0 | 3 | 2 | 4 | 1 |
| # of Individuals | | 100 | 96 | 100 | 58 | 80 | 77 |
| Pollution Tolerance Index | | 31 | 28 | 32 | 31 | 28 | 21 |
| Biological Condition | | Excellent | Excellent | Excellent | Excellent | Excellent | Good |
| CQHEI | | 87/110 | 73/110 | 69/110 | 70/110 | 65/110 | 76/110 |

