

9.0 SECTION 319 UPDATES TO THE COOL CREEK WATERSHED MANAGEMENT PLAN

9.1 PROJECT INTRODUCTION

9.1.1 Preface and History of the Cool Creek Watershed Management Plan

Planning efforts for the Cool Creek watershed began in 2001, when Hamilton County, the Town of Westfield, and the City of Carmel agreed to jointly fund a study of the Cool Creek watershed. The project need grew out of concern about rapid development in the upper watershed of Cool Creek (Westfield and Hamilton County) and the potential for increases in downstream flooding and water quality degradation. Clark Dietz, Inc. was retained by Hamilton County (the lead agency) to conduct the necessary engineering analyses and develop the plan with input from watershed stakeholders. Planning efforts began in September 2001 and were completed in November 2003.

Subsequent to the completion 2003 plan, Cool Creek was placed on IDEM's 303(d) list for *E.Coli* impairment. To help address the impairment from *E.Coli*, as well as other pollutants of concern (nutrients, suspended solids, metals, etc.) Hamilton County applied to the Indiana Department of Environmental Management (IDEM) for a Section 319 Nonpoint Source Program Grant. The purpose of the grant application was to update the Cool Creek Watershed Management Plan to make it compliant with Section 319 requirements to reduce nonpoint source pollution. Although, the original 2003 plan did address stormwater quality issues, concerns, and recommendations, not all of the requirements of a Section 319 project were included. Having a fully compliant Section 319 Watershed Management Plan will further address nonpoint source pollution reductions and allow the County to apply for additional Section 319 grant funds to implement recommended improvement projects. The goal of implementing the water quality improvement projects is to remove Cool Creek from the 303(d) list of impaired waterbodies.

The section 319 grant was approved by IDEM in 2004 and a Contract for Services was formally approved by the State of Indiana on December 29, 2004. On January 24, 2005, Clark Dietz was retained by Hamilton County to provide the additional enhancements to the Cool Creek Watershed Management Plan.

The purpose of this chapter of the Cool Creek Watershed Management Plan is to address the Section 319 grant requirements that were not fully included in the 2003 plan.

9.1.2 Mission Statement

The original mission of the Cool Creek Watershed Management grew out of interest and concern regarding stormwater management practices and their effectiveness in controlling the quantity and quality of stormwater runoff. This issue was of special concern given the rapid growth in the Westfield area (upper half of the Cool Creek watershed). Over the course of the Cool Creek planning efforts, the mission of the Cool Creek Watershed Management Plan has evolved to:

Preserve and improve the overall health of the Cool Creek watershed by addressing existing stormwater quantity and quality concerns and by proactively guiding future stormwater management practices and decisions.

9.1.3 Building Partnerships

A key element of the Cool Creek planning process was involving stakeholders and developing partnerships. The main partnership was through joint planning efforts by representatives of Hamilton County, the Town of Westfield, and City of Carmel. Stakeholders in these entities included the Surveyor's Office, the County Drainage Board, Engineering Departments, Planning Departments, Parks Departments, Soil and Water Conservation District, and others. Developers in the watershed were also consulted to obtain feedback and identify concerns. The general public was also involved through public meetings and outreach activities (newspaper articles, posting information on websites, etc.).

Meetings were held during the development of the 2003 plan as well as during the Section 319 planning process in 2005. Information on partnerships and stakeholder involvement during the original 2003 planning process can be found in the following locations in this report:

- Section 3.2 – Staff Interviews
- Section 3.3 – Developer Meetings and Input
- Section 3.4 – Public Meetings and Input
- Appendix B – Developer Meeting Summary
- Appendix C – Public Meeting Presentation Materials and Meeting Summaries

During the course of the current Section 319 update project, additional outreach and information activities were completed. The structure of these activities included public meetings, stakeholder committee meetings, interviews, and newspaper articles. The meetings were coordinated and advertised by the Hamilton County Surveyor's Office. Since most of the recommendations in the Cool Creek Watershed Management Plan were with regard to stormwater management public policy and public improvements, the primary decision makers were government representatives from Hamilton County, Westfield, and Carmel, which are the three public jurisdictions in the watershed. Clark Dietz's role was to prepare meeting presentations and materials, facilitate meetings, and summarize input obtained at the meetings.

Concerns and input on plan elements were obtained through conversations with the public or other stakeholders at the meetings. A variety of stakeholders were invited to participate in Stakeholder Committee meetings:

- Hamilton County, Westfield, and Carmel Staff (Surveyor's Office, SWCD, Engineering Department, Parks Department, Planning Department, Public Works)
- IDEM Staff
- IUPUI – Center for Earth and the Environment Staff
- Indianapolis Water (Veolia Water)
- Representatives from other Engineering and Ecological Consulting Firms
- Newspaper Reporters
- Business Community Representative
- Watershed Groups (Upper White River Watershed Alliance Technical Committee)

The following sections of Appendix H contain presentation materials, sign-up sheets, and summaries of input obtained at the various interviews and meetings:

- Appendix H.1 – Public Meeting Exhibits
- Appendix H.2 – Stakeholder Meeting Exhibits
- Appendix H.3 – Interview Exhibits
- Appendix H.4 – Newspaper Articles

9.2 WATERSHED DESCRIPTION

9.2.1 Watershed Features

The Cool Creek watershed is a sub-watershed of the Upper White watershed. The Hydrologic Unit Codes (HUC) and drainage areas are as follows:

- Upper White
 - 8-digit HUC – 05120201
 - Drainage Area – 2719.6 mi²
- Cool Creek-Grassy Branch/Little Cool Creek (*commonly known as Cool Creek*)
 - 14-digit HUC – 05120201090030
 - Drainage Area – 23.6 mi²

Figure 9-1 shows the Cool Creek watershed within the larger Upper White River Basin.

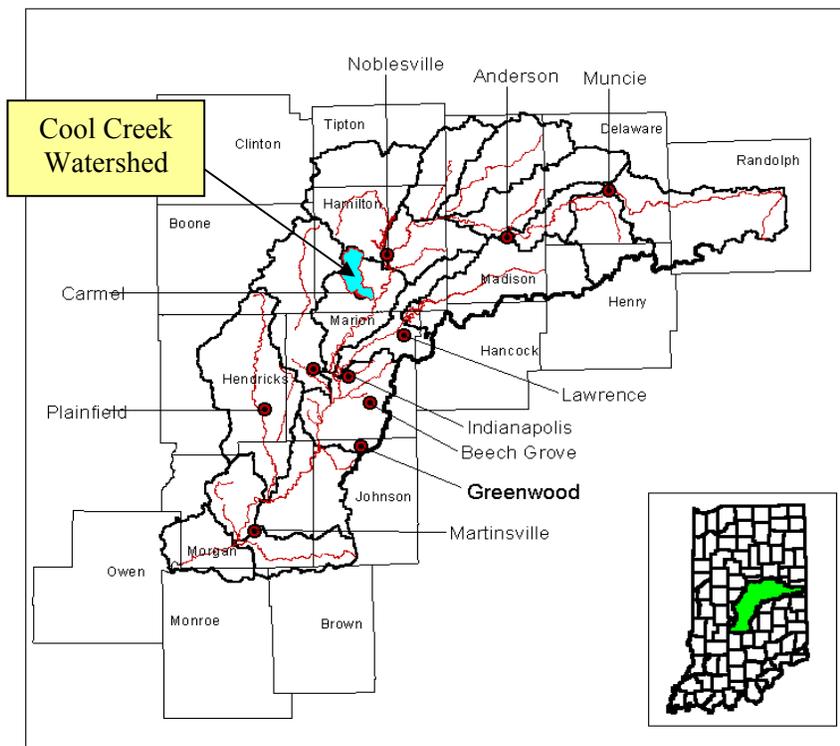


Figure 9-1
Cool Creek Watershed Location within Upper White River Basin
(Base map source – Upper White River Watershed Alliance)

Figure 1-1 in Chapter 1.0 of this report shows a map of the Cool Creek watershed with the approximate corporate boundaries of Westfield and Carmel shown. Figure 9-2 shows an aerial photograph (2003) with the Cool Creek watershed boundary and major streams.

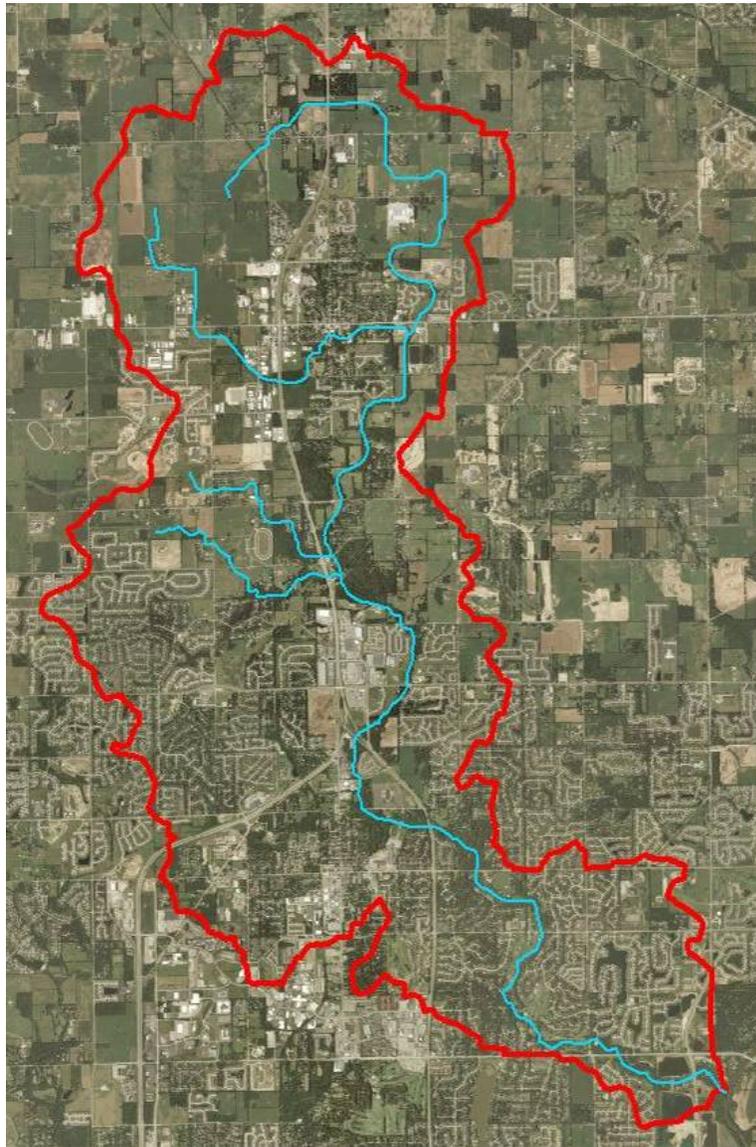


Figure 9-2
Cool Creek Watershed Aerial Photograph

Cool Creek flows south and southeasterly, discharging into the White River south of 116th Street. Tributaries include Hot Lick Creek, Little Cool Creek, Highway Run, Mary Wilson Drain, Osborn & Collins #2 Drain, H. G. Kenyon Drain, and Anna Kendall Drain (see Figure 3-1 in Chapter 3 for location of tributaries). US 31 and SR 431 are major roadways that run through the middle portion of the watershed.

The Westfield portion of the watershed contains both urbanized areas as well as significant tracts of undeveloped land (primarily agricultural). The Carmel portion of the watershed is fully

urbanized. Portions of the watershed lie in unincorporated Hamilton County, but are subject to potential annexation in the future.

9.2.2 Physical Setting

The continental ice sheets covered Hamilton County some 20,000 years ago and earlier and had a profound effect on the terrain of the area. The preglacial bedrock topography which underlies the county was almost completely masked by the deposition of glacial clays, silt, sand, gravel and boulders. The existence of former valleys, which are today filled with as much as 350 feet of glacial materials, cannot be determined by visual examinations of or the present land surface. Much of the sand and gravel occurring within the valleys was deposited by the huge quantities of meltwater which issued from the receding glaciers.

(Source: www.state.in.us/dnr/water/publications/publicat/atlas608.htm)

The Hamilton County climate is temperate, with average monthly temperatures ranging from 24.9°F in January to 74.3°F. The climate varies with strongly marked seasons. Winters are often cold (sometimes very cold). The transition from cold to hot weather can produce an active spring with thunderstorms and tornadoes. Oppressive humidity and high temperatures arrive in summer. Autumn generally has lower humidity than the other seasons and mostly sunny skies.

Average precipitation (inches) is as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1.93	1.93	2.88	3.47	3.86	3.91	4.36	3.70	2.79	2.54	3.07	2.67	37.11

(Source: Indiana State Climate Office)

9.2.3 Natural History

Hamilton County, named for Alexander Hamilton, the first Secretary of the Treasury, was organized in 1823. It was largely agricultural and sparsely populated until well after World War II when suburban development began pushing into the area from Indianapolis. Since this time, most of the lower watershed has been converted from agricultural to primarily residential land. The upper watershed still has large tracts of agricultural land.

In the lower watershed, there are larger forested areas along Cool Creek and some of its tributaries. Native species in the forested areas include the following:

Trees

Black Cherry	Sugar Maple	American Basswood
Tulip	American Beech	Black Willow
Hackberry	Cottonwood	American Sycamore
White Ash	Ohio Buckeye	Red Oak
White Oak	Slippery Elm	Pignut Hickory

Shrubs and Small Trees

Flowering Dogwood	Elderberry	Wahoo
Spicebush	Pawpaw	Eastern Redbud

Red-osier Dogwood Witch Hazel	Serviceberry	Hawthorne
<i>Forbs and Grasses</i>		
Swamp Milkweed Pokeweed Pale Jewelweed Bloodroot	White Snakeroot Bottle-brush Grass Tall Bellflower	Wild Ginger Blue-false Indigo Dutchman's Breeches
<i>Vines</i>		
Poison Ivy Dutchman's Pipe Clematis species	Virginia Creeper American Bittersweet	Trumpet Creeper Wild Grape species

(Source: Hamilton County Parks and Recreation Department)

9.2.4 Endangered Species

Information on threatened or endangered species was obtained from US 31 Preliminary Alternatives Analysis and Screening Report prepared for the Indiana Department of Transportation by the Parsons Transportation Group (July 2002). US 31 runs through the center of the Cool Creek watershed. The following is an excerpt from this report regarding threatened or endangered species:

“Information about threatened and endangered species within the project area was provided by the United States Fish and Wildlife Services (USFWS) and IDNR (Appendix C). The USFWS stated that the project area is within the range of the federally endangered Indiana bat and 11 US 31 Preliminary Alternatives Analysis and Screening Report federally threatened bald eagle. There are no current records of Indiana bats near the project corridor, however, the streams in the affected area have not been surveyed for the species. The USFWS indicated that there is suitable summer habitat for Indiana bats in forested areas along Cool Creek and possibly in the other riparian forest areas within the project area. Locally, there are multiple records of this species in adjacent Marion County, including a location within ten miles of the project area. It was also reported that there are no bald eagle nests or significant habitat areas near the project corridor. According to the IDNR NHP database (January 31, 2002), the Red Shouldered hawk, a state species of special concern, and the American badger, a state endangered species, have been reported to occur in the project vicinity, though these reports are 13 to 45 years old. No critical habitat for any threatened or endangered species, including the Indiana bat, has been identified within the project area.”

Table 9-1 also contains a listing of State and Federal endangered, threatened, or rare species in Hamilton County.

In addition to Table 9-1, the endangered, threatened, or rare birds listed below have been observed in Cool Creek Park. Cool Creek Park is a popular attraction for bird watching enthusiasts. The Red Shouldered Hawk (listed in Table 9-1 as a species of special concern) and the Black and White Warbler have been observed nesting in the park. Other birds listed as

endangered or special concern by the IDNR Division of Fish and Wildlife that have been sighted in the park include:

Yellow-crowned Night Heron	Osprey
Bald Eagle	Sharp-shinned Hawk
Peregrine Falcon	Sandhill Crane
Golden-winged Warbler	Cerulean Warbler
Black-and-White Warbler	Worm-eating Warbler
Hooded Warbler	Broad-Winged Hawk

(Source: Hamilton County Parks and Recreation Department)

9.2.5 Soils

Section 2.3.4 of this report describes the predominant soil types and their characteristics in the Cool Creek watershed.

9.2.6 Topography

Topography in the Cool Creek watershed was reviewed as part of the hydrologic analysis. The watershed was subdivided into 35 subbasins (see Figure 5-2). To estimate hydrologic times of concentration, subbasin slopes were computed. The slopes ranged from 0.1 percent to 1.7 percent. The upper watershed generally has flatter slopes (average of 0.5 percent) while the lower watershed exhibits steeper slopes (average of 0.8 percent).

The lower watershed (south of 146th Street) generally has reaches of steep slopes (20 to 40 percent) along the floodplain fringe of Cool Creek. In areas where the channel of Cool Creek is located adjacent to the steep banks, streambank erosion is often found. These reaches can be seen on the Stream Inventory Maps contained on the CD found in Appendix H.5.

9.2.7 Hydrology

The major and minor stream systems of Cool Creek are shown on various figures in this report (Figure 3-1, Figure 5-2, and the Stream Inventory Maps on the CD in Appendix H.5). The overall stream system drains in a south, southeast direction, until its confluence with the White River. Some stream channelization and straightening has occurred in the far upper reaches of Cool Creek (referred to as Grassy Branch) as well as along the Anna Kendall Drain.

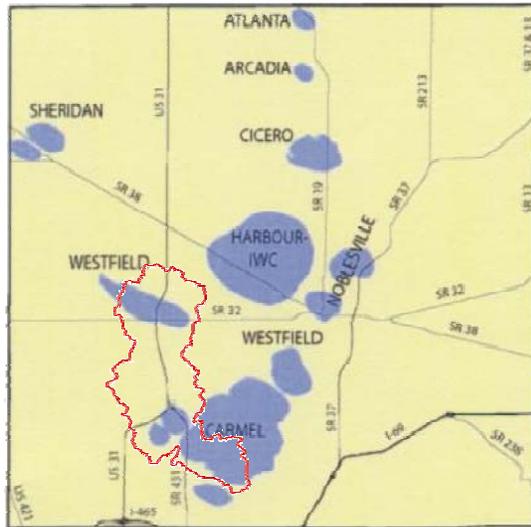
There are no dams or reservoirs in the watershed, other than a series of on-line lakes that provide stormwater detention for the Countryside development, which is located in subbasin C10 (see Figure 5-2). These lakes are located in the headwaters of the Osborn & Collins Drain.

**Table 9-1
State and Federal Endangered, Threatened or Rare Species in Hamilton County.**

Common Name	State Rank	Federal Rank
Vascular Plants		
Lake Cress	SE	**
Spoon-Leaved Sundew	SR	**
Prairie White-Fringed Orchid	SE	LT
Mollusca: Bivalvia (Mussels)		
Black Sandshell	**	**
Round Hickorynut	SSC	**
Clubshell	SE	LE
Rabbitsfoot	SE	**
Lilliput	**	**
Rayed Bean	SSC	**
Little Spectaclecase	SSC	**
Fish		
Eastern Sand Darter	SSC	**
Amphibians		
Mudpuppy	SSC	**
Reptiles		
Spotted Turtle	SE	**
Eastern Massasauga	SE	**
Birds		
Upland Sandpiper	SE	**
Red-Shouldered Hawk	SSC	**
Least Bittern	SE	**
Black-Crowned Night-Heron	SE	**
Bewick's Wren	SE	**
Mammals		
Bobcat	SE	**
American Badger	SE	**
High Quality Natural Community		
Wet-Mesic Floodplain Forest	SG	**
Mesic Upland Forest	SG	**
<u>Key:</u>		
State: SE=endangered, ST=threatened, SR=rare, SSC=special concern, SG=significant, **=not listed		
Federal: LT=threatened, LE=Endangered, **= not listed		

(Source: <http://www.in.gov/dnr/naturepr/species/>)

There are no water supply reservoirs in the watershed. However, there are significant wellfield areas, as shown on Figure 9-3. A smaller wellfield is located in the upper portion of the watershed in Westfield. A larger wellfield is located in the lower watershed in Carmel. Signage is located in the watershed to raise awareness. Carmel, Westfield, and Hamilton County all provide outreach materials (website, brochures) on drinking water protection.



Example Signage for Wellfield Protection

Figure 9-3
Wellfield Protection Areas

(Source: Hamilton County Survey's Office Brochure on "Protecting Your Drinking Water")

Other hydrology features in the watershed include wetlands. Figure 9-4 shows wetlands (light blue areas) from the National Wetland Inventory Maps on an aerial photograph of the watershed. The types of wetlands are more fully described in Section 2.2.3 of this report.



Figure 9-4
Wetland Areas

9.2.8 Land Use

Hamilton County, near the geographic center of Indiana, has a population of about 175,000 (2000 Census) and a land area of 400 square miles. As shown in Figure 9-5, population has steadily increased since about 1970, with a significant increase between 1990 and 2000.

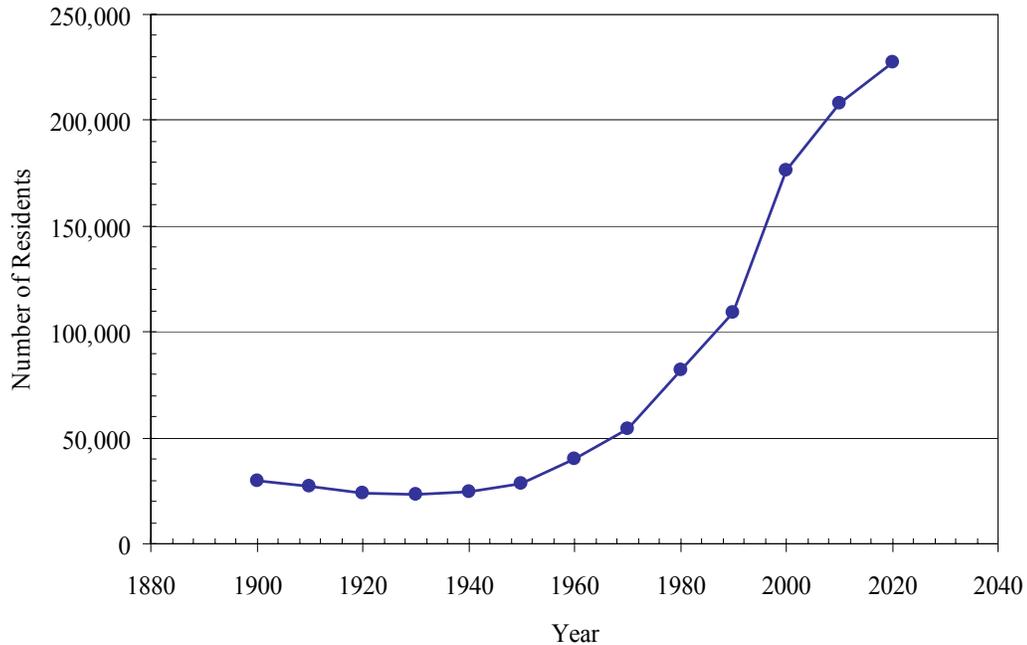
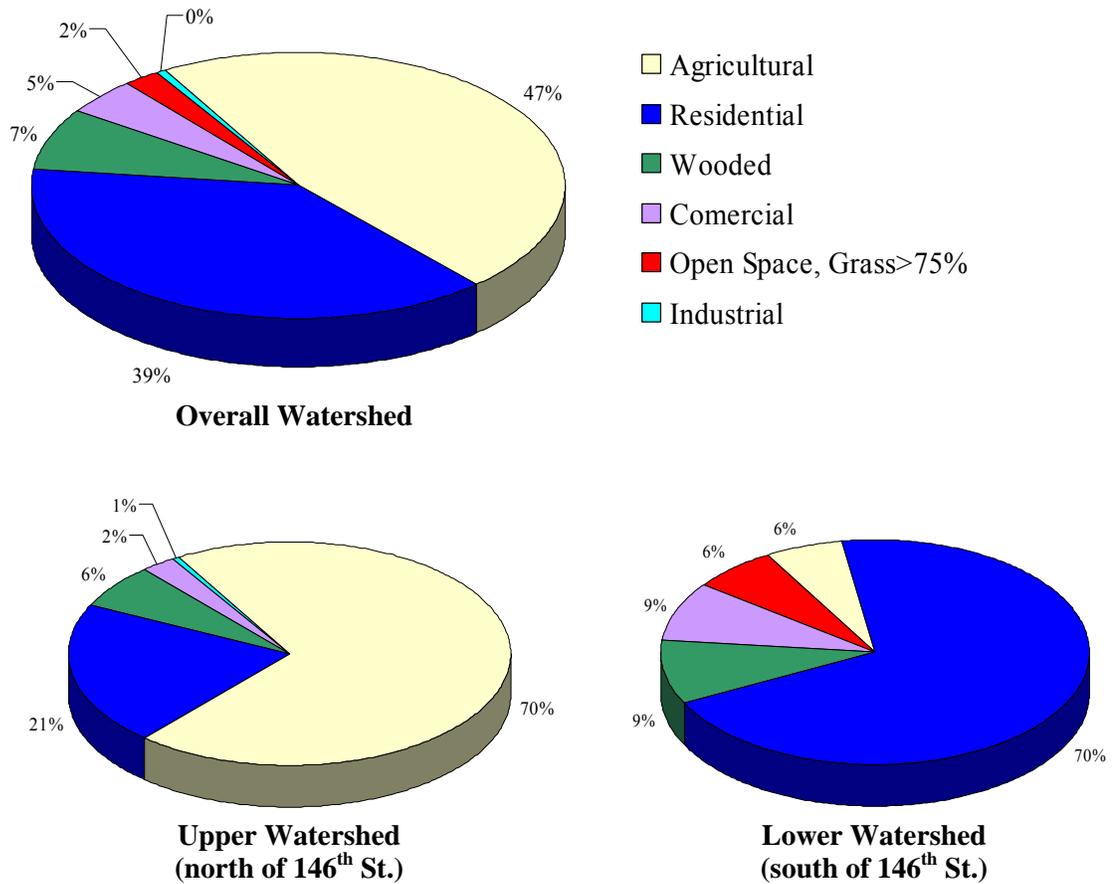


Figure 9-5
Population Trends for Hamilton County

With rapid increases in population, the corresponding land use has changed in the watershed. As part of the hydrologic analysis portion of this project, land use was computed for each of the watershed subbasins (Figure 5-2). Figure 9-6 illustrates the land use distribution for the total watershed, upper watershed, and lower watershed. For the overall watershed, land use consists of 47% agricultural, 39% residential, 7% wooded, 5% commercial, 2% Open Space, and less than one percent industrial. In the upper watershed, agricultural is the predominant land use (70%) while the lower watershed has residential as the predominant land use (70%). Agricultural land in the upper watershed is expected to be urbanized as population in Westfield and Hamilton County continues to grow. Appendix H.6 contains land use maps from the City of Carmel and Town of Westfield.



**Figure 9-6
Land Use Distribution in the Cool Creek Watershed**

The only significant public lands in the watershed are park areas. Cool Creek Park, located north of 151st Street and east of Westfield Boulevard, was opened by the Hamilton County Parks Department in 1990. The park is approximately 90 acres in size and is 80 percent forested and 20 percent open space, with Cool Creek meandering through the park. The park has a large trail network and is a popular attraction for bird watching enthusiasts. A nature center is also located at the park and provides educational exhibits on wildlife habitat.

Flowing Well Park located in the lower watershed (north of 116th Street and east of Gray Road) contains natural areas and open space, a one-and-half-mile walking trail, manmade wetlands, interpretive signs, two observation decks and an open shelter. Cool Creek also meanders through Flowing Well Park. The 18-acre park is a popular attraction for its flowing artesian well. According to historical accounts, the well was discovered by accident when a crew drilling for natural gas in the early 1900s missed the gas but hit a natural pocket of water that spewed under great pressure into the air. People from across Hamilton County gathered to see the geyser. In the 1920s, the well flowed at 60 gallons per minute, and it still runs about 15 gpm, according to the Carmel Parks Department, which maintains the Flowing Well and its small, heavily wooded park.

9.3 WATER QUALITY EVALUATION AND BENCHMARKS

9.3.1 Designated Uses and Stream Impairment

Under the provisions of the Clean Water Act, the Indiana Water Pollution Control Board has designated state waters, except waters within the Great Lakes system (327 IAC 2-2.5), for the following uses (327 IAC 2-1-3): Full-body contact recreation (April-October); capable of supporting a well-balanced, warm water aquatic community and where temperatures permit, capable of supporting put-and-take trout fishing.

Every two years, under Section 303(d) of the Federal Clean Water Act, states are required to identify waterbodies that do not meet water quality standards for designated uses. Impaired waterbodies may be impacted by both point and nonpoint sources of pollution. From the 303(d) list, states must establish priority rankings to develop Total Maximum Daily Loads (TDML). The most recent (2004) IDEM 303(d) list has Cool Creek included, with the parameter of concern being *E. Coli*.

The Indiana Integrated Water Quality Monitoring and Assessment Report (IDEM, 2004) lists Cool Creek as fully supporting for aquatic life support and non supporting for primary contact. The impairment is due to pathogens (classification is moderately impaired).

9.3.2 Water Quality Sampling

Stream sampling was performed during the development of the original Cool Creek Watershed Management Plan (sampling completed in 2002). Section 4.4 of this report provides a detailed description of this sampling program and results as well as more general observations, including the results of visual inspections.

Table 9-2 contains the results of existing pollutant loadings that were calculated for pollutants sampled during the 2003 Cool Creek Watershed Management Plan. The load calculations are based on the March 25th, 2002 sample results and HEC-HMS flow rates for the median storm event in an average year. The March 25th, 2002 storm event was 0.70 inches which approximates a median storm event for central Indiana (about 0.65 inches over 13 hours).

Table 9-2
Load Calculations of Existing Pollutants

Parameter	Units	116 th St.	146 th St.	186 th St.
BOD	tons/yr	2,880	1,890	430
COD	tons/yr	5,640	3,790	870
Nitrogen, Kjeldahl	tons/yr	1,300	800	100
Nitrogen, Nitrate	tons/yr	510	460	190
Nitrogen, Ammonia	tons/yr	500	1,930	370
Nitrogen, Total	tons/yr	1,800	1,250	290
Nitrogen, Organic	tons/yr	790	----	----
Suspended Solids	tons/yr	67,720	23,110	960
Dissolved Solids	tons/yr	158,000	110,000	34,000
E coli	mCFU/yr	4,620,000	1,030,000	710,000
Fecal Streptococcus	mCFU/yr	615,600	826,700	----

Note: Dissolved Phosphorus, Hex Chromium, Phenol, Copper, Nickel, and Zinc load calculations are not shown since the measured levels were below the detection limits.

Loadings were also calculated using the Indiana Water Quality Standard for *E. Coli* (235 CFU/100ml) in order to find the threshold value for Cool Creek at the different sample locations. *E. coli* levels for each sample location were above the Indiana Water Quality Standard for *E. Coli*. Table 9-3 shows these results:

Table 9-3
Indiana Water Quality Standard for *E. Coli* Load Calculations

Parameter	Units	116 th St.	146 th St.	186 th St.
Indiana Standard	mCFU/yr	1,206,000	809,000	185,000
Sampled (03-25-02)	mCFU/yr	4,620,000	1,030,000	710,000

During the water quality sampling program completed as part of the 2003 plan, slightly elevated levels of two metals (Chromium Hex and Nickel) were found during one of the wet weather events (August 19, 2002 event). The most common source of metals is automobiles (tire wear, brake linings, leaking fluids, engine parts, etc.). The August 19, 2002 storm event was very heavy and intense, with 2.5 to 2.9 inches falling over a few hours. Runoff of particulates from vehicular roads was likely greater than in a typical median event of 0.65 inches of rain. During the other wet weather sampling event (0.7 inches of rain), metals were found to be below the detection limit. Hence it is not possible to conclude that metals are a major concern in the Cool Creek watershed. Promotion of pollution prevention practices such as proper automobile

maintenance, municipal good housekeeping practices, and other stormwater BMPs will help to reduce metals entering Cool Creek during storm events.

As part of this Section 319 project, additional available water quality data from other sources was investigated and summarized. These sources include the IDEM Assessment Branch Data and volunteer monitoring.

Assessment Branch Data

The IDEM Division of Water’s Assessment Branch collected water quality samples in 1992, 1996 and 2001. These results were reviewed and compared to water quality sampling data completed for the original Cool Creek study in 2002. The IDEM samples were taken in the 116th Street area.

The 1992 data included a survey of Benthic aquatic macroinvertebrate Index of Biotic Integrity (mIBI). The resulting score was 4, which indicated fully supporting at that time. The mIBI support classifications are as follows:

- Fully Supporting mIBI ≥ 4
- Partially Supporting mIBI < 4 and ≥ 2
- Not Supporting mIBI < 2

Figure 9-7 and 9-8 compare the IDEM data to the data collected during the original Cool Creek study. The results are presented for E. Coli and nitrogen. E. Coli levels have increased significantly when comparing 1996 to 2001 and 2002. The three samples collected in 1996 were all below the standard for primary contact recreation (235 CFU/100ml). The 2001 IDEM and 2002 Cool Creek study results for E. Coli showed all but two samples exceeding the primary contact standard. This result is reflected in Cool Creek being placed on the 2004 303(d) list. For Kjelhdahl Nitrogen two of the four samples collected in 2002 were significantly higher than the IDEM 1996 data. The other two samples were similar to the 1996 IDEM data.

**Figure 9-7
E. Coli Sample Results (116th St.)**

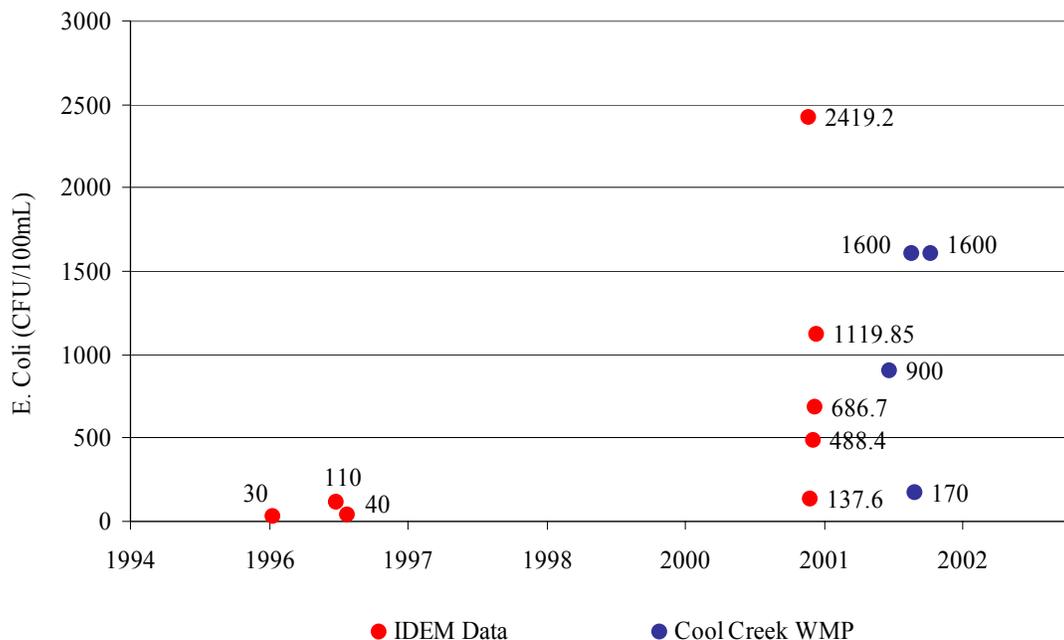
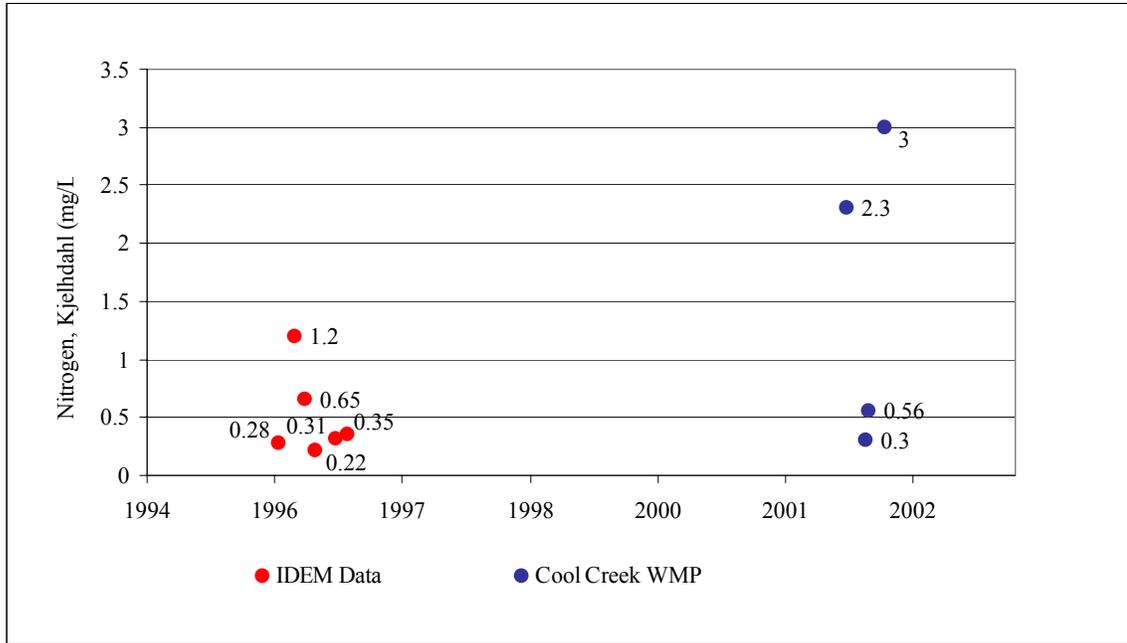


Figure 9-8
Kjeldahl Nitrogen Sample Results (116th St.)

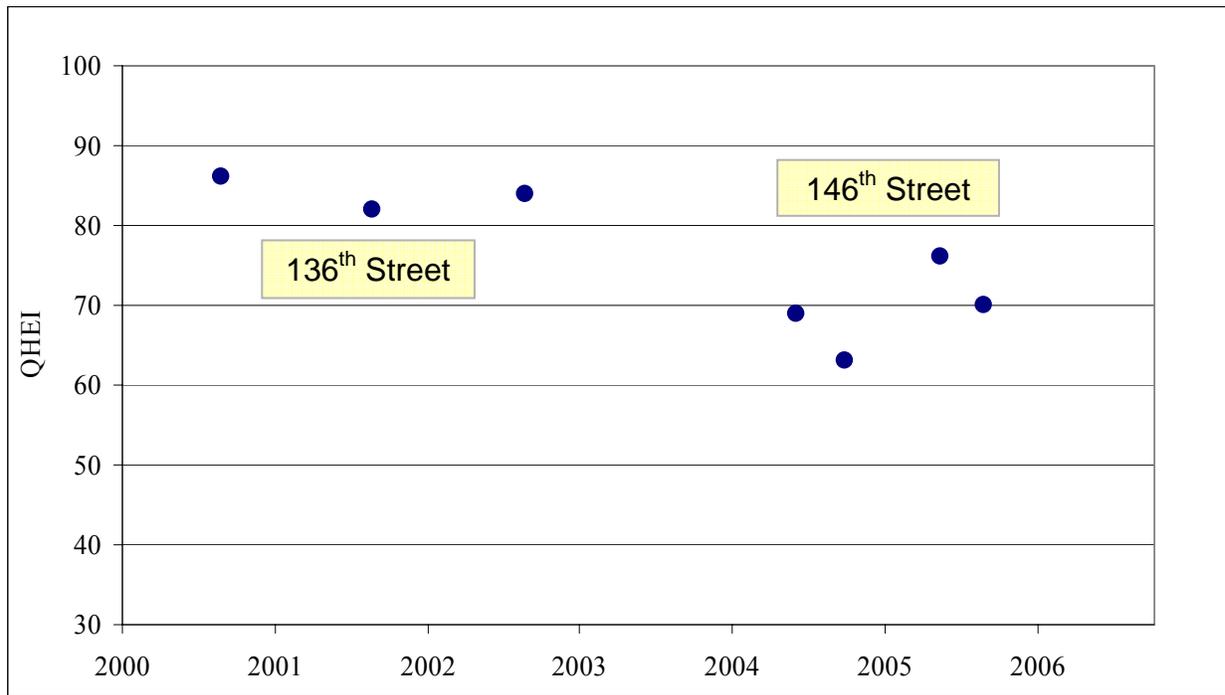


Volunteer Data

Volunteer data for Cool Creek watershed was obtained from the Hoosier Riverwatch Volunteer Stream Monitoring Internet Database. Indiana volunteer stream monitoring groups enter data collected during habitat, chemical, and biological sampling. Only volunteers who have completed a Hoosier Riverwatch training workshop may enter data into the statewide Internet Database. Available data for Cool Creek included the Qualitative Habitat Evaluation Index (QHEI).

The QHEI was developed by the Ohio EPA to provide a qualitative evaluation of the stream habitat by measuring the physical features that affect aquatic communities. This index provides information on a stream's ability to support fish and macroinvertebrate communities. The QHEI is composed of six parameters that are related to stream fish communities: substrate, in stream cover, channel morphology, riparian and bank conditions, pool and riffle quality, and gradient. Each parameter is scored individually and then summed to provide a total score, not to exceed 100. An QHEI of greater than 64 is fully supporting for designated uses, from 64 to 51 is considered partially supporting for designated uses, and less than 51 is not supporting for designated uses. Figure 9-9 illustrates the findings of the volunteer samples taken from 8/30/2000 to 8/29/2005:

**Figure 9-9
QHEI Results**



The QHEI results showed Cool Creek to be fully supporting for aquatic habitat in 6 of the 7 samples obtained. The samples on the left were taken at 136th Street and the samples shown on the right were taken at 146th Street. The stream characteristics at these two locations differ so the data points at the different location cannot be compared over time to indicate a trend. The scores at 146th Street are a result of a lower substrate scores which could be attributed to sediment from recent construction in the 146th Street area.

Other Sources

Though not directly tied to water quality, other observations and information obtained during the course of the previous and current Section 319 Cool Creek study provide additional insight into the overall health of the Cool Creek watershed. A detailed evaluation of the riparian corridor was completed to identify stream reaches with significant erosion, stormwater outfalls, encroachments, potential pollutant sources, and other noteworthy findings. The results of this effort are shown on the Problem Area Map (Figure 3-1) and on the Stream Inventory Maps contained on the CD in Appendix H.5.

Other observations on water quality included a review of the riparian areas along Cool Creek. South of approximately 171st Street, Cool Creek generally has a healthy riparian zone that provides wildlife and aquatic habitat. This accounts for approximately 9.8 miles of Cool Creek. North of 171st Street, the stream has limited riparian vegetation with agricultural land located very close to the stream (limited stream buffers). This accounts for approximately 2.2 miles of Cool Creek.

Another issue affecting habitat in wooded areas of Cool Creek is the invasion of non-native species. This issue has been identified as part of the Nature Center activities at Cool Creek Park. Staff at Cool Creek Park typically organize 5 to 10 service days for various organizations that assist in the removal of invasive species from the park. The Center for Earth Center for Earth and Environmental Science (CEES) at Indiana University ~ Purdue University, Indianapolis recently sponsored a service day, as outlined on their website as follows:

“One of the major threats to the ecology of Cool Creek Park are invasive species; namely Bush Honeysuckle. This shrub is extremely prevalent in the park. Over the last 10 years the plant has found its way into nearly every section of forested area of the park and is drastically effecting the ecological diversity. Several species of native shrubs and small trees including Spicebush, Elderberry, Dogwood, and Wahoo are beginning to decline due to this invasive. Efforts by park staff and volunteers have been underway for about 3 years to manage the issue.”

(Source: www.cees.iupui.edu/Service_Learning/All_Projects/Cool_Creek_Park.htm)

9.3.3 Water Quality Benchmark Summary

To summarize, the review of water quality information collected by IDEM, volunteer monitoring groups, and during the original Cool Creek Study has led to the following benchmark findings:

- Overall, Cool Creek is fully supportive for aquatic life.
- The constituents and concentrations of pollutants found in Cool Creek are generally comparable to urban and urbanizing watersheds across the country.
- Nutrients appear to be somewhat higher than national averages. This could be the result of excess fertilizer use coupled with agricultural runoff from the upper watershed. Public education regarding proper lawn care may be an appropriate follow up activity.
- Suspended solids were very high for one of the sampled events, though this was an atypical storm event. Proper erosion and sediment control on construction sites, in addition to streambank restoration, will help to control suspended solids levels.
- Bacteria levels exceed those required for recreational contact (problem common in many urban watersheds). Efforts should be made to track and reduce human sources of bacteria that may result from failing septic systems, illegal sanitary sewer connections, and other sources. Public education on proper disposal of pet waste would also be a best management practice to help reduce bacteria levels.
- Increased streambank erosion, particularly along Cool Creek south of Keystone Avenue, adversely impacts water quality as eroded channel banks result in downstream sedimentation.
- Limited riparian vegetation and stream buffers north of 171st Street provides limited wildlife habitat and increases transportation of sediment into Cool Creek.

9.4 DEVELOPMENT OF PROBLEM STATEMENTS AND GOALS

9.4.1 Stressors and Sources

The Cool Creek watershed is experiencing rapid development which is resulting in increased urbanization and impervious areas in the watershed. Sampling, investigation, and analysis of the data have shown that the sedimentation, streambank erosion, flooding, and stormwater pollutants have become areas of concern. Previous chapters of this report and previous sections of this chapter have identified numerous stressors and sources throughout the watershed. The following summarizes the stressors and sources that were used to develop problem statements and goals.

- Streambank Erosion
 - Urbanization (increase in impervious areas)
 - Impacts of detention basins (longer bank full flow conditions)
 - Channel encroachments
 - See Figure 3-1 for locations of stream reaches with erosion problems.
- Sedimentation
 - Inadequate erosion control on construction sites
 - Limited stream buffers in upper watershed
 - Supported by high TSS levels during wet weather event with nearby construction site (see Table 4-1)
- Elevated nutrients in wet weather runoff
 - Fertilizers (agricultural, residential, commercial)
 - Supported by high levels of nutrients during wet weather sampling event (see Table 4-1)
- Bacteria (now listed as non-supportive for primary contact on 305(b) report, on 303(d) list for E.Coli)
 - Wildlife, pet waste
 - Leaky septic systems
 - SSOs, spills, general urbanization
 - Supported by sampling results (see Table 4-1 and Figure 9-7)
- Flooding problems
 - Inadequate bridges, culverts
 - Undersized local drainage systems
 - Floodplain development
 - See Chapter 7
- Loss of Ecological Diversity in Riparian Areas (Cool Creek Park)
 - Influx of invasive species (Bush Honeysuckle)
 - Supported by Hamilton County Parks and Recreation Department

9.4.2 Problem Statements

Based on the water quality evaluation benchmarks and the identified watershed stressors and sources for Cool Creek, the following problem statements have been developed.

- Continued urbanization in the upper Cool Creek watershed is increasing streambank erosion, degrading aquatic habitat, and increasing the stormwater pollutants in runoff.
- Lack of riparian buffers in the agricultural areas in the upper Cool Creek watershed increase downstream sediment loads and provide limited wildlife habitat.
- Inadequate construction site erosion and sediment controls threaten downstream aquatic habitat.
- High nutrient levels (particularly ammonia) caused by both urban and agricultural runoff threaten aquatic life.
- Increased bacterial levels caused by urbanization and other sources have impaired full contact recreation use of Cool Creek.
- The influx of invasive species such as the Bush Honeysuckle has resulted in reduced ecological diversity in forested areas of Cool Creek.
- Inconsistent floodplain regulations have resulted in loss of floodplain storage and riparian habitat.
- Undersized bridges and culverts result in roadway overtopping and threaten public safety.

9.4.3 Development of Goals

The following goals have been developed to address the problem statements.

- Reduce impact of urbanization by modifying stormwater detention policy to control smaller storms and treat the first flush of runoff.
- Implement consistent floodplain development restrictions by adopting necessary legal authority (ordinances).
- Develop comprehensive erosion and sediment control programs in Hamilton County, Westfield, and Carmel (ordinance, plan review, inspection, and enforcement).
- Provide public education and outreach to residents and business in Cool Creek Watershed to promote good watershed behavior (disposal of pet waste, proper lawn chemical use, illicit discharges, etc.).
- Construct the bridge and culvert conveyance improvement projects to reduce flood hazards and protect of public safety.

- Continue the Hamilton County Parks and Recreation Department's community service program to remove invasive species and protect ecological diversity in forested areas.
- Implement the Oak Manor Regional Stormwater Quality Facility and other similar facilities to reduce downstream channel erosion and reduce non-point source pollutant levels (nutrients, sediment, metals, bacteria).
- Repair/restore severe channel erosion in the lower reaches of Cool Creek to improve aquatic habitat, reduce sedimentation, and protect public and private facilities.
- Improve the riparian habitat in the upper watershed by establishing stream buffers and vegetation as areas are developed around Cool Creek.
- Provide sanitary sewer service to the few neighborhood areas in Westfield still on septic systems.

9.5 CRITICAL AREA IDENTIFICATION

9.5.1 Targeting Critical Areas

Critical areas for the Cool Creek watershed were identified for each of the stressors/sources listed in section 9.4. The potential pollutant load reductions (for those that could be quantified) for these critical areas are presented in section 9.6.

Streambank Erosion

This is significant threat to the Cool Creek watershed. Streambank erosion transports sediment downstream as channel banks erode and fall into the creek. Erosion also threatens public and private property. Urbanization is the likely cause of increased erosion.

The most critical areas of streambank erosion are the orange shaded areas on the Problem Area Map in Figure 3-1 and summarized as follows:

- Cool Creek upstream of the confluence with the White River (1500 feet)
- Cool Creek downstream of Gray Road (200 feet)
- Cool Creek upstream and downstream of Hot Lick Creek (575 feet)
- Cool Creek upstream of 131st Street (150 feet)
- Cool Creek upstream of Keystone Avenue (100 feet)
- Highway Run downstream of Stonehedge Drive (100 feet)
- H.G. Kenyon Drain downstream of Rolling Court (250 feet)

Sedimentation (from construction sites and agricultural areas)

By volume, sediment is the largest contributor of pollutants to the receiving streams in the Cool Creek watershed. Construction sites are temporary and therefore cannot be specifically targeted. Hamilton County, Carmel, and Westfield will all be implementing programs for plan review, inspection, and enforcement of runoff from construction sites as part of their Rule 13 permit with IDEM.

Agricultural areas can also provide high sediment loads, particularly where conservation tillage is not practiced and where stream buffers are limited. Many agricultural lands in Hamilton County utilize conservation tillage (particularly for soy beans, less so for corn). Stream buffers on Cool Creek north of 171st Street are limited (approximately 2.2 miles of stream). This reach of Cool Creek is targeted for implementation of additional stream buffers.

Elevated Nutrients in Wet Weather Runoff

Elevated nutrients from fertilizers can be caused by both agricultural and urban land uses. As such, it is difficult to target specific critical areas. Elevated nutrients were found during the March 25, 2002 sampling event, but not the August 19, 2002 sampling event. This finding points to spring fertilizers (agricultural as well as residential/business lawn fertilizing) as a potential source. For agricultural runoff, grassed or vegetated buffer strips along Cool Creek would help reduce nutrients. This would be applicable for the Cool Creek from its headwaters, downstream to approximately SR 32. Another potential nutrient source includes a golf course that runs along Cool Creek between 116th Street and 126th Street. However, the sampling results at 116th Street did not show elevated nutrients. Golf courses typically are large users of fertilizers, but they are generally very careful in their application since this is a high cost operation item. Lastly, residential areas are potential sources for nutrients from lawn fertilizers. Neighborhood associations would be good targets to distribute information on proper use of lawn chemicals.

Bacteria

Potential sources of bacteria are widespread and difficult to target critical areas (see section 4.4.4 of this report for additional discussion). Specific areas that could be a source of bacteria are neighborhoods on septic systems. There are five neighborhoods in Westfield that are still on septic systems. These areas are shown on the Problem Area Map (Figure 3-1) and listed below:

- Far Hills
- Buena Vista
- Brookview Place
- Bokeelia
- Ridgewood

Other sources of bacteria include pet waste and wildlife waste. Pet walking is allowed in the two parks that Cool Creek runs through (Cool Creek Park and Flowing Well Park). Pet owners are required to have dogs on leashes and pick up pet waste. Education to homeowners in general regarding pet waste would be a good public education topic in the watershed given the bacteria impairment. Wildlife waste is also a source of bacteria. The proliferation of stormwater ponds associated with new development can be an attraction to increasing geese populations. Proper pond design with shoreline vegetation can discourage resident geese from populating these areas.

Flooding Problems

A total of 10 stream/roadway and neighborhood flooding problems have been identified as critical to the affected communities. These include:

- E. 151st Street (Cool Creek)
- E. 171st Street (Cool Creek)
- Gurley Street (Anna Kendall Drain)

- Cherry Street (Anna Kendall Drain)
- SR 32 (J. M. Thompson Drain)
- US 31 and Adjacent Private Drive (Highway Run)
- Walter Street, Private Drive, and Walter Court (Highway Run)
- Thornberry Drive (Highway Run)
- Carmel Drive (Hot Lick Creek)
- Hot Lick Creek Channel Improvement

These critical flooding problem areas are detailed in Sections 7.4 and 7.5 of this report.

Loss of Ecological Diversity in Riparian Areas

Invasive species such as the Brush Honeysuckle have resulted in loss of ecological diversity in forested riparian areas of Cool Creek. To date, this problem has been primarily targeted towards Cool Creek Park, which is publicly owned land.

9.5.2 Prioritizing Critical Areas

Goals were prioritized to target the most critical areas and maximize environmental benefits to the Cool Creek watershed. Goals are numbered to reflect the general priority (see Section 9.6). Goals 1 through 5 would have higher priority than Goals 5 through 10. Sedimentation in the watershed is one of the primary focuses for this plan since reducing sedimentation generally reduces other pollutants attached to the sediment.

The key critical areas that Hamilton County and other stakeholders would like to address are the channel erosion problems that are worsening with upstream urbanization. The County feels there are viable solutions to address this problem that can be implemented in the next three to five years. In particular, a regional off-line stormwater quality facility at Oak Road and 171st Street appears to be feasible. This facility will help reduce future downstream erosion as well as capture and treat other stormwater pollutants such as suspended solids, nutrients and bacteria. Repairing areas already damaged by streambank erosion is also feasible, especially given some of the cost share programs available for property owners through the Hamilton County SWCD.

The critical flooding areas are also a priority for Westfield, as many of the flooding problems in the Cool Creek watershed are located in this community. These problems are a priority to reduce safety concerns, traffic disruptions, and property damage that can be associated with flooding.

Though stream buffers in agricultural lands would be desirable, they are a lower priority because much of the agricultural land will be developed in coming years. There may be opportunities to establish additional riparian vegetation in the upper reaches of Cool Creek as these areas are converted to residential and commercial land uses.

9.6 IMPLEMENTATION MEASURES

This section summarizes implementation measures needed to implement the goals that were identified during the project. Goals are listed higher priority lower priority. Load reduction calculations and action registers are provided where applicable.

Goal #1 – Develop comprehensive erosion and sediment control program in Hamilton County, Westfield, and Carmel (ordinance, plan review, inspection, and enforcement)

As part of their requirements for their Rule 13 permits, Hamilton County, Westfield, and Carmel have developed comprehensive erosion and sediment control programs to manage runoff from construction sites. These programs include enacting the necessary legal authority and implementing plan review, inspection, and enforcement procedures. Hamilton County recently has enacted a new ordinance regulating storm water runoff associated with construction and post-construction activities as well as an Illicit Discharge and Detection Elimination (IDDE) ordinance. These county ordinances as well as a Report-a-Polluter program can be found at following link:

<http://www.co.hamilton.in.us/services.asp?id=3921&entity=2200>

Since Goal #1 is already being implemented by Rule 13 requirements for MS4s which encompass the entire Cool Creek Watershed no action register is included for this goal.

Goal Indicators: Number of construction site inspections and enforcements, reduced concentrations of TSS

Goal #2 – Implement the Oak Manor Regional Stormwater Quality Facility and other similar facilities to reduce downstream channel erosion and reduce nonpoint source pollutant levels (nutrients, sediment, metals, bacteria)

Regional Stormwater Quality Facilities

Natural drainage channels are highly sensitive to changes in the magnitude of frequent stormwater runoff (i.e. 1-year and 2-year recurrence interval) events. Urban development, despite the presence of stormwater detention ponds, often increases the magnitude of 1-year and 2-year peak flows. This is a result of a detention pond design focus on the design (i.e. 100-year and 10-year) events. Although detention ponds typically reduce peak flow rates for larger (i.e. 100-year and 10-year) storm events, they often *increase* peak flow rates for more frequent (i.e. 1-year, 2-year) storm events and extend the overall duration of higher flow.

The hydrologic analysis completed for this project showed that major regional detention is not warranted to control the larger storms. Flooding is not a major problem in the lower watershed reaches and the existing detention policy for new development will be effective in controlling peak flows from these larger storms. However, it is recommended that regional detention/water quality treatment facilities be constructed in the upper reaches of Cool Creek to help control the magnitude of 1-year and 2-year recurrence interval rainfall events and filter stormwater pollutants. These facilities should be constructed “off-line” so as to maintain base flow in the

channel, avoid disrupting the existing riparian corridor, and avoid extensive dam safety requirements.

Regional stormwater detention facilities will provide the following benefits to the Cool Creek watershed:

- Reduce peak flow rates for more frequent storms
- Improve water quality by reducing concentrations of sediment, nutrients, metals, and bacteria
- Increase aquatic habitat by providing wetland and open water areas
- Reduce downstream erosion potential by decreasing the magnitude and duration of the 1-year and 2-year flows, thus further reducing sediment pollution

Several potential sites for regional stormwater quality detention facilities were identified during the course of the Cool Creek planning efforts. In the original Cool Creek study two sites were identified. The first site was along the Grassy Branch of Cool Creek north of 186 Street. The second site was south of 171st Street and east of Oak Road. Two additional sites were identified during the Section 319 update project. The first is at the confluence of the Anna Kendall Drain with Cool Creek. The second is along Cool Creek at the southeast corner of 161st Street and Westfield Boulevard. Figure 9-10 shows the general locations of these facilities.

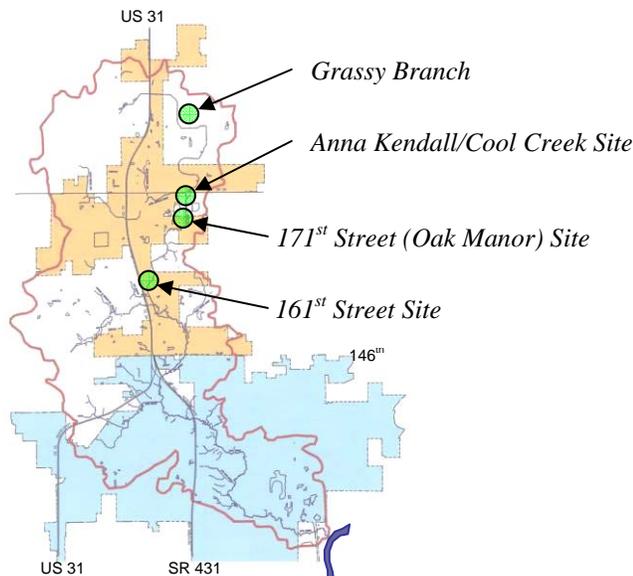


Figure 9-10
Regional Off-Line
Stormwater Quality Facility Locations

Hamilton County has been working on planning and design efforts for the site south of 171st Street. This site was selected because of cooperation with an adjacent development, called Oak Manor. The developer of this site has agreed to donate the land for the facility and possibly coordinate earthwork activities during construction of the facility. The following sections describe the Oak Manor facility in more detail, followed by an overview of the other three sites identified for regional off-line stormwater quality facilities.

Oak Manor Regional Stormwater Quality Facility

The Oak Manor Stormwater Quality Facility (previously referred to as the 171st Street facility in Chapter 7 of this report) involves the construction of a regional stormwater quality facility, off-line and adjacent to Cool Creek south of 171st Street and east of Oak Road. The area where the facility is planned is in the floodplain of Cool Creek, and is currently being farmed. The facility will be situated on the east side of the creek, and will consist of a 3-month storm event inflow channel which will divert flows to a settling pool, approximately one (1) acre in size and then into an additional six (6) acres of a constructed wetland system with a meandering shallow channel. Treated water from this facility will flow back into Cool Creek through a staged outfall pipe system, including a submerged orifice. A similar facility is also envisioned for the west side of Cool Creek, which Hamilton County would like to pursue in the future. Figure 9-11 is a schematic of the Oak Manor Stormwater Quality Facility.

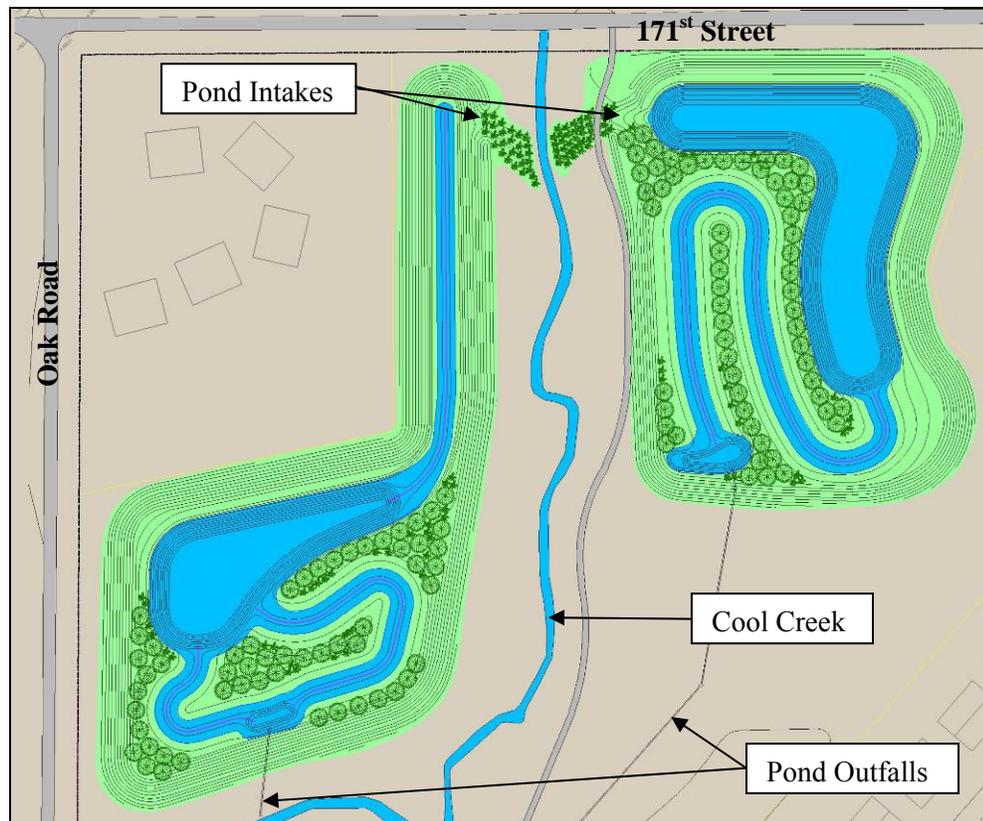


Figure 9-11
Oak Manor Stormwater Quality Facility Schematic

The stormwater quality facilities are designed to collect, detain and treat the “first flush” of urban nonpoint source pollutants. Additionally, downstream peak flows will be reduced by approximately 23% for events up to a 1-year event. Slowing the flow down during these smaller events (up to 1-year) will help reduce downstream bank erosion currently occurring due to urbanization in the watershed.

The Oak Manor pond/wetland system is anticipated to achieve the following pollutant removal percentages (*Source: National Management Measures Guidance to Control Nonpoint Source Pollution from Urban Areas, U.S. EPA, Draft, July 2002*):

- 80% - Total Suspended Solids
- 56% - Total Phosphorus
- 37% - Ortho-Phosphorus
- 19% - Total Nitrogen
- 40% - Nitrate and Nitrite Nitrogen
- 58% - Copper
- 56% - Zinc

In addition, stormwater wetland systems can help reduce bacteria by a 2 log reduction factor (or 99%) (*Source: Design of Stormwater Wetland Systems, Metropolitan Washington Council of Governments, October, 1992.*)

Existing loadings and load reductions for the Oak Manor Stormwater Quality Facility were computed using the sample taken at 186th Street and flow calculated by HEC-HMS at the Oak Manor location. Flows were based on a median central Indiana storm event (0.65 inches). Load reductions were also based on the above pollutant removal percentages. It was assumed that the Oak Manor Stormwater Quality Facility would treat 75% of the flow during this event.

Pollutant	Units	Existing Loadings	Projected Load Reductions
Total Suspended Solids	tons/yr	2104	1262
Total Nitrogen	tons/yr	631	156
Nitrogen, Nitrate	tons/yr	421	136
<i>E. Coli</i>	mCFU/yr	1,565,050	1,162,050

Additional Off-Line Stormwater Quality Detention Facilities

Though Hamilton County is currently focusing on the Oak Manor Stormwater Quality Facility, three other locations for similar facilities were identified during the course of the original Cool Creek study and during the Section 319 plan update. Figures 9-12, 9-13, and 9-14 show the sites for Grassy Branch, Anna Kendall/Cool Creek, and 161st Street (respectively). The Grassy Branch site was identified in the original Cool Creek study (see Section 7.7.2). The site, at the confluence of the Anna Kendall Drain with Cool Creek, was identified by the Hamilton County Surveyor as a good site to treat runoff from the Anna Kendall Drain. The site at the southeast corner of 161st Street and Westfield Boulevard was suggested by a participant at a public meeting held in the spring of 2005 for the Section 319 update project.

These three additional sites are located off-line in the floodplain of Cool Creek. The sites are currently farmed and would all provide opportunities to enhance water quality and reduce downstream channel erosion by constructing pond/wetland systems in these areas.



Figure 9-12
Grassy Branch Location
Regional Off-Line Stormwater Quality Facility



Figure 9-13
Anna Kendall/Cool Creek Location
Regional Off-Line Stormwater Quality Facility



Figure 9-14
161st Street and Westfield Boulevard Location
Regional Off-Line Stormwater Quality Facility

161st Street and Westfield Boulevard Stormwater Quality Facility

In November of 2005, the project team learned that a constructed wetland/pond system is planned for the 161st Street and Westfield Boulevard location. This facility is being funded by a private developer who is using the site for mitigation for filling of another isolated wetland in the watershed. The land was already owned by the Town of Westfield Parks Department.

The following is a project summary from Williams Creek Consulting, Inc. who is the consulting firm that designed the project.

“Early coordination with a local site developer, Williams Creek Consulting, Inc., Westfield Parks Department, Indiana Department of Environmental Management, and the U.S. Army Corps of Engineers has allowed the implementation of this plan as early as spring of 2006. Through this coordination, the property owned by Westfield Parks will be converted into a 2 acre wetland park for the purpose of natural flood control and water quality improvement with an educational theme for the heavily developed watershed”

“The Westfield Parks Department desires to create a wetland area along Cool Creek for the creation of additional community greenspace. The wetland park will additionally provide for an educational public feature demonstrating the important functions and values of wetlands and stream buffers in our environment. Approximately 2 acres will be graded for the wetland area and will include low-flow braided channels. The wetland will be planted with a wet meadow seed mixture and the surrounding upland will be planted with a diverse tall prairie seed mixture. Thirty four native trees and thirty eight native shrubs will be planted within the wetland including species such as oak, sweetgum, maple, river birch, buttonbush, and dogwood. Additionally, the wetland park

will have a trail and an observation deck constructed to help facilitate the educational experience.”

A schematic of the 161st Street and Westfield Boulevard wetland park facility is shown in Figure 9-15.

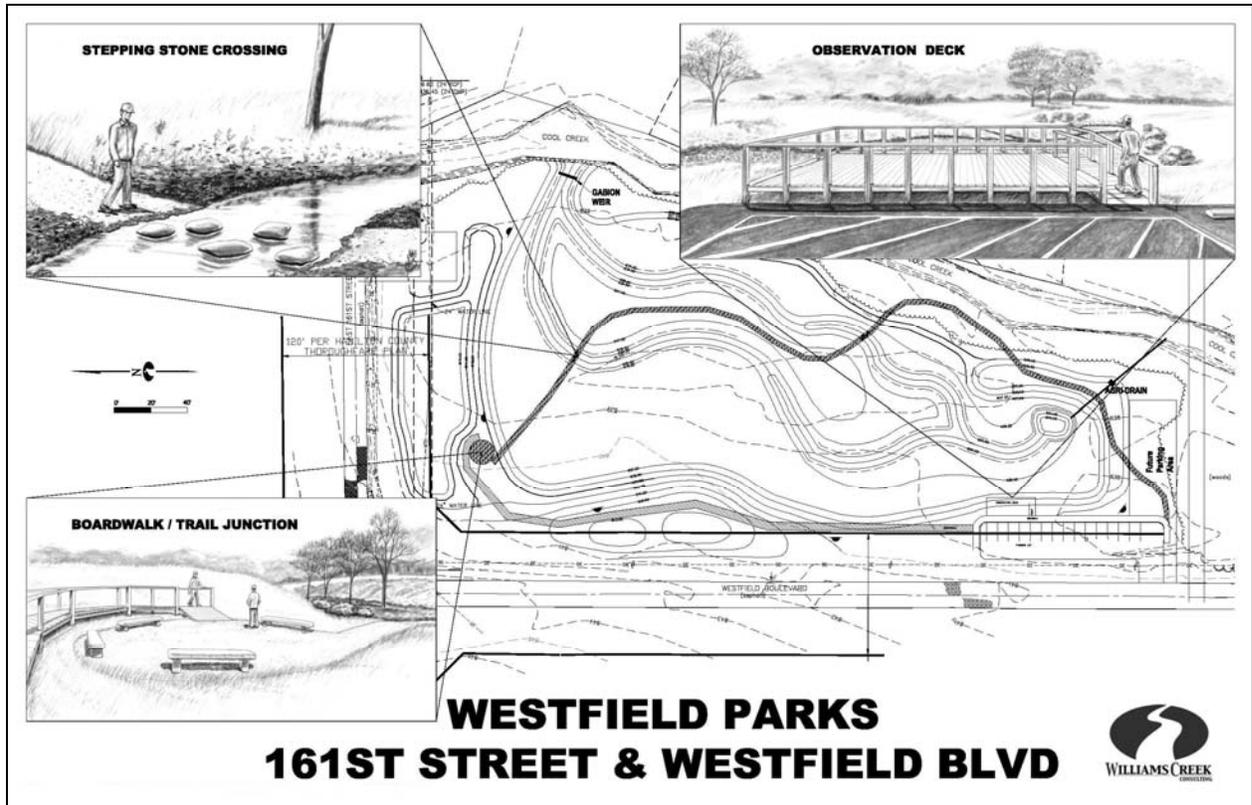


Figure 9-15
161st Street and Westfield Boulevard Location
Site Layout

Goal # 2 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Oak Manor Regional Stormwater Quality Facility	Complete Construction Plans (East Facility)	Hamilton County	Currently in progress	Hamilton County	Construction Plans
	Bid and Construct	319 Grant, Local Funding	Start in 2006	Hamilton County	Completed Facility
	Complete Construction Plans (West Facility)	Hamilton County	Currently in progress	Hamilton County	Construction Plans
	Bid and Construct	319 Grant, Local Funding	Start in 2007	Hamilton County	Completed Facility

Goal # 2 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
161st Street and Westfield Stormwater Quality Facility	Construct Pond	Developer	Start in 2006	Local Developer	Completed Facility
Anna Kendall/Cool Creek Stormwater Quality Facility	Acquire property	Donation	One year from plan approval	Hamilton County	Property
	Complete Construction Plans	319 Grant, Local Funding	Immediately after grant approval	Hamilton County	Construction Plans
	Bid and Construct	319 Grant, Local Funding	One year after grant approval	Hamilton County	Completed Facility
Grassy Branch Stormwater Quality Facility	Acquire property	Developer	As development occurs near site	Developer or Hamilton County	Property
	Complete Construction Plans	Developer or Hamilton County	As development occurs near site	Developer or Hamilton County	Construction Plans
	Bid and Construct	Developer or 319 Grant	One year after grant approval	Developer or Hamilton County	Completed Facility

Goal Indicators: Number of completed facilities, lower pollutants levels (nutrients, bacteria, TSS, metals, etc.), increased habitat

Goal #3 – Provide public education and outreach to residents and business in Cool Creek watershed to promote good watershed behavior (disposal of pet waste, proper lawn chemical use, illicit discharges, etc.)

Since Goal #3 is already being implemented by Rule 13 requirements for MS4s which encompass the entire Cool Creek Watershed no action register is included for this goal. As part of its Rule 13 program, Hamilton County surveyed residents in the Cool Creek watershed (as well as other parts of the County) to determine current awareness of stormwater quality issues. This survey was completed during the period of July 2004 through October 2004. The surveys were distributed at various local events. When asked “how concerned are you about stormwater pollution,” nearly 85 percent responded either somewhat concerned or very concerned. When asked “whether you agree that waterbodies in Hamilton County are polluted,” more than 88 percent responded somewhat agree or agree. When asked to rank four key stormwater pollutants in terms of their severity, the respondents ranked toxins (oils and greases) as having the largest impact, followed closely by bacteria, then sediment and nutrients. When asked to select the top three sources of stormwater pollutants from a list of ten potential sources, respondents ranked agricultural runoff as the top source, followed by runoff from industrial/municipal facilities and runoff from parking lots.

Hamilton County residents (including Carmel and Westfield) will be surveyed throughout the Rule 13 permit term to evaluate and monitor the effectiveness of the stormwater education program. Surveys will likely be distributed during local events, at public meetings, via

stormwater websites, and as inserts to local utility bills. Details of each community's Rule 13 program can be found at the following websites.

Hamilton County Stormwater Website:

<http://www.co.hamilton.in.us/services.asp?id=3921&entity=2200>

Carmel Stormwater Website:

<http://www.ci.carmel.in.us/government/deptcommunityrelations3.html>

Westfield Stormwater Website:

<http://www.westfield.in.gov/egov/apps/directory/list.exe?path=divs&action=47&fDD=8-47>

Goal Indicators: Improved public knowledge of water quality issues, reflected through awareness surveys; number of brochures distributed; number of public outreach events completed

Goal #4 – Repair/restore severe channel erosion in the lower reaches of Cool Creek to improve aquatic habitat, reduce sedimentation, and protect public and private facilities.

Streambank Erosion Solutions (See Section 7.6)

Proposed solutions range from minor regrading and seeding (for areas experiencing moderate flow velocities) to more intensive improvements such as riprap, geotextile fabric, woody plantings, vegetated geogrids, etc. for areas experiencing high flow velocities or containing steep channel sideslopes. Whenever possible, streambank stabilization should employ vegetative measures, so as to maintain the natural state of the channel corridor and to enhance instream water quality. In some instances of severe erosion, a more structural solution such as gabion baskets or revetment may be a more appropriate solution.

The proposed solutions described in this section are preliminary only. Upon choosing specific streambank restoration sites, detailed information will need to be collected and each site will need to be analyzed separately. Detailed information needed for a final design would be as follows:

- Channel cross sections at each restoration site, including location of private features, property corners, and nearby utilities.
- Hydraulic analysis for each restoration site, including velocity calculations and shear stress calculations for more frequent (i.e. 1-year, 2-year) recurrence interval rainfall events.
- Soil analysis for each restoration site.
- Determination of land availability (i.e. easements, right-of-way, and land acquisition) for proposed grading.
- Determination of construction access points.
- Public input on proposed improvements (most important when improvements are immediately adjacent to existing homes)

Critical stream bank erosion areas are listed below. Load calculations for each area have been performed and the areas have been prioritized based on this calculation. A photograph of the erosion area is shown on the right for each area. A figure for each stream bank solution can be

found at the end of Chapter 7 (Figures 7-11 through 7-17). Additional details, including costs, are provided in Section 7.6.

Priority #1 - Cool Creek: upstream of confluence with the White River (See Section 7.6.3)

Severity of Erosion: Very Severe
Lateral Recession Rate: 0.7 ft./yr.
Length: 1500 feet
Height: 4 feet
Load Reduction: **189.0 tons per year**



Priority #2 - Cool Creek: upstream and downstream of Hot Lick Creek (See Section 7.6.5)

Severity of Erosion: Very Severe
Lateral Recession Rate: 0.7 ft./yr.
Length: 575 feet
Height: 4 feet
Load Reduction: **72.5 tons per year**



Priority #3 - Cool Creek: downstream of Gray Road (at bend) (See Section 7.6.4)

Severity of Erosion: Very Severe
Lateral Recession Rate: 0.6 ft./yr.
Length: 200 feet
Height: 8 feet
Load Reduction: **43.2 tons per year**



Priority #4 - Cool Creek: upstream of 131st Street (Main Street) (See Section 7.6.6)

Severity of Erosion: Very Severe
Lateral Recession Rate: 0.6 ft./yr.
Length: 150 feet
Height: 9 feet
Load Reduction: **36.5 tons per year**



Priority #5 - Cool Creek: upstream of Keystone Avenue (See Section 7.6.7)

Severity of Erosion: Very Severe
 Lateral Recession Rate: 0.7 ft./yr.
 Length: 100 feet
 Height: 8 feet
 Load Reduction: **25.2 tons per year**



Priority #6 - H.G. Kenyon Drain: downstream of Rolling Court (See Section 7.6.2)

Severity of Erosion: Severe
 Lateral Recession Rate: 0.5 ft./yr.
 Length: 250 feet
 Height: 4 feet
 Load Reduction: **22.5 tons per year**



Priority #7 - Highway Run: downstream of Stonehedge Drive (See Section 7.6.1)

Severity of Erosion: Severe
 Lateral Recession Rate: 0.4 ft./yr.
 Length: 100 feet
 Height: 6 feet
 Load Reduction: **10.8 tons per year**



Goal # 4 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Reduce Sedimentation from Channel Erosion	Priority #1 - Cool Creek: upstream of confluence with the White River	319 Grant	Initiate within 1 year	Hamilton County	Complete Project/Reduced TSS
	Priority #2 - Cool Creek: upstream and downstream of Hot Lick Creek	319 Grant	Initiate within 1 year	Hamilton County	Complete Project/Reduced TSS
	Priority #3 - Cool Creek: downstream of Gray Road (at bend)	319 Grant	Initiate within 1 year	Hamilton County	Complete Project/Reduced TSS
	Priority #4 - Cool Creek: upstream of 131st Street (Main Street)	319 Grant	Initiate within 3 to 5 year	Hamilton County	Complete Project/Reduced TSS

Goal # 4 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
	Priority #5 - Cool Creek: upstream of Keystone Avenue	319 Grant	Initiate within 3 to 5 year	Hamilton County	Complete Project/Reduced TSS
	Priority #6 - H.G. Kenyon Drain: downstream of Rolling Court	319 Grant	Initiate within 3 to 5 year	Hamilton County	Complete Project/Reduced TSS
	Priority #7 - Highway Run: downstream of Stonehedge Drive	319 Grant	Initiate within 3 to 5 year	Hamilton County	Complete Project/Reduced TSS

Goal Indicators: Number of projects completed, reduced concentrations of TSS

Goal #5 – Reduce impact of urbanization by modifying stormwater detention policy to control smaller storms and treat the first flush of runoff

Modify Detention Pond Design Standards (See Section 7.8.1)

Many communities require detention pond designs that incorporate features to help capture pollutants in stormwater runoff. This is generally accomplished by providing a *Water Quality Volume*. The water quality volume is the storage needed to capture and treat runoff from 90% of the average annual rainfall (runoff from approximately a 1-inch rain event). Design standards for reviewing authorities within the Cool Creek watershed should be modified to contain a similar requirement. The *Water Quality Volume* standard will help to control peak flows during more frequent storm events, reduce pollutant loadings to receiving streams, and reduce the potential for downstream channel erosion.

Properly designed and constructed stormwater ponds are generally capable of the following pollutant load reductions:

Pollutant	Percent Reduction*
Total Suspended Solids	80%
Total Phosphorus	51%
Ortho-Phosphorus	65%
Total Nitrogen	33%
Nitrate and Nitrite Nitrogen	43%
Copper	57%
Zinc	66%

*Source: National Management Measure Guidance to Control Nonpoint Source Pollution from Urban Areas. U. S. EPA, Draft, July 2002

Ordinance and Standards Updates (See Section 8.3.5)

The recommendations outlined in the land use and planning policies section of this report will require updates and/or new ordinances and design standards. All three entities in the watershed are currently updating their ordinances and standards to address stormwater quality.

Goal # 5 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Reduce impact of urbanization	Modify Detention Pond Design Standards	Local Funding	Initiate by year 1	Hamilton County, Carmel, Westfield	Updated Detention Pond Design Standards
	Ordinance and Standards Updates	Local Funding	On Going, complete by year 1	Hamilton County, Carmel, Westfield	Updated Ordinances and Standards

Goal Indicators: Completed Design Standards and Ordinances, lower pollutants levels

Goal #6 – Continue the Hamilton County Parks and Recreation Department’s community service program to improve watershed quality, including removing invasive species, stream trash pick up and public education.

Community Service Program

To improve the Cool Creek watershed quality, the Hamilton County Parks and Recreation Department has been organizing community service days for volunteers. These days can be either open to the public or for private groups such as the Boy/Girl Scouts, churches, environmental organizations, and other interested groups. A Service Learning Day was recently (October 16, 2005) sponsored by IUPUI Center for Earth and Environmental Science to get volunteers to assist in removing invasive species. This is a valuable program to improve watershed health and provide public education. The goal included continuing to support and promoting awareness of this program.

Goal # 6 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Improve Watershed Quality	5-10 Community Service Days a Year	Local Funding	On Going	Hamilton County Parks and Recreation Department	Ecological Diversity and Improved Watershed Quality

Goal Indicators: Number of community service days per year, increased public awareness

Goal #7 – Provide sanitary sewer service to the few neighborhood areas in Westfield still on septic systems

The Town of Westfield has identified five neighborhoods that are served by septic systems, rather than sanitary sewers. Some of these neighborhoods have had failure problems. These neighborhoods are shown on the Problem Area Map in Figure 3-1 of this report. Septic system failures occur when systems are not maintained properly which can increase bacterial levels in receiving streams. Therefore, converting neighborhoods from septic systems to sanitary collection systems has been made a goal of this plan and of the Town. Based on an estimated cost of \$15,000 per home, a preliminary estimate of cost to install sanitary sewers in these neighborhoods is as follows:

- Far Hills - \$540,000
- Buena Vista - \$195,000
- Brookview Place - \$615,000
- Bokeelia - \$195,000
- Ridgewood - \$405,000

Goal # 7 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Provide Sanitary Service to reduce <i>E. Coli</i>	Far Hills Sanitary Sewers	Local Funding	Initiate within 2 years	Westfield	Reduced <i>E. Coli</i>
	Buena Vista Sanitary Sewers	Local Funding	Initiate within 2 years	Westfield	Reduced <i>E. Coli</i>
	Brookview Place Sanitary Sewers	Local Funding	Initiate within 2 years	Westfield	Reduced <i>E. Coli</i>
	Bokeelia Sanitary Sewers	Local Funding	Initiate within 2 years	Westfield	Reduced <i>E. Coli</i>
	Ridgewood Sanitary Sewers	Local Funding	Initiate within 2 years	Westfield	Reduced <i>E. Coli</i>

Goal Indicators: Number of households converted form septic system to sanitary sewers, lower bacteria levels

Goal #8 – Implement consistent floodplain development restriction by adopting necessary legal authority (ordinances)

Floodplain Protection (See Section 7.8.3)

Floodplain development concerns tie directly to preservation of the riparian stream buffers along Cool Creek (and its tributaries). Filling of floodplains can cause loss of flood storage and riparian habitat. As noted previously, Hamilton County has an ordinance that prohibits filling of land in the floodplains of its regulated drains. It would be very beneficial for Carmel and Westfield to adopt similar policies for floodplains under their jurisdiction. This would provide a uniform policy and would help preserve existing riparian buffers. Carmel and Westfield are currently considering these issues as part of their ordinance updates.

Goal # 8 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Reduce Flooding and Protect Riparian Areas	Ordinance and Standards Updates	Local Funding	On Going, complete by year 1	Carmel, Westfield	Updated Ordinances and Standards

Goal Indicators: Adoption of consistent floodplain development ordinances

Goal #9 – Construct the bridge and culvert conveyance improvement projects to reduce flood hazards and protect public safety

Stream Flooding/Roadway Overtopping Critical Areas and Solutions (See Section 7.4)

Proposed improvements to solve the critical flooding areas are presented in Section 7.4 of this report. These improvements will be completed as local funds allow.

Goal # 9 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Reduce Flood Hazards	E. 151 st Street (Cool Creek)	Local Funding	During Roadway Improvements	Westfield	Reduced Local Flooding
	Walter Street, Private Drive, and Walter Court (Highway Run)	Local Funding	During Roadway Improvements	Westfield	Reduced Local Flooding
	E. 171st Street (Cool Creek)	Local Funding	During Roadway Improvements	Westfield	Reduced Local Flooding
	Gurley Street (Anna Kendall Drain)	Local Funding	During Roadway Improvements	Westfield	Reduced Local Flooding
	Cherry Street (Anna Kendall Drain)	Local Funding	During Roadway Improvements	Westfield	Reduced Local Flooding
	SR 32 (J. M. Thompson Drain)	Local Funding	During Roadway Improvements	Westfield	Reduced Local Flooding
	US 31 and Adjacent Private Drive (Highway Run)	State Funds	During Roadway Improvements	Carmel	Reduced Local Flooding
	Thornberry Drive (Highway Run)	Local Funding	During Roadway Improvements	Carmel	Reduced Local Flooding
	Carmel Drive (Hot Lick Creek)	Local Funding	During Roadway Improvements	Carmel	Reduced Local Flooding
	Hot Lick Creek Channel Improvement	Local Funding	During Roadway Improvements	Carmel	Reduced Local Flooding

Goal Indicators: Number of completed projects, amount of roadway overtopping occurring during a year

Goal #10 – Improve the riparian habitat in the upper watershed by establishing stream buffers and vegetation as areas are developed adjacent to Cool Creek

Buffer strips should be incorporated into development plans as Hamilton County, and more specifically areas adjacent to Cool Creek and its tributaries, continue to develop. Currently agricultural lands in the northern watershed adjacent to Cool Creek have limited or no buffer strips. Based on current population trends in Hamilton County these lands will be developed relatively soon. Space for buffer strips and green space along Cool Creek provide valuable stormwater runoff protection by filtering pollutants before they enter the stream. These features should be provided as part of the development of the area and incorporated in the plan review process for each community.

Goal # 10 Action Register					
Objective	Task	Funding	Schedule	Responsible	Products
Improve the Riparian Habitat	Increase Amount of Buffer Strips by Incorporating into Development Plans	Developer, Local Funding	On Going	Hamilton County, Carmel, Westfield	Additional Stream Buffers

Goal Indicators: Length of stream with additional buffers strips added that previously did not have buffers

9.7 EVALUATING, MONITORING, AND ADAPTING THE PLAN

Hamilton County, Carmel, and Westfield will ultimately be responsible for tracking the progress of the plan achievements, making any changes to the plan that the Stakeholder Committee deems necessary, keeping all plan-related records and documents, and distributing copies of the plan to necessary participants. The follow items are recommended to evaluate and monitor the plan achievements:

Stakeholder Meetings

- Quarterly meetings
- Include Hamilton County, Carmel, Westfield representatives
- Include any other parties who have been involved to this point
- Once a year, the Stakeholder committee should invite new participants that have not been involved to this point.
- Review the progress of the plan and implementation measures
- Organize and review water quality monitoring data
- Organize and review visual Inspection
- Organize and review progress of implementation projects in the WMP
- Organize and review plan updates as needed

Water Quality Monitoring Data

- Samples should be taken once per year (ideally two times)
- Samples should be obtained during typical storm events (0.5 inches to 1.0 inches of rain)
- A minimum of 3 sample locations should be considered for each event. If needed more sites could be added to measure the effectiveness of the implementation measures
- Additional samples could be taken in dry weather
- Parameters sampled should included:
 - Sediment
 - Bacteria
 - Nutrients
 - Other Physical Properties (temperature, D.O., pH, etc.)
- Sampling for pesticides should also be considered (at least once) to determine baseline conditions
- Continue to promote volunteer monitoring by Hoosier Riverwatch or other similar programs

Visual Inspection

- Visual inspections responsibilities should be shared by Hamilton County, Westifield, and Carmel.
- Visual inspection logs should be kept for each tributary including the following
 - Date inspected
 - Inspector initials
 - Stream reach location
 - Photo log identified on map of area
 - Specific data on channel problems
- Streams in the watershed should be inspected at least once every three years

- Severe channel problems should be monitored quarterly
- Feet per year estimates of erosion problems should be made and documented in the log

Implementation of Recommended Improvements

- Recommended improvements shall have monthly progress meetings
- Progress reported at quarterly Stakeholder meetings

Update the Plan as Needed

- Plan updates will be made by Hamilton County with input from Carmel and Westfield
- Plan updates will be based on monitoring, visual inspections, and stakeholder and public input
- Plan updates will be discussed at quarterly Stakeholder meetings

The approval of this Section 319 Cool Creek Watershed Management Plan will not be the end of the project but rather the start of continual effort to achieve the mission statement:

Preserve and improve the overall health of the Cool Creek Watershed by addressing existing stormwater quantity and quality concerns and by proactively guiding future stormwater management practices and decisions.

Contact Information

The following persons can be contacted with suggestions to improve the Cool Creek Watershed Management Plan.

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