**New Albany Stormwater Master Plan**

The 2010 Stormwater Master Plan provides a City-wide evaluation of stormwater drainage issues based on drainage requests, field monitoring and the results of hydrologic and hydraulic models. It identifies local and watershed-scale capital improvements, identifies costs, sets priorities and evaluates funding options to lay the foundation for planning efforts that will help the Stormwater Drainage Board and Utility fulfill their mission.

# Executive Summary

The City of New Albany has experienced significant flooding and extensive damage due to recent storm events. A 1992 Stormwater Master Plan was developed by GRW Engineers, Inc. to address stormwater issues and aid in the development of a stormwater utility fee. Due to the recent flooding and development, an updated Master Plan has become a priority to address stormwater drainage issues. Stantec Consulting Services Inc. (Stantec) has designed the New Albany Stormwater Master Plan to address drainage issues using a multi-pronged approach that includes field modeling, the evaluation of existing data and studies and the development of supplemental hydrologic and hydraulic models to evaluate existing storm sewer systems. Resident drainage request data and field reconnaissance activities were used to determine where the most extensive and frequent flooding occurred throughout the city.

Two tiers of modeling efforts were used to provide a tool for evaluating existing infrastructure that may require repairs or replacement and to identify existing and future stormwater issues. The Tier 1 model is based in GIS (Geographic Information Systems), which uses the Rational Method to calculate flowrates through existing infrastructure. It is designed for the City to use as a tool to evaluate existing stormwater infrastructure and to make improvements to infrastructure using New Albany field crews. The Tier 2 tool is an XPSWMM-based model which predicts the response of stormwater drainage systems to design and historical storm events. It is designed to evaluate drainage issues on a larger scale and provides the basis for a proactive approach to develop capital improvement projects to meet current and future needs. Tier 2 model results were used to evaluate existing conditions and develop potential improvements such as storage basins, pipe improvements, and stormwater infrastructure installation. It can be used to evaluate both local and watershed-scale drainage issues and projects.

The plan identifies local and watershed-scale drainage improvements, provides budget-level opinions of cost of improvements for the Falling Run, Silver Creek, Middle Creek and Ohio River watersheds that drain the City of New Albany, sets project priorities on a city-wide basis and identifies funding opportunities at the local, state, and federal level to support the work of the stormwater utility. Capital improvements totaling $22.4M in cost were identified in the 2010 planning study. The study also sets priorities for their implementation and identifies funding strategies and opportunities at the local, state and federal level. The highest project priorities are in the Falling Run and Silver Creek watersheds.

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# 1.0 Introduction

The 2010 New Albany Stormwater Master Plan represents a wide-reaching effort to identify the stormwater drainage needs of the New Albany community and lays the foundation for the development of five (5)-year plans to provide significant improvements in the drainage system for its residents and businesses. The plan identifies $22.4 M in both local and watershed-scale drainage improvements and sets priorities for their implementation. These costs and priorities, along with administrative, operational and maintenance costs, provide the basis for setting user fees and identifying additional sources of funding to support the mission of the City of New Albany Stormwater Drainage Board and Stormwater Utility.

A review of regulations and policies that affect the management of stormwater in the City of New Albany is provided in **Section 2**. Regulations and policies require municipalities to comply with standards established by federal and state agencies. Regulatory programs such as the municipal separate storm sewer (MS4) program, the Clean Water Act, floodplain regulations, and the National Flood Insurance Program. New Albany's ordinances related to stormwater and floodplains are tools that can be used implement these programs and set standards and design criteria for stormwater, floodplain management, and can be used as a planning tool for development and redevelopment.

A comprehensive field monitoring program was implemented to collect high water mark data; determine the extent of flooding; confirm and/or document the nature of drainage requests; evaluate drainage system performance; and identify areas that require maintenance following significant storm events in 2009. Information from the monitoring effort was used to calibrate hydrologic and hydraulic models for the evaluation of existing stormwater drainage systems. This data can also be used to calibrate models and evaluate drainage problems for design studies. The implementation and results of the monitoring program are presented in **Section 3**.

The Stormwater Management Model (SWMM) (Rossman, 2009) was used to evaluate stormwater infrastructure on a system-wide basis. Drainage channels larger than two (2) feet in width and storm sewers larger than 24 inches in diameter were included in models for the Falling Run, Silver Creek, Middle Creek and Ohio River watersheds within the City of New Albany Limits. **Section 4** provides an overview of the modeling effort; the development of inputs necessary to simulate the response of watersheds and drainage systems to design storms; and an evaluation of SWMM model performance. It was anticipated that the HEC-RAS used in the draft Flood Insurance Study for Floyd County and Incorporated areas (FEMA, 2009) would be available for use in this study. This model was not available so a system-wide SWMM model was developed to evaluate New Albany's stormwater drainage systems.

Evaluations of stormwater drainage issues for the four watersheds that drain the City of New Albany: Falling Run, Silver Creek; Middle Creek; and the Ohio River are presented in **Sections 5, 6, 7**, and **8**, respectively. These sections provide the following information for each watershed where applicable:

- Discussions of watershed characteristics;
- Evaluations of the implications of the transition from the current effective floodplain maps based on the Flood Insurance Study (FIS) for the City of New Albany (FEMA, 2000) and the preliminary floodplain maps based on the draft FIS for Floyd County and Incorporated Areas (FEMA, 2009);
- Descriptions of SWMM model inputs;
- Evaluations of areas of concern that were identified through a review of drainage requests;
- Action plans for each area of concern;
- Planning level opinions of cost for capital improvements to address drainage issues in the areas of concern;
- Evaluations of the performance of existing culverts that have been identified as potential problems;
- Planning level opinions of cost for culvert replacements;
- Priorities for culvert replacement projects on each watershed;
- Identification of potential sites that could provide stormwater detention;
- Evaluation of proposed detention basins; and
- Preliminary opinions of cost for proposed detention basins.

City-wide priorities for capital improvement projects, culvert replacement projects and watershed-scale studies are set in **Section 9.** The prioritization of capital improvement projects are based on an objective score that quantifies the nature and severity of drainage requests in each area of concern. The city-wide prioritization of culvert improvements is based on a compilation of watershed priorities. Watershed-scale projects are large projects with interdependent components that usually provide benefits in the floodplains of Falling Run, Silver Creek, Middle Creek and their major tributaries. Watershed-scale projects can also provide water quality benefits for these streams. Most of the stormwater detention basins identified in **Sections 5, 6**, and **7** are watershed-scale projects.

Opportunities for funding the improvements identified in the master plan study are also identified in **Section 9**. Funding opportunities include local, state, and federal sources from user fees, general funds and grant programs. This section also provides an assessment of the stormwater user fee and its ability to support capital improvements for the City of New Albany Stormwater Utility.

The priorities and funding opportunities identified in **Section 9** provide the foundation for the development of a five (5)-year plan for capital improvements and set funding goals for the stormwater utility based on the needs of the community.

# 2.0 Regulation and Policy Review

Federal, state, and local regulations and policies impact local stormwater programs and can be an effective tool to manage stormwater quality and quantity issues. These regulations and policies require municipalities to comply with standards established by federal and state agencies. These regulatory programs include the municipal separate storm sewer (MS4) program, permitting requirements for stream work and wetlands pursuant to the Clean Water Act, restrictions on floodplain development, and voluntary participation in the National Flood Insurance Program. Local ordinances are a tool to implement these programs and a means to set the standards for design criteria for stormwater, and to use as a planning mechanism for development and redevelopment. As more is learned about local drainage systems and watersheds, ordinances and policies should be updated to be an effectively manage stormwater quality and quantity issues. The following sections provide an overview of the federal, state, and local programs that impact stormwater management. This section concludes with programmatic recommendations for managing water quality and quantity.

## 2.1 FEDERAL REGULATORY PROGRAMS

### 2.1.1 Municipal Separate Storm Sewer System (MS4)

The City of New Albany is designated as a Municipal Separate Storm Sewer System (MS4) by the United States Environmental Protection Agency (EPA). The MS4 program is an unfunded mandate to improve water quality. As such, the City of New Albany does not receive federal or state funding to implement and enforce this program. This designation requires the City to comply with Federal and State mandates for water quality and must meet the Six Minimum Control Measures (MCMs). These six minimum control measures are:

1. Public Education and Outreach;
2. Public Participation and Involvement;
3. Illicit Discharge Detection and Elimination;
4. Construction Site Runoff Control;
5. Post-Construction Runoff Control; and
6. Pollution Prevention and Good Housekeeping Practices for Municipal Operations.

There are educational resources available to assist the regulated communities with the implementation of this program. Both federal and state entities provide guidance materials to assist with the Six Minimum Control Measures. The United States Environmental Protection Agency (EPA) administers the MS4 program at the federal level and has provided educational resources to assist in compliance at: http://cfpub.epa.gov/npdes/stormwater/munic.cfm.

The State of Indiana administers the MS4 program through the Indiana Department of Environmental Management (IDEM) and has provided educational resources for communities to assist with the implementation and enforcement of this program. The resources are located at: http://www.in.gov/idem/4900.htm. Since Indiana administers the MS4 program, it will be discussed in more detail in the section titled, State Regulatory Programs.

During the development of this plan, the EPA announced that it would have listening sessions regarding future rulemaking impacting the MS4 program. These listening sessions will occur in January of 2010, followed by a webinar in February of 2010. Topics to be discussed include expanding the area subject to federal stormwater regulations; establish specific requirements to control stormwater discharge from new development and redevelopment; develop a single set of consistent stormwater requirements for all municipal stormwater sewer systems; require those sewer systems to address stormwater discharges in areas of existing development through retrofitting the sewer system or drainage area with improved stormwater control measures; explore specific stormwater provisions to protect sensitive areas. In addition, the EPA issued a policy statement in 2009 for federal projects including requirements for stormwater sampling and monitoring during construction and requirements for treating stormwater volume as a water quality pollutant.

### 2.1.2 Federal Construction General Permit

During the development of this SWMP, new rules for construction sites were promulgated by the EPA. On November 28, 2008, the EPA published the proposed rules, titled Effluent Limitation Guidelines, to regulate water quality in runoff from construction sites. The City, through the efforts of the Southern Indiana Stormwater Advisory Committee (SWAC), submitted comments to the EPA regarding concerns associated with cost and feasibility of implementing the proposed rules. The fact sheet regarding this rule can be found in **Appendix 2.1**. On December 1, 2009, the EPA released the final rules. These new rules will eventually apply to all construction sites throughout the nation that are one acre or larger, or for sites that are under one acre but are part of a larger common plan of development; and will also apply to linear projects.

The final rules include the following requirements and deadlines:

- A numeric turbidity limit, which is a measure of sediment and other pollutants in runoff from construction sites. This limit will eventually apply to sites that disturb ten or more acres of soil. The limit will be phased in over the course of four years, beginning on February 1, 2010.
- States are required to include the new requirements consistent with the regulations on February 1, 2010.
- The new regulations will take effect for those governed by the EPA Construction General Permit when it is reissued.

- The new rules contain minimum requirements for all construction sites including the following: sediment and erosion controls, pollution prevention measures, outlet controls, and soil stabilization.
- Discharges from construction sites will also be curtailed, including: dewatering and concrete wastewaters; wastewater washouts; oils or other fuels; and soaps and solvents.

The development and implementation of these rules in the state of Indiana should continue to be monitored by the City and implemented accordingly.

### 2.1.3 Federal Emergency Management Administration (FEMA)

The Federal Emergency Management Administration oversees several programs that can impact the regulation of stormwater activities. These include the National Flood Insurance Program, Hazard Mitigation Planning, the Severe Repetitive Loss Program, and the Severe Repetitive Flood Claims Program and the Community Rating System. In addition, there are funding opportunities for stormwater projects that are discussed in **Section 9** of this report.

### 2.1.4 National Flood Insurance Program

The City is a participant in the National Floodplain Insurance Program (NFIP) through the Federal Emergency Administration (FEMA). Participation in the NFIP is voluntary and the City has participated in the NFIP since 1976. The NFIP is composed of three regulatory aspects: flood insurance; floodplain management; and flood hazard mapping. The goal of the NFIP is to reduce future flood damage through flood plain management. According to FEMA, roughly 25% of all claims paid by the NFIP are in low to moderate risk communities. The average home has a 26% chance of being damaged by a flood during the course of a thirty-year mortgage, compared to a 9% chance of being damaged by a fire during the same timeframe. According to FEMA, buildings that are constructed pursuant to NFIP building standards experience 80% less damage than those that do not comply with NFIP standards.

Participation in this program requires the City to implement floodplain regulations. These regulations are updated from time to time pursuant to Federal and State requirements. The current ordinance is expected to be updated in 2010-2011. This ordinance can be found in the Code of Ordinances at 156.080 Open Space (Flood Plain) District Regulations. Due to the City's participation in the NFIP homeowners, business owners, and renters can obtain federally-backed flood insurance policies. This program is administered at the local level by the City planning office.

The City participated in the development of the Floyd County Multi-Hazard Mitigation Plan and subsequently adopted the plan, as is required by the Federal Disaster Mitigation Act of 2000 (DMA 2000). By meeting these requirements, the City maintains eligibility for certain federal disaster assistance and hazard mitigation funding programs that are discussed in **Section 9** of this report. The Multi-Hazard Mitigation Plan contained a summary from the National Climatic

Data Center for past flooding events in the County. An updated summary can be found in **Appendix 2.2**.

Other FEMA programs include the severe repetitive loss program and the repetitive flood claims program. The severe repetitive loss program is also a program available to NFIP communities through FEMA. A Severe Repetitive Loss (SRL) property is defined as a residential property that is covered under an NFIP flood insurance policy and that has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or there must be at least two separate claims payments (building payments only) made with the cumulative amount of the building portion of such claims exceeding the market value of the building. In order to meet the definition of a SRL property, at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart. The City of New Albany has seven repetitive loss buildings.

The severe repetitive claims program is another program that allocates up to $10 million annually for FEMA to provide RFC funds to assist States and communities reduce flood damages to insured properties that have had one or more claims to the NFIP.

### 2.1.5 Community Rating System

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance. The NFIP has been successful in requiring new buildings to be protected from damage by a 100-year flood. However, flood damage still results from floods greater than the 100-year flood and from flooding in unmapped areas. Under the Community Rating System (CRS), there is an incentive for communities to do more than just regulate construction of new buildings to minimum national standards. Under the CRS, flood insurance premiums are adjusted to reflect community activities that reduce flood damage to existing buildings, manage development in areas not mapped by the NFIP, protect new buildings beyond the minimum NFIP protection level, help insurance agents obtain flood data, and help people obtain flood insurance.

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5%. The CRS classes for local communities are based on 18 creditable activities, organized under four categories: (i) Public Information, (ii) Mapping and Regulations, (iii) Flood Damage Reduction, and (iv) Flood Preparedness.

There are approximately 1000 communities nationwide receiving flood insurance premium discounts based on their implementation of local mitigation, outreach, and educational activities that go well beyond minimum NFIP requirements. While premium discounts are one of the

benefits of participation in CRS, it is more important that these communities are carrying out activities that save lives and reduce property damage. These communities represent a significant portion of the Nation's flood risk as evidenced by the fact that over 66% of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS cover a full range of sizes from small to large, and a broad mixture of flood risks including coastal and riverine.

**Credit points earned, classification awarded, and premium reductions given for communities in the National Flood Insurance Program Community Rating System.**

| | | *Premium Reduction* | |
|---|---|---|---|
| **Credit Points** | **Class Rating** | **SFHA*** | **Non-SFHA**** |
| 4,500+ | 1 | 45% | 5% |
| 4,000 – 4,499 | 2 | 40% | 5% |
| 3,500 – 3,999 | 3 | 35% | 5% |
| 3,000 – 3,499 | 4 | 30% | 5% |
| 2,500 – 2,999 | 5 | 25% | 5% |
| 2,000 – 2,499 | 6 | 20% | 5% |
| 1,500 – 1,999 | 7 | 15% | 5% |
| 1,000 – 1,499 | 8 | 10% | 5% |
| 500 – 999 | 9 | 5% | 5% |
| 0 – 499 | 10 | 0 | 0 |

** Special Flood Hazard Area*
*** Preferred Risk Policies are available only for properties in X Zones that are shown to have a minimal risk of flood damage. The Preferred Risk Policy does not receive premium rate credits under the CRS because it already has a lower premium than other policies. Although they are in SFHAs, Zones AR and A99 are limited to a 5% discount.*

Today, most communities enter the program at a Class 9 rating, which entitles residents in Special Flood Hazard Areas to a five percent (5%) discount on their flood insurance premiums. As of October 2009, there were approximately 188 flood insurance policies documented in FEMA's database in force within the City of New Albany. The approximate amount of insurance in place was $34,307, 500; $153,735 in premiums; the number of paid losses to date was 85.

### 2.1.6 Clean Water Act (CWA)

Pursuant to Section 404 of the Clean Water Act (CWA) the United States Army Corps of Engineers (USACE) must give approval for discharges of dredged or fill materials into waters of the United States. IDEM also regulates isolated wetlands pursuant to *IC 13-18-22-1* et seq.

#### 2.1.6.1 Section 404 of the CWA

Section 404 of the CWA will become an issue when stormwater projects impact streams and wetlands on the ground. This program is administered by the USACE and requires that permits be issued prior to construction if a stream or wetland impact is planned. The USACE will make a jurisdictional determination to decide whether the wetland or stream in question is within their regulatory authority. Should the project result in the "loss" of the aquatic value of the stream or wetland, the USACE may require that compensatory mitigation be performed. Projects covered by this rule include detention basin dams, culverts, bridges, streambank stabilization, dredging, and debris removal under certain circumstances.

## 2.2 STATE PROGRAMS

The State of Indiana regulates several programs that impacts water quality and quantity at the local level. These programs include construction site activities, Rule 5; the MS4 program, Rule 13; construction in a floodplain; and water quality permitting.

### 2.2.1 Construction Land Disturbance Permitting: Rule 5

The State of Indiana regulates construction and land disturbance activities. The goal of this program is to reduce the amount of contaminants from construction sites entering local waterways. Soil erosion is the number one pollutant in local streams and can impact aquatic wildlife, habitat, and local stream aesthetics and the quality of life. The EPA delegated the authority for the State of Indiana to regulate these activities. The regulations can be found at *327 IAC 15-5* and are in **Appendix 2.3** of this report. The requirements of this rule apply to all who are involved in construction activities that results in the disturbance of one (1) acre or more of total land area, but is part of a larger common plan of development or sale. Construction activities include: clearing, grading, excavation, and other land disturbing activities.

Most construction permits in Indiana are administered through a general permit, which means that Rule 5 applies to the regulated construction site. If IDEM determines that the project and any resulting discharges will lower water quality, then an individual stormwater permit will be required and notice will be given to the project site owner. An individual stormwater permit has different requirements than those set forth in Rule 5. These requirements can be found in **Appendix 2.4**.

### 2.2.2 Municipal Separate Storm Sewer System (MS4): Rule 13

The State of Indiana regulates municipalities that are designated as MS4 pursuant to Rule 13, the general permit rule, *327 IAC 15-13*. The full text of Rule 13 can be found in **Appendix 2.5**. MS4 is defined as the conveyance or system of conveyances owned by a state, city, town or other public entity that discharges to waters of the United States as is designed or used for collecting or conveying stormwater. An MS4 is not a combined sewer and is not a publicly-owned treatment works. Although the states were required to adopt the MS4 program by December 8, 2002, the rule was not effective in Indiana until August 6, 2003.

The City of New Albany submitted its original MS4 permit to the State in 2005. The renewal documents were submitted to the state in 2008. The City continues to implement and enforce the MS4 program, including the development, adoption and enforcement of three ordinances mandated pursuant to the MS4 program. The current ordinances can be found in **Appendix 2.6**. These ordinances include the identification and elimination of illicit discharges, construction runoff and post-construction runoff. In addition, the City implemented a stormwater management user fee ordinance.

Rule 13 requires that regulated communities have written documentation that new flood management projects are assessed for their impacts on water quality and that these projects are examined for incorporation of additional water quality protection measures (*327 IAC 15-13-17(4)*).

The City must require that water quality consideration should be addressed and documented. It is recommended that this occur during the design phase of construction projects in the City.

### 2.2.3 Section 401 Permitting

The Indiana Department of Environmental Management administers Section 401 of the Clean Water Act, which is a companion rule to Section 404 and requires the state to approve impacts to stream and wetlands. IDEM approval is required before the beginning of the project. Typical activities permitted pursuant to Section 401 are dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations or relocations and stormwater impoundments.

The approval issued by IDEM for Section 401 is called a Water Quality Certification (WQC). For several years, the Louisville District of the USACE and IDEM have had a joint agreement on the processing of most small stream and wetland impact projects under Regional General Permit #1 (RGP 1). RGP 1 is an expedited project review process that has been accepted by both agencies that gives IDEM the primary regulatory role for projects less than one acre of wetland and stream impact. As with the USACE, IDEM may require compensatory mitigation for stream and wetland impacts.

## 2.3 OTHER STATE PROGRAMS

Indiana Department of Natural Resources (IDNR) has the responsibility to regulate construction activities within, over, and/or under the State's waterways through the creation of a number of regulatory programs, including the Flood Control Act, Navigable Waterways Permit, Dewatering Well Installation, Water Well Abandonment, the Lakes Preservation Act and County Drains.

## 2.4 LOCAL POLICIES AND ORDINANCES

Currently, there are several sources for local stormwater guidance. City ordinances, the 1992 Master Plan, the City of New Albany Stormwater Board Policy, and User Fee Credits Policy all provide technical and programmatic guidance for the stormwater program. The City of New Albany Zoning Ordinance, Subdivision Regulations, and 1992 Master Plan impact stormwater management. These are discussed in further detail below.

### 2.4.1 Stormwater Board Policy

The Stormwater Board Policy provides procedures for the operation of the Stormwater Board and stormwater utility. This includes membership of the Stormwater Board, appeals process for Board decisions, the credits policy, contract letting, guidance for stormwater drainage performed by City crews, and guidelines for sizing drainage infrastructure. This document can be found in **Appendix 2.7**.

Some aspects that play a role in managing stormwater quality and quantity for the City are the stormwater that are in the Board include the policy for the type of work to be performed by City crews and the sizing goals for stormwater infrastructure.

The City of New Albany Stormwater Board Policy limits stormwater drainage work performed by City crews to the following areas:

*"The Board will not authorize maintenance or capital projects for areas outside of a defined drainage easement or public right-of-way unless flooding or drainage (standing water) are caused by a failure of public drainage system and only in such a case that the resulting system can be maintained through an easement or public right-of-way.(a) General maintenance of ditches, swales and other drainage system infrastructure that are not in drainage easements or public right-of-way shall be the responsibility of the property owner."* This policy is consistent with others in Indiana, including Fishers, Indiana. The Fishers Policy requires adjacent property owners to maintain swales and ditches up to six cubic feet per second. The Town of Fishers also enforces limitations on the construction of permanent structures in easements. It is important for the City to distinguish between public and private property drainage issues.

The Stormwater Board Policy defined the following as sizing goals for drainage infrastructure:

- *"Detention and Retention Ponds should detain or retain the first 0.5-inches, 2-, 10- and 25-year, 24-hour design storm event and an emergency bypass of the 100-year 24-hour design storm event.*
- *Curb, gutter and catch basin systems convey the 10-year, 24-hour design storm event.*
- *Bridges, culverts, channels and cross-drains convey the 25-year, 24-hour design storm event.*
- *Critical Service roads, such as those servicing hospitals, emergency shelters and emergency egress routes, are to be protected so as not to be inundated by more than three (3) inches of water over one-half the roadway width under the 100-year, 24-hour design storm event.*
- *Other new roads are to be protected so as not to be inundated by more than six (6) inches of water overtopping under the 25-year, 24-hour design storm event.*
- *Other existing road protection roads are to be protected so as not to be inundated by more than nine (9) inches of water overtopping under the 25-year, 24-hour design storm event."*

Design criteria are also identified in City ordinances and the 1992 Stormwater Master Plan and are discussed in more detail below.

### 2.4.2 Chapter 54: Drainage Review

Chapter 54 of the New Albany Code of Ordinances provides that all new development shall be constructed based on the provisions of the (1992) SWMP. New developments must share the cost of drainage across the City. This ordinance was adopted in 1998.

The Stormwater Master Plan is identified in this section as the basis for drainage review. The assumption has been made that the ordinance is referring to the 1992 Stormwater Master Plan developed by GRW Engineers, Inc. since there is no evidence of other master plans or updates at the time of the adoption of this ordinance. The section of the 1992 SWMP can be found in **Appendix 2.8**.

The 1992 Stormwater Master Plan provided the following technical criteria for the design of stormwater facilities:

**Drainage facilities:**

- The 10-year return interval storm will be used for the planning and design of drainage facilities in the City of New Albany.
- The 100-year rainfall event will be used as the "check storm".
- The 10-year return interval storm will generally be used for the design of facilities to manage post-development stormwater runoff for both the minor and major drainage systems. The City may require more stringent design criteria, when it is determined to be necessary in major drainage systems.

- 100-year flood elevations, as documented by current FEMA FIS elevations, or in areas where there is no FIS study analysis provided by the development engineer, will be used to demonstrate that the flood plain is not increased under post-development conditions.
- Culverts will be sized for the 10-year post-development storm runoff rate. The 100 year discharge will be used as a check for sizing.
- Culvert headwater depths will be determined as a function of the headwater to the height of the culvert ratio (HW/D). For culverts up to 36 inches in diameter or their equivalents, a HW/D of 1.0 to 1.2 should be used. For culverts 36 inches in diameter and larger or their equivalents, a HW/D of 1.0 will be used in their design.
- Elevations of the water surface resulting from the 100-year check discharge must be reviewed to insure that they do not cause flooding of existing or proposed buildings and they do not exceed the crown elevations of any thoroughfares having a usage classification of a collector street or higher.
- The minimum size for culverts under driveways will be 10 inches and the minimum elsewhere will be 15 inches.
- Materials for culverts under driveways or secondary roads may consist of corrugated metal or concrete. All other culverts will be constructed from concrete.
- Pipe slopes will be steep enough to maintain a minimum of three feet per second at the design flow.
- Outlet velocities should be determined for all culverts. If the erosive velocity of the downstream channel is exceeded, protective channel lining or some other means of energy dissipation must be employed.

**Storm sewers:**

- Manning's equation is recommended for determining the conduit sizes required in the storm sewer system. The assumption is that the flow capacity of a structure is the capacity occurring when the depth of the flow is 0.8 times the structure height. The hydraulic grade line will be at least one foot below the ground surface or building drain elevations.
- The 10-year post-development storm runoff rate shall be used for conduit sizing. The 100-year discharge will be used as the check. The rates will be calculated based on the methods discussed in the 1992 SWMP.
- Concrete will be the material used for storm sewers unless some other material is approved by the City.
- The minimum conduit dimension for storm sewers will be 15 inches.
- Conduit slopes will be steep enough to maintain a minimum velocity of three feet per second at the design flow.
- Access to the sewer system through either inlets or manholes will be spaced no greater than intervals of 400 feet. Access structures will be provided at all breaks in horizontal or vertical alignments.

**Inlets:**

- The 10-year post-development storm runoff rate will be used for inlet design. The 100-year discharge will be used as a check.
- The allowable drainage flow spread on city streets will be six feet, or eight feet if gutter exists for cul-de-sacs, local streets and collector streets. For minor and major arterials the spread shall be four feet, or six feet if a gutter exists.

**Channels:**

- The 10-year post-development storm runoff rate will be used for sizing the channel. The 100-year post-development discharge will be used to check the major system capacity. These flow rates should be calculated by the methods discussed in the 1992 SWMP. The 100-year discharge surface elevations will be reviewed to ensure that no structural flooding occurs. Design discharge velocities may not exceed six per second for grassed waterways.
- The minimum channel slope is one percent (1%) for the minor drainage system.
- A concrete low flow channel is required if the channel slope is less than two percent (2%). The low flow channel should be designed for the base flow or the two-year frequency storm, whichever is greater.
- Channel slopes of two percent (2%) or greater will be sodded.
- The maximum side slopes for grass-lined channels is 4:1, with 3:1 being preferable.

**Riprap Lined Channels:**

- The 10-year post-development storm runoff rate will be used for sizing the channel. The 100-year post-development discharge will be used to check the major system capacity. These flow rates should be calculated by the appropriate methods discussed in the SWMP. The 100-year discharge surface elevations will be reviewed to ensure that no structural flood damage occurs.
- Stone used for riprap should be graded with minimum specific gravity of 2.5.

Maximum Permissible Velocity for Various Stone Sizes:

| Velocity (ft/sec) | Stone Diameter (inches) |
|---|---|
| 4 | 2.5 |
| 6 | 5 |
| 8 | 9 |
| 10 | 14 |
| 12 | 20 |
| 14 | 28 |
| 16 | 37 |

- The thickness of the riprap layer will be 1.5 times the diameter of the maximum stone used with a minimum thickness of six inches.
- The minimum slope is one percent (1%) for the minor drainage system.
- Maximum side slopes for riprap lined channels will be 1.5:1.

**Concrete Lined Channel:**

- Procedures for the design of concrete lined channels should be similar to those found in "Open Channel Hydraulics" by V.T. Chow.
- The 10-year post-development storm runoff rate will be used for sizing the channel. The 100-year post-development discharge will be used to check the major system capacity. The flow rates should be calculated using the methods discussed in the 1992 SWMP. The 100 year surface discharges will be reviewed to ensure that structural flood damage does not occur.
- Channels with slopes of less than one percent (1%) will be paved with concrete.
- The maximum side slopes will typically be 2:1. Steeper side slopes will be considered when accompanied with the appropriate structural design information.

### 2.4.3 Construction Criteria Set Forth In The 1992 SWMP

The 1992 SWMP also has guidelines for best management practices for construction sites. However, since the adoption of the 1992 SWMP, the City has implemented the Stormwater Best Management Practices Manual, the Qualified Inspector Program developed through the Southern Indiana Stormwater Advisory Committee, and the stormwater ordinances found in Chapter 54, implemented pursuant to Rule 13. It is recommended that the City use the Stormwater Best Management Practices Manual and any subsequent updates to comply with State and Federal requirements.

### 2.4.4 Chapter 56: Stormwater Management

The City of New Albany adopted the Stormwater Management Ordinance in 2006. These ordinances include implementation of the three required MS4 ordinances construction, post-construction, and illicit discharge.

**Construction**

The purpose of the construction ordinance is to reduce the amount of pollution leaving construction sites. Best management practices are required on active construction sites one acre or larger to reduce pollutants from leaving the construction site. Inspections and self-inspections are required for active construction sites to ensure that BMPs are in place and working. Enforcement of this ordinance is required. Currently, the Soil and Water Conservation District inspects construction sites on behalf of the City.

## Post-Construction

As the EPA continues to develop regulations for post-construction policies, the City will need to continue to develop policies for the management and inspection of these BMPs. Currently, as part of the MS4 program, the City has in place an ordinance regarding post-construction BMPs. The EPA is in the early stages of promulgating rules for more defined stormwater regulations for post-construction.

The current post-construction stormwater ordinance for the City requires for new development and redevelopment sites that result in a disturbance of one acre for more of land, including land disturbing activities on individual lots that are less than one acre but are part of a larger common plan of development or sale must have a stormwater quality management permit. For projects that meet this requirement the following are required to be in the SWQMP:

- Must include provisions for stormwater quality BMPs functioning independently or in combination.
- Reduce total suspended solids from the first flush.
- Reduce or buffer stormwater increases in stormwater run-off temperature caused by contact with impervious surfaces.
- Reduce or buffer stormwater increases in stormwater runoff volume and flowrate caused by increases in directly connected impervious area and overall impervious area.
- Stormwater detention/retention facilities must be designed to address the rate at which the flow is released over the entire runoff discharge period and the volume of the discharge of the design storm period. The outlet structure must be designed as a v-notch weir or other multiple stage configurations capable of controlling the discharge rates for the first flush, two, ten, and twenty five year design storm events. The outlet structure will be designed to safely bypass the 100 year storm event.
- Soil bioengineering, green and other soft slope and stream bank stabilization methods will receive preferential treatment over rip rap, concrete and other hard armoring techniques. “Hard” alternatives will only be permitted when their necessity can be demonstrated given site specific conditions.

**Illicit Discharge**

Pursuant to the federal and state MS4 regulations, illicit discharges to the MS4 are defined as illegal. All non-stormwater discharges into the MS4 are prohibited and declared to be unlawful. It is illegal for any person to connect any pipe, open channel or any other conveyance system that discharges anything except stormwater or unpolluted water, which is approved by the City Stormwater Engineer. There are exceptions to the rule: discharges from emergency fire-fighting activities; diverted stream flows; rising ground waters; uncontaminated groundwater infiltration to separate storm sewer systems (as defined by 40 C.F.R. § 35.2005(20)); uncontaminated pumped ground water; discharges from potable water sources, as required for system maintenance; drinking water line flushing; air conditioning condensate; uncontaminated landscape irrigation; uncontaminated irrigation water; lawn watering; uncontaminated springs; uncontaminated water from crawl space pumps; uncontaminated water from footing drains and pumps; individual residential car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; controlled flushing stormwater conveyances (contained and treated by appropriate Best Management Practices (BMPs)); discharges made from residential construction sites fully and completely utilizing guidance provided by Standard of Practice for Residential Construction Stormwater Management; discharges within the constraints of an NPDES permit from IDEM; and discharges approved at the discretion of the City Stormwater Engineer. Furthermore, it is unlawful for any person to discharge waters from residential construction activities that are not complying with the standard of practice for residential construction stormwater management as approved and advertised by the City Stormwater Engineer.

### 2.4.5 Chapter 154: Land Usage: Special Environmental Districts

This section of the New Albany Code of Ordinances is the local ordinance that regulates development in the floodplain. This ordinance is mandated by FEMA and IDNR in order to participate in the NFIP. Pursuant to the New Albany Community Assistance Visit (CAV), the City is in compliance with FEMA and IDNR standards.

Section 154.06 of the subdivision ordinances, states the following regarding storm drainage: “The subdivision shall provide a storm sewer, if, in the opinion of the Commission, natural surface drainage is inadequate.”

### 2.4.6 Chapter 156: City of New Albany Zoning Code

The City of New Albany Zoning Code includes environmental goals and land use policies that impact stormwater. In § 156.035 (c), the Code identifies that “the lands in natural drainage courses, flood plains, marshes, and steep hillside unsuitable because of topographic or geological characteristics should remain undeveloped.” Section (d) further provides, “Lands not well suited to development because of natural characteristics should be permanently reserved as open space through action by public agencies; ownership in fee; zoning; or by establishing scenic easements or through land use regulation. In addition to retaining the lands to satisfy natural functions, open space can serve as a determinant of urban form can be utilized for casual recreation and the study of nature; and can make a valuable contribution to the quality of life.”

## 2.5 RECOMMENDATIONS FOR THE CITY OF NEW ALBANY

The following recommendations were made after a review of the federal, state, and local programs that impact the City's stormwater program.

The City should develop one comprehensive stormwater ordinance and technical manual (including high density polyethylene (HDPE) pipe for specific drainage projects) to consolidate ordinances, policies, and technical criteria. In combination with this comprehensive stormwater ordinance and technical manual, the City should streamline the review of City drainage plans associated with new development and redevelopment and review enforcement practices to efficiently manage enforcement of the stormwater program in conjunction with other city enforcement efforts. The City should define in a comprehensive set of ordinances the following:

1.) Who has the authority to review the plans;

2.) What person or entity approves the plans; and

3.) Who inspects and enforces the ordinances and design criteria.

Currently, the drainage review for sites larger than five acres is performed by a private engineering firm through the Planning Commission. Currently, the Stormwater Board is not required to review these plans. This is likely due to the evolution of the stormwater program and that the ordinances for the planning commission pre-date the stormwater board. The stormwater board should approve drainage plans and erosion and sediment control practices and consider recommendations from the approved reviewers. Approved reviewers may include the City Engineer, City Planner, a representative from the Floyd County Soil and Water Conservation District, or as currently is the practice, a firm authorized by the City to perform plan review. After Board approval of drainage plans, these plans would then go before the planning commission for final approval.

Due to programmatic complexities, the City should communicate with federal, state, and local agencies that impact the New Albany Stormwater program. These agencies include the United States Environmental Protection Agency, the United States Army Corps of Engineers, and the Federal Emergency Management Administration. State agencies include: the Indiana Department of Environmental Management and the Indiana Department of Natural Resources.

Local agencies include the City of New Albany Flood Control District, the City of New Albany Stormwater Board, the City of New Albany Board of Public Works and Safety, the City of New Albany Board of Zoning Appeals, the City of New Albany Plan Commission, the City of New Albany Street Department, the City of New Albany Sewer Board, the City of New Albany and Floyd County Parks Department, and the City of New Albany Redevelopment Commission. All of these local agencies impact stormwater and improved coordination can impact the efficiency and successes of the stormwater program. These local agencies play a role in both stormwater quality and quantity. As the program evolves, organizational charts and roles and responsibilities should be defined.

The City of New Albany should also communicate with neighboring communities and agencies therein regarding stormwater programs.

### Water Quality Recommendations

The EPA Water Quality Scorecard was developed to assist communities to use ordinances, policies and technical criteria as a means to improve water quality. The goals of the tool are to assist communities to protect water quality by reducing the amount of stormwater flows in a community and educate the public regarding the connection between local development and stormwater ordinances and water quality. For purposes of this report, the EPA Water Quality Scorecard was used to assess the City of New Albany ordinances and Board Policy. Recommendations generated from the Water Quality Scorecard are below. This document can be found in **Appendix 2.9**.

#### General

- The Subdivision Control Ordinance (Ch. 154) and the Zoning Code (Ch. 156) should require the Drainage Board to approve drainage plans of all new development or redevelopment prior to issuing permits. The requirements of drainage plans should be included in the Stormwater Management Ordinance (Ch. 56), and the Subdivision Control Ordinance and the Zoning Code should refer to the Stormwater Management Ordinance. The Stormwater Management Ordinance should reference a Technical Standards Document that will include the specifications of the drainage plans.

#### Natural Resource Areas

- Expand the zoning ordinance (§156.056 D) to identify and map critical natural resource areas such as wetlands, forests and wildlife habitat. The ordinance currently identifies and protects areas in the flood plain and areas with steep slopes.
- Assist landowners and developers in identifying critical natural resource areas, laying out developments to avoid these areas, and offer stormwater user fee credits for protection of these areas.

#### Trees

- Require site plans to include number and diameter (dbh) of trees proposed to be removed during site development. If the total diameter of trees removed exceeds a certain threshold, require an equivalent diameter of trees to be replaced onsite (e.g., remove one 24” tree, replace with six 4” trees).
- Provide developers with a list of tree species based on size and known performance for managing stormwater runoff. If tree replacement is needed, require/encourage site plans to include the proposed species of replacement trees from this list.
- Offer incentives, such as reduced setbacks or stormwater fee credits, for tree preservation.

**Development**

- Require or provide incentives to developers to restore degraded riparian/wetland areas on a development site, or require compensation for damaged areas on a minimum 2:1 basis on- or off-site.
- Adopt requirements or incentives to dedicate open space in new developments using the average open space requirements adopted by the National Recreation and Park Association as a baseline (e.g., 10 acres of community and neighborhood parks for every 1,000 persons in a development).
- Development standards addressing landscaping, buffering, parking, etc. should be reduced for redevelopments in urban areas to promote redevelopment over new greenfield development in fringe or outlying areas.
- Adopt large-lot/agricultural zoning (e.g., one unit/160 acres) in fringe areas to restrict inappropriate greenfield development.

**Streets**

- Require or encourage alternative street specifications in appropriate circumstances (reduced minimum widths, replace curb and gutter with swales, reduce sidewalk requirements).
- Encourage or provide incentives to developers or homeowners (reduction in street widths or parking requirements, cost sharing, stormwater user fee credits) who utilize pervious pavements.

**Parking/Driveways**

- Adopt maximum parking caps (e.g., 125% of minimum) for multi-family and commercial developments.
- Encourage or provide incentive shared or alternative parking arrangements that result in reduced impervious area.
- Provide incentives to businesses with different peak demand periods to share their required parking spaces.
- Reduce minimum widths for single-family driveways to nine feet.
- Reduce parking requirements and provide other incentives for developments that utilize shared driveways or rear-loaded garages on a minimum percentage of homes.

**Parking Lots/Landscaping**

- Require landscaping on a minimum percentage of parking lot interior area. Require a minimum area of the parking lot to drain into landscaped areas. Require individual landscaped areas to be a minimum size (e.g., island planting areas will be a minimum of 25 square feet).
- Encourage the preservation of large, mature trees within parking lot landscaped areas.
- Require reduced drive aisle widths in parking lots to reduce the overall impervious area.

**Stormwater Green Infrastructure/Stormwater General**

- Encourage the use of home-based green infrastructure practices (rain barrels, rain gardens, etc.).
- Develop a system to monitor and track stormwater management practices at new development and redevelopment sites. Tracking should begin during the plan review and approval process with a database or GIS, and will be used to monitor and enforce proper maintenance requirements, and effectively identify problem areas.

The above are recommendations to management a stormwater program. The needs vary from community to community and as the stormwater program evolves in the City of New Albany the City will need to assess and revisit these issues from time to time.

# Appendix 2.1

United States Environmental Protection Agency | Office of Water 4303T | EPA 821-F-09-004 November 2009

# EPA Fact Sheet

# Final Rule: Effluent Guidelines for Discharges from the Construction and Development Industry


## Summary

The U.S. Environmental Protection Agency (EPA) is promulgating effluent limitations guidelines (ELGs) and new source performance standards (NSPS) to control the discharge of pollutants from construction sites. This rule requires construction site owners and operators to implement a range of erosion and sediment control measures and pollution prevention practices to control pollutants in discharges from construction sites. In addition, the rule requires certain construction site owners and operators to sample stormwater discharges and comply with a numeric standard for the pollutant turbidity in these discharges starting in August of 2011.


## Background on Construction Activity

Construction activities like clearing, excavating, and grading significantly disturb the land. The disturbed soil, if not managed properly, can easily be washed off of the construction site during storms and enter water bodies. Stormwater discharges from construction activities can cause an array of physical, chemical and biological impacts.

Pollutants discharged from construction sites include sediment, turbidity and nutrients. All of these pollutants are important contributors to water quality impairment nationwide. Sediment, turbidity, and nutrients degrade aquatic ecosystem health, drinking water supplies, and surface water clarity. Sediment deposition reduces water depth in lakes, reservoirs, and navigational channels, increasing the need for dredging.

## Background on Effluent Guidelines

Effluent guidelines are national standards that apply to stormwater and wastewater discharges to surface waters and publicly owned treatment works (municipal sewage treatment plants). EPA issues effluent guidelines for categories of existing sources and new sources under Title III of the Clean Water Act to control pollution from these sources. The standards are based on the performance of treatment and control technologies.

## Final Rule Requirements

The final rule is intended to work in concert with existing state and local programs, adding a technology-based "floor" that establishes minimum requirements that apply nationally. Once implemented, these new requirements will significantly reduce the amount of sediment and other pollutants discharged from construction sites.

The rule requires all construction site owners and operators to implement a range of erosion and sediment control best management practices (BMPs) to reduce pollutants in stormwater discharges. Permittees are also required to implement a range of pollution

prevention measures to control discharges from activities such as dewatering and concrete washout. The rule contains stringent requirements for soil stabilization as well.

EPA is phasing in the numeric limitation over four years to allow permitting authorities adequate time to develop monitoring requirements and to allow the regulated community time to prepare for compliance with the numeric limitation. Construction sites that disturb 20 or more acres at one time will be required to conduct monitoring of discharges and comply with the numeric limitation beginning 18 months after the effective date of the final rule. Beginning four years after the effective date of the final rule, the monitoring requirements and numeric limitation will apply to all sites that disturb 10 or more acres at one time..

**Costs and Benefits of the Proposed Rule**

This regulation is projected to reduce the amount of sediment discharged from construction sites by about 4 billion pounds each year, at an annual cost of about $953 million, once fully implemented. Because of the phase-in period for the numeric limit, and the timing of state construction general permit renewals, it is expected that the cost of the rule will be $8 million in 2010, $63 million in 2011, and $204 million in 2012. The benefits from reducing discharges of sediment and turbidity include improved water clarity, protection of drinking water supplies, improvements in aquatic environments, and lessen the need for dredging of navigational channels and reservoirs.

**Implementation**

EPA currently issues permits for construction activities in four states, the District of Columbia and in certain U.S. territories and tribal areas. The EPA Construction General Permit (CGP), which is set to expire on June 30, 2011, will be updated to include the new requirements when reissued. The remaining states issue their own construction general permits, and the new requirements must be incorporated into any new general permits issued after the effective date of the regulation, which is 60 days after publication in the Federal Register. The requirements also apply to individual permits issued by states or EPA. Therefore, the implementation date of the new requirements will vary depending on when states reissue their permits and whether projects are covered by individual or general permits.

**Additional Information and Copies**

For further information, please contact:

Mr. Jesse W. Pritts
U.S. Environmental Protection Agency, Office of Water (4303T)
Engineering and Analysis Division
1200 Pennsylvania Ave. N.W.
Washington, D.C. 20460

or send an e-mail to:

Pritts.Jesse@epa.gov. You can view or download the complete text of the *Federal Register* notice on the Internet at http://www.epa.gov/waterscience/guide/construction.

# Appendix 2.2

# Query Results

**29 FLOOD** event(s) were reported in **Floyd County, Indiana** between **01/01/1950** and **08/31/2009**.

*Click on **Location or County** to display Details.*

**Mag**: Magnitude
**Dth**: Deaths
**Inj**: Injuries
**PrD**: Property Damage
**CrD**: Crop Damage

**Indiana**

| Location or County | Date | Time | Type | Mag | Dth | Inj | PrD | CrD |
|---|---|---|---|---|---|---|---|---|
| 1 Central And Southern | 11/14/1993 | 1630 | Flood | N/A | 0 | 0 | 5.0M | 500K |
| 2 FLOYD | 05/17/1995 | 2235 | Flash Flooding | N/A | 0 | 0 | 0 | 0 |
| 3 INZ079 - 084 - 090>092 | 01/22/1996 | 07:00 AM | Flood | N/A | 0 | 0 | 0 | 0 |
| 4 Georgetown | 05/11/1996 | 01:20 AM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 5 Countywide | 03/01/1997 | 05:30 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 6 INZ079 - 084 - 089>092 | 03/02/1997 | 11:00 PM | Flood | N/A | 0 | 0 | 60.0M | 0 |
| 7 Countywide | 01/22/1999 | 07:00 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 8 Countywide | 02/18/2000 | 12:00 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 9 Floyds Knobs | 01/24/2002 | 02:30 AM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 10 Countywide | 12/19/2002 | 05:00 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 11 INZ090>091 | 12/19/2002 | 09:40 PM | Flood | N/A | 0 | 0 | 0 | 0 |
| 12 New Albany | 07/17/2004 | 02:49 AM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 13 New Albany | 05/19/2005 | 08:23 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 14 Countywide | 03/11/2006 | 02:07 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 15 Countywide | 03/11/2006 | 02:45 PM | Flood | N/A | 0 | 0 | 0 | 0 |
| 16 Countywide | 07/14/2006 | 06:59 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 17 Countywide | 09/22/2006 | 09:01 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18 Countywide | 09/23/2006 | 01:15 AM | Flood | N/A | 0 | 0 | 0 | 0 |
| 19 Countywide | 09/23/2006 | 01:45 PM | Flash Flood | N/A | 0 | 0 | 0 | 0 |
| 20 Edwardsville | 12/15/2007 | 17:30 PM | Flood | N/A | 0 | 0 | 0K | 0K |
| 21 Edwardsville | 03/18/2008 | 19:50 PM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 22 New Albany | 04/04/2008 | 10:00 AM | Flood | N/A | 0 | 0 | 0K | 0K |
| 23 New Albany | 06/26/2009 | 02:58 AM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 24 Floyds Knobs | 06/26/2009 | 04:03 AM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 25 New Albany | 08/04/2009 | 07:50 AM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 26 New Albany | 08/04/2009 | 08:40 AM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 27 New Albany | 08/04/2009 | 09:12 AM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 28 Edwardsville | 08/04/2009 | 13:15 PM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| 29 Edwardsville | 08/10/2009 | 18:30 PM | Flash Flood | N/A | 0 | 0 | 0K | 0K |
| | | | | TOTALS: | 0 | 0 | 65.000M | 500K |

**Top of Page**

# Appendix 2.3

hundred fifty (250) persons or having gross annual sales or expenditures exceeding twenty-five million dollars ($25,000,000) (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(B) For a partnership or sole proprietorship, by a general partner or the proprietor, respectively.

(C) For a municipality, state, federal, or other public agency or political subdivision thereof, by either a principal executive officer or ranking elected official.

(2) A person is a duly authorized representative only if:

(A) the authorization is made in writing by a person described under subdivision (1);

(B) the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility (a duly authorized representative may thus be either a named individual or any individual occupying a named position); and

(C) the written authorization is submitted to the commissioner.

(3) Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.".

(h) Except for data determined to be confidential under 327 IAC 12 *[327 IAC 12 was repealed filed Mar 9, 2000, 7:47 a.m.: 23 IR 1637. See 327 IAC 12.1.]*, all reports prepared in accordance with the terms of the applicable general permit rule shall be available for public inspection at the offices of the Indiana department of environmental management and the U.S. Environmental Protection Agency Regional Administrator. As required by the Federal Act, information contained in the NOI letter and effluent data shall not be considered confidential.

(i) The Indiana Environmental Management Act at IC 13-7-13-3(b) provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under the applicable general permit rule, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than ten thousand dollars ($10,000) per violation, or by imprisonment for not more than six (6) months per violation, or by both. The Federal Act, as well as IC 13-7-13-3 and IC 35-50-3-3, provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this article shall, upon conviction, be punished by a fine of not more than ten thousand dollars ($10,000) per violation, or by imprisonment for not more than one hundred eighty (180) days per violation, or by both. *(Water Pollution Control Board; 327 IAC 15-4-3; filed Aug 31, 1992, 5:00 p.m.: 16 IR 21; errata filed Apr 10, 2006, 2:46 p.m.: 29 IR 2547)*

## Rule 5. Storm Water Run-Off Associated with Construction Activity

### 327 IAC 15-5-1 Purpose

Authority: IC 13-14-8; IC 13-14-9; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3
Affected: IC 13-11-2; IC 13-18-4

Sec. 1. The purpose of this rule is to establish requirements for storm water discharges from construction activities of one (1) acre or more so that the public health, existing water uses, and aquatic biota are protected. *(Water Pollution Control Board; 327 IAC 15-5-1; filed Aug 31, 1992, 5:00 p.m.: 16 IR 23; errata, 16 IR 898; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 833; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

### 327 IAC 15-5-2 Applicability of general permit rules

Authority: IC 13-14-8; IC 13-14-9; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3
Affected: IC 13-11-2; IC 13-18-4; IC 14-34

Sec. 2. (a) The requirements under this rule apply to all persons who:

(1) do not obtain an individual NPDES permit under 327 IAC 15-2-6;

(2) meet the general permit rule applicability requirements under 327 IAC 15-2-3; and

(3) are involved in construction activity, except operations that result in the land disturbance of less than one (1) acre of total land area as determined under subsection (h) and are not part of a larger common plan of development or sale.

(b) The requirements under this rule do not apply to persons who are involved in:

(1) agricultural land disturbing activities; or

(2) forest harvesting activities.

(c) The requirements under this rule do not apply to the following activities, provided other applicable permits contain provisions requiring immediate implementation of soil erosion control measures:

(1) Landfills that have been issued a certification of closure under 329 IAC 10.

(2) Coal mining activities permitted under IC 14-34.

(3) Municipal solid waste landfills that are accepting waste pursuant to a permit issued by the department under 329 IAC 10 that contains equivalent storm water requirements, including the expansion of landfill boundaries and construction of new cells either within or outside the original solid waste permit boundary.

(d) The project site owner has the following responsibilities:

(1) Complete a sufficient notice of intent letter.

(2) Ensure that a sufficient construction plan is completed and submitted in accordance with section 6 of this rule.

(3) Ensure compliance with this rule during:

(A) the construction activity; and

(B) implementation of the construction plan.

(4) Notify the department with a sufficient notice of termination letter.

(5) Ensure that all persons engaging in construction activities on a permitted project site comply with the applicable requirements of this rule and the approved construction plan.

(e) For off-site construction activities that provide services (for example, road extensions, sewer, water, and other utilities) to a permitted project site, these off-site activity areas must be considered a part of the permitted project site when the activity is under the control of the project site owner.

(f) For an individual lot where land disturbance is expected to be one (1) acre or more and the lot lies within a project site permitted under this rule, the individual lot owner shall:

(1) complete his or her own notice of intent letter; and

(2) ensure that a sufficient construction plan is completed and submitted in accordance with section 6 of this rule.

(g) For an individual lot where the land disturbance is less than one (1) acre and the lot lies within a project site permitted under this rule, the individual lot operator shall be in accordance with the following:

(1) Comply with:

(A) the provisions and requirements of the plan developed by the project site owner; and

(B) section 7.5 of this rule.

(2) Does not need to submit a notice of intent letter and construction plans.

(h) Multilot project sites are regulated by this rule in accordance with the following:

(1) A determination of the area of land disturbance shall be calculated by adding the total area of land disturbance for improvements, such as roads, utilities, or common areas, and the expected total disturbance on each individual lot, as determined by the following:

(A) For a single-family residential project site where the lots are one-half (0.5) acre or more, one-half (0.5) acre of land disturbance must be used as the expected lot disturbance.

(B) For a single-family residential project site where the lots are less than one-half (0.5) acre in size, the total lot must be calculated as being disturbed.

(C) To calculate lot disturbance on all other types of project sites, such as industrial and commercial project sites, the following apply:

(i) Where lots are one (1) acre or greater in size, a minimum of one (1) acre of land disturbance must be calculated as the expected lot disturbance.

(ii) Where the lots are less than one (1) acre in size, the total lot must be calculated as being disturbed.

(2) For purposes of this rule, strip developments:

(A) are considered as one (1) project site; and

(B) must comply with this rule;

unless the total combined disturbance on all individual lots is less than one (1) acre and is not part of a larger common plan of development or sale.

(i) Submittal of a notice of intent and construction plans is not required for construction activities associated with a single-family residential dwelling disturbing less than five (5) acres when the dwelling is not part of a larger common plan of development or sale. Provisions in section 7(b)(1) through 7(b)(5), 7(b)(10) through 7(b)(17), 7(b)(19), and 7(b)(20) of this rule shall be complied with throughout construction activities and until the areas are permanently stabilized.

(j) The department may waive the permit requirements under this rule for construction activities that disturb less than five (5) acres where the waiver applicant determined by the commissioner certifies that:

(1) a total maximum daily load (TMDL) for the pollutants of concern from storm water discharges associated with construction activity indicates that controls on construction site discharges are not needed to protect water quality; or

(2) in receiving waters that do not require a TMDL study, an equivalent analysis demonstrates water quality is not threatened by storm water discharges, and it has been determined that allocations for the pollutants of concern from the construction site discharges are not needed to protect water quality based on consideration of existing in-stream concentrations, expected growth in pollutant contributions from all sources, and a margin of safety.

*(Water Pollution Control Board; 327 IAC 15-5-2; filed Aug 31, 1992, 5:00 p.m.: 16 IR 23; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 833; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-3 General permit rule boundary**

Authority: IC 13-14-8; IC 13-14-9; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3
Affected: IC 13-11-2; IC 13-18-4

Sec. 3. This general permit covers all lands within Indiana. *(Water Pollution Control Board; 327 IAC 15-5-3; filed Aug 31, 1992, 5:00 p.m.: 16 IR 23; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 834; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-4 Definitions**

Authority: IC 13-14-8; IC 13-14-9; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3
Affected: IC 13-11-2; IC 14-32; IC 14-34

Sec. 4. In addition to the definitions contained in IC 13-11-2, 327 IAC 1, 327 IAC 5, and 327 IAC 15-1-2, the following definitions apply throughout this rule:

(1) "Agricultural conservation practices" means practices that are constructed on agricultural land for the purposes of controlling soil erosion and sedimentation. These practices include grass waterways, sediment basins, terraces, and grade stabilization structures.

(2) "Agricultural land disturbing activity" means tillage, planting, cultivation, or harvesting operations for the production of agricultural or nursery vegetative crops. The term also includes pasture renovation and establishment, the construction of agricultural conservation practices, and the installation and maintenance of agricultural drainage tile. For purposes of this rule, the term does not include land disturbing activities for the construction of agricultural related facilities, such as:

(A) barns;
(B) buildings to house livestock;
(C) roads associated with infrastructure;
(D) agricultural waste lagoons and facilities;
(E) lakes and ponds;
(F) wetlands; and
(G) other infrastructure.

(3) "Commissioner" refers to the commissioner of the department.

(4) "Construction activity" means land disturbing activities and land disturbing activities associated with the construction of infrastructure and structures. This term does not include routine ditch or road maintenance or minor landscaping projects.

(5) "Construction plan" means a representation of a project site and all activities associated with the project. The plan includes the location of the project site, buildings and other infrastructure, grading activities, schedules for implementation, and other

pertinent information related to the project site. A storm water pollution prevention plan is a part of the construction plan.
(6) "Construction site access" means a stabilized stone surface at all points of ingress or egress to a project site for the purpose of capturing and detaining sediment carried by tires of vehicles or other equipment entering or exiting the project site.
(7) "Contractor" or "subcontractor" means an individual or company hired by the project site or individual lot owner, their agent, or the individual lot operator to perform services on the project site.
(8) "Department" refers to the department of environmental management.
(9) "Developer" means:

(A) any person financially responsible for construction activity; or

(B) an owner of property who sells or leases, or offers for sale or lease, any lots in a subdivision.

(10) "DNR-DSC" means the division of soil conservation of the department of natural resources.
(11) "Erosion" means the detachment and movement of soil, sediment, or rock fragments by water, wind, ice, or gravity.
(12) "Erosion and sediment control measure" means a practice, or a combination of practices, to control erosion and resulting sedimentation.
(13) "Erosion and sediment control system" means the use of appropriate erosion and sediment control measures to minimize sedimentation by first reducing or eliminating erosion at the source and then, as necessary, trapping sediment to prevent it from being discharged from or within a project site.
(14) "Final stabilization" means the establishment of permanent vegetative cover or the application of a permanent nonerosive material to areas where all land disturbing activities have been completed and no additional land disturbing activities are planned under the current permit.
(15) "Grading"means the cutting and filling of the land surface to a desired slope or elevation.
(16) "Impervious surface" means surfaces, such as pavement and rooftops, that prevent the infiltration of storm water into the soil.
(17) "Individual building lot" means a single parcel of land within a multiparcel development.
(18) "Individual lot operator" means a contractor or subcontractor working on an individual lot.
(19) "Individual lot owner" means a person who has financial control of construction activities for an individual lot.
(20) "Land disturbing activity" means any manmade change of the land surface, including removing vegetative cover that exposes the underlying soil, excavating, filling, transporting, and grading.
(21) "Larger common plan of development or sale" means a plan, undertaken by a single project site owner or a group of project site owners acting in concert, to offer lots for sale or lease; where such land is contiguous, or is known, designated, purchased or advertised as a common unit or by a common name, such land shall be presumed as being offered for sale or lease as part of a larger common plan. The term also includes phased or other construction activity by a single entity for its own use.
(22) "Measurable storm event" means a precipitation event that results in a total measured precipitation accumulation equal to, or greater than, one-half (0.5) inch of rainfall.
(23) "MS4 area" means a land area comprising one (1) or more places that receives coverage under one (1) NPDES storm water permit regulated by 327 IAC 15-13 or 327 IAC 5-4-6(a)(4) and 327 IAC 5-4-6(a)(5).
(24) "MS4 operator" means the person responsible for development, implementation, or enforcement of the minimum control measures for a designated MS4 area regulated under 327 IAC 15-13.
(25) "Municipal separate storm sewer system" or "MS4" has the same meaning set forth at 327 IAC 15-13-5(42).
(26) "Peak discharge" means the maximum rate of flow during a storm, usually in reference to a specific design storm event.
(27) "Permanent stabilization" means the establishment, at a uniform density of seventy percent (70%) across the disturbed area, of vegetative cover or permanent nonerosive material that will ensure the resistance of the soil to erosion, sliding, or other movement.
(28) "Phasing of construction" means sequential development of smaller portions of a large project site, stabilizing each portion before beginning land disturbance on subsequent portions, to minimize exposure of disturbed land to erosion.
(29) "Project site" means the entire area on which construction activity is to be performed.
(30) "Project site owner" means the person required to submit the NOI letter under this article and required to comply with the terms of this rule, including either of the following:

(A) A developer.

(B) A person who has financial and operational control of construction activities and project plans and specifications, including the ability to make modifications to those plans and specifications.

(31) "Sediment" means solid material (both mineral and organic) that is in suspension, is being transported, or has been moved

from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.
(32) "Sedimentation" means the settling and accumulation of unconsolidated sediment carried by storm water run-off.
(33) "Soil" means the unconsolidated mineral and organic material on the surface of the earth that serves as the natural medium for the growth of plants.
(34) "Soil and Water Conservation District" or "SWCD" means a political subdivision established under IC 14-32.
(35) "Storm water pollution prevention plan" means a plan developed to minimize the impact of storm water pollutants resulting from construction activities.
(36) "Storm water quality measure" means a practice, or a combination of practices, to control or minimize pollutants associated with storm water run-off.
(37) "Strip development" means a multilot project where building lots front on an existing road.
(38) "Subdivision" means any land that is divided or proposed to be divided into lots, whether contiguous or subject to zoning requirements, for the purpose of sale or lease as part of a larger common plan of development or sale.
(39) "Temporary stabilization" means the covering of soil to ensure its resistance to erosion, sliding, or other movement. The term includes vegetative cover, anchored mulch, or other nonerosive material applied at a uniform density of seventy percent (70%) across the disturbed area.
(40) "Tracking" means the deposition of soil that is transported from one (1) location to another by tires, tracks of vehicles, or other equipment.
(41) "Trained individual" means an individual who is trained and experienced in the principles of storm water quality, including erosion and sediment control as may be demonstrated by state registration, professional certification, experience, or completion of coursework that enable the individual to make judgments regarding storm water control or treatment and monitoring.

*(Water Pollution Control Board; 327 IAC 15-5-4; filed Aug 31, 1992, 5:00 p.m.: 16 IR 23; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 834; errata filed Feb 4, 2004, 1:45 p.m.: 27 IR 2284; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-5 Notice of intent letter requirements**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 5. (a) The following information must be submitted by the project site owner with a complete NOI letter under this rule:
(1) Name, mailing address, and location of the project site for which the notification is submitted.
(2) The project site owner's name, address, telephone number, e-mail address (if available), ownership status as federal, state, public, private, or other entity.
(3) Contact person (if different than project site owner), person's name, company name, address, e-mail address (if available), and telephone number.
(4) A brief description of the construction project, including a statement of the total acreage of the project site. Total acreage claimed in the NOI letter shall be consistent with the acreage covered in the construction plan.
(5) Estimated dates for initiation and completion of construction activities. Within forty-eight (48) hours of the initiation of construction activity, the project site owner must notify the commissioner and the appropriate plan reviewing agency of the actual project start date.
(6) The latitude and longitude of the approximate center of the project site to the nearest fifteen (15) seconds, and the nearest quarter section, township, range, and civil township in which the project site is located.
(7) Total impervious surface area, in square feet, of the final project site including structures, roads, parking lots, and other similar improvements.
(8) The number of acres to be involved in the construction activities.
(9) Proof of publication in a newspaper of general circulation in the affected area that notified the public that a construction activity is to commence, that states, "(Company name, address) is submitting an NOI letter to notify the Indiana Department of Environmental Management of our intent to comply with the requirements under 327 IAC 15-5 to discharge storm water from construction activities for the following project: (name of the construction project, address of the location of the construction project). Run-off from the project site will discharge to (stream(s) receiving the discharge(s)).".
(10) As applicable, a list of all MS4 areas designated under 327 IAC 15-13 within which the project site lies.

(11) A written certification by the operator that:

(A) the storm water quality measures included in the construction plan comply with the requirements under sections 6.5, 7, and 7.5 of this rule and that the storm water pollution prevention plan complies with all applicable federal, state, and local storm water requirements;

(B) the measures required by section 7 of this rule will be implemented in accordance with the storm water pollution prevention plan;

(C) if the projected land disturbance is one (1) acre or more, the applicable soil and water conservation district or other entity designated by the department has been sent a copy of the construction plan for review;

(D) storm water quality measures beyond those specified in the storm water pollution prevention plan will be implemented during the life of the permit if necessary to comply with section 7 of this rule; and

(E) implementation of storm water quality measures will be inspected by trained individuals.

(12) The name of receiving water or, if the discharge is to a municipal separate storm sewer, the name of the municipal operator of the storm sewer and the ultimate receiving water.

(13) The NOI letter must be signed by a person meeting the signatory requirements in 327 IAC 15-4-3(g).

(14) A notification from the SWCD, DNR-DSC, or other entity designated by the department as the reviewing agency indicating that the constructions plans are sufficient to comply with this rule. This requirement may be waived if the project site owner has not received notification from the reviewing agency within the time frame specified in 327 IAC 15-5-6(b)(3).

(b) Send NOI letters to:

Indiana Department of Environmental Management
Office of Water Quality, Urban Wet Weather Section
100 North Senate Avenue, Room N1255
Indianapolis, Indiana 46204
Attention: Rule 5 Storm Water Coordinator.

*(Water Pollution Control Board; 327 IAC 15-5-5; filed Aug 31, 1992, 5:00 p.m.: 16 IR 24; errata filed Sep 10, 1992, 12:00 p.m.: 16 IR 65; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 836; errata filed Feb 6, 2006, 11:15 a.m.: 29 IR 1938; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-6 Submittal of an NOI letter and construction plans**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 6. (a) After the project site owner has received notification from the reviewing agency that the construction plans meet the requirements of the rule or the review period outlined in subsection (b)(3) has expired, all NOI letter information required under section 5 of this rule shall be submitted to the commissioner at least forty-eight (48) hours prior to the initiation of land disturbing activities at the site. A copy of the completed NOI letter must also be submitted to all SWCDs, or other entity designated by the department, where the land disturbing activities are to occur. If the NOI letter is determined to be deficient, the project site owner must address the deficient items and submit an amended NOI letter to the commissioner at the address specified in section 5 of this rule.

(b) For a project site where the proposed land disturbance is one (1) acre or more as determined under section 2 of this rule, the following requirements must be met:

(1) A construction plan must be submitted according to the following:

(A) Prior to the initiation of any land disturbing activities.

(B) Sent to the appropriate SWCD or other entity designated by the department for:

(i) review and verification that the plan meets the requirements of the rule; or

(ii) a single coordinated review in accordance with subsection (d)(3) if:

(AA) the construction activity will occur in more than one (1) SWCD; and

(BB) the project site owner has made a request for a single coordinated review.

(2) If the construction plan required by subdivision (1) is determined to be deficient, the SWCD, DNR-DSC, or other entity designated by the department as the reviewing agency may require modifications, terms, and conditions as necessary to meet the requirements of the rule. The initiation of construction activity following notification by the reviewing agency that the plan does not meet the requirements of the rule is a violation and subject to enforcement action. If notification of a deficient plan

is received after the review period outlined in subdivision (3) and following commencement of construction activities, the plans must be modified to meet the requirements of the rule and resubmitted within fourteen (14) days of receipt of the notification of deficient plans.

(3) If the project site owner does not receive notification within twenty-eight (28) days after the plan is received by the reviewing agency stating that the reviewing agency finds the plan is deficient, the project site owner may submit the NOI letter information.

(c) The following apply for a project where construction activity occurs inside a single MS4 area regulated under 327 IAC 15-13:

(1) A copy of the completed NOI letter must be submitted to the appropriate MS4 operators.

(2) The project site owner must comply with all appropriate ordinances and regulations within the MS4 area related to storm water discharges. The MS4 operator ordinance as required by 327 IAC 15-13-15(b) and 327 IAC 15-13-16(b) will be considered to have the same authority as this rule within the regulated MS4 area.

(d) For a project that will occur in more than one (1) jurisdiction, such as an SWCD or regulated MS4 area, the following must be met:

(1) Project site owners of project sites occurring in multiple MS4 areas, but not in nondesignated areas, shall submit the information required in subsection (c) to each appropriate MS4 operator.

(2) Project site owners of project sites occurring in one (1) or more MS4 areas and nondesignated areas shall submit the information required in subsections (a) through (c) to all appropriate MS4 operators, and the SWCD or other entity designated by the department.

(3) Project site owners of project sites occurring in multiple nondesignated areas, but not occurring within an MS4 area, may request a single coordinated review through the DNR-DSC office at the following address:

402 West Washington Street
Room W265
Indianapolis, Indiana 46204.

Upon acceptance of the request, the DNR-DSC will coordinate the plan review with appropriate SWCDs and other entities designated by the department. *(Water Pollution Control Board; 327 IAC 15-5-6; filed Aug 31, 1992, 5:00 p.m.: 16 IR 24; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 837; errata filed Feb 4, 2004, 1:45 p.m.: 27 IR 2284; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-6.5 Requirements for construction plans**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 6.5. (a) For project sites that do not meet the criteria in subsection (b), the project site owner shall develop a set of construction plans. Storm water quality measures included in the plan must achieve the minimum project site requirements specified in section 7 of this rule. The construction plans must include the following:

(1) Project narrative and supporting documents, including the following information:

(A) An index indicating the location, in the construction plans, of all information required by this subsection.

(B) Description of the nature and purpose of the project.

(C) Legal description of the project site. The description should be to the nearest quarter section, township, and range, and include the civil township.

(D) Soil properties, characteristics, limitations, and hazards associated with the project site and the measures that will be integrated into the project to overcome or minimize adverse soil conditions.

(E) General construction sequence of how the project site will be built, including phases of construction.

(F) Hydrologic Unit Code (14 Digit) available from the United States Geological Survey (USGS).

(G) A reduced plat or project site map showing the lot numbers, lot boundaries, and road layout and names. The reduced map must be legible and submitted on a sheet or sheets no larger than eleven (11) inches by seventeen (17) inches for all phases or sections of the project site.

(H) Identification of any other state or federal water quality permits that are required for construction activities associated with the owner's project site.

(2) Vicinity map depicting the project site location in relationship to recognizable local landmarks, towns, and major roads,

such as a USGS topographic quadrangle map or county or municipal road map.

(3) An existing project site layout that must include the following information:

(A) Location and name of all wetlands, lakes, and water courses on or adjacent to the project site.

(B) Location of all existing structures on the project site.

(C) One hundred (100) year floodplains, floodway fringes, and floodways. Please note if none exists.

(D) Soil map of the predominant soil types, as determined by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey, or an equivalent publication, or as determined by a soil scientist. A soil legend must be included with the soil map.

(E) Identification and delineation of vegetative cover, such as grass, weeds, brush, and trees, on the project site.

(F) Land use of all adjacent properties.

(G) Existing topography at a contour interval appropriate to indicate drainage patterns.

(4) Final project site layout, including the following information:

(A) Location of all proposed site improvements, including roads, utilities, lot delineation and identification, proposed structures, and common areas.

(B) One hundred (100) year floodplains, floodway fringes, and floodways. Please note if none exists.

(C) Proposed final topography at a contour interval appropriate to indicate drainage patterns.

(5) A grading plan, including the following information:

(A) Delineation of all proposed land disturbing activities, including off-site activities that will provide services to the project site.

(B) Location of all soil stockpiles and borrow areas.

(C) Information regarding any off-site borrow, stockpile, or disposal areas that are associated with a project site and under the control of the project site owner.

(D) Existing and proposed topographic information.

(6) A drainage plan, including the following information:

(A) An estimate of the peak discharge, based on the ten (10) year storm event, of the project site for both preconstruction and postconstruction conditions.

(B) Location, size, and dimensions of all storm water drainage systems, such as culverts, storm sewers, and conveyance channels.

(C) Locations where storm water may be directly discharged into ground water, such as abandoned wells or sinkholes. Please note if none exists.

(D) Locations of specific points where storm water discharge will leave the project site.

(E) Name of all receiving waters. If the discharge is to a separate municipal storm sewer, identify the name of the municipal operator and the ultimate receiving water.

(F) Location, size, and dimensions of features, such as permanent retention or detention facilities, including existing or manmade wetlands, used for the purpose of storm water management.

(7) A storm water pollution prevention plan associated with construction activities. The plan must be designed to, at least, meet the requirements of sections 7 and 7.5 of this rule and must include the following:

(A) Location, dimensions, detailed specifications, and construction details of all temporary and permanent storm water quality measures.

(B) Temporary stabilization plans and sequence of implementation.

(C) Permanent stabilization plans and sequence of implementation.

(D) Temporary and permanent stabilization plans shall include the following:

(i) Specifications and application rates for soil amendments and seed mixtures.

(ii) The type and application rate for anchored mulch.

(E) Construction sequence describing the relationship between implementation of storm water quality measures and stages of construction activities.

(F) Self-monitoring program including plan and procedures.

(G) A description of potential pollutant sources associated with the construction activities, that may reasonably be expected to add a significant amount of pollutants to storm water discharges.

(H) Material handling and storage associated with construction activity shall meet the spill prevention and spill response requirements in 327 IAC 2-6.1.

(8) The postconstruction storm water pollution prevention plan. The plan must include the following information:

(A) A description of potential pollutant sources from the proposed land use, that may reasonably be expected to add a significant amount of pollutants to storm water discharges.

(B) Location, dimensions, detailed specifications, and construction details of all postconstruction storm water quality measures.

(C) A description of measures that will be installed to control pollutants in storm water discharges that will occur after construction activities have been completed. Such practices include infiltration of run-off, flow reduction by use of open vegetated swales and natural depressions, buffer strip and riparian zone preservation, filter strip creation, minimization of land disturbance and surface imperviousness, maximization of open space, and storm water retention and detention ponds.

(D) A sequence describing when each postconstruction storm water quality measure will be installed.

(E) Storm water quality measures that will remove or minimize pollutants from storm water run-off.

(F) Storm water quality measures that will be implemented to prevent or minimize adverse impacts to stream and riparian habitat.

(G) A narrative description of the maintenance guidelines for all postconstruction storm water quality measures to facilitate their proper long term function. This narrative description shall be made available to future parties who will assume responsibility for the operation and maintenance of the postconstruction storm water quality measures.

(b) For a single-family residential development consisting of four (4) or fewer lots or a single-family residential strip development where the developer offers for sale or lease without land improvements, and the project is not part of a larger common plan of development or sale, the project site owner shall develop a set of construction plans containing storm water quality measures that achieve the minimum project site requirements specified in section 7 of this rule. The construction plan must include the following:

(1) Project narrative and supporting documents, including the following information:

(A) An index indicating the location, in the construction plans, of all required items in this subsection.

(B) Description of the nature and purpose of the project.

(C) Legal description of the project site. The description should be to the nearest quarter section, township, and range, and include the civil township.

(D) Soil properties, characteristics, limitations, and hazards associated with the project site and the measures that will be integrated into the project to overcome or minimize adverse soil conditions.

(E) Hydrologic Unit Code (14 Digit) available from the United States Geological Survey (USGS).

(F) Identification of any other state or federal permits that are required for construction activities associated with the project site owner's project site.

(2) Vicinity map depicting the project site location in relationship to recognizable local landmarks, towns, and major roads, such as a USGS topographic quadrangle map or county or municipal road map.

(3) A project site layout that must include the following information:

(A) Location and name of all wetlands, lakes, and water courses on or adjacent to the project site.

(B) Location of all existing structures on the project site (if applicable).

(C) One hundred (100) year floodplains, floodway fringes, and floodways. Please note if none exists.

(D) Soil map of the predominant soil types, as determined by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey, or an equivalent publication, or as determined by a soil scientist. A soil legend must be included with the soil map.

(E) Identification and delineation of vegetative cover, such as grass, weeds, brush, and trees, on the project site.

(F) Land use of all adjacent properties.

(G) Existing and proposed topography at a contour interval appropriate to indicate drainage patterns.

(H) Location of all proposed site improvements, including roads, utilities, lot delineation and identification, and proposed structures.

(4) A storm water pollution prevention plan associated with construction activities. The plan must be designed to, at least, meet the requirements of sections 7 and 7.5 of this rule and must include the following:

(A) Delineation of all proposed land disturbing activities, including off-site activities that will provide services to the project site.

(B) Location of all soil stockpiles and borrow areas.

(C) Location, size, and dimensions of all storm water drainage systems, such as culverts, storm sewers, and conveyance channels.

(D) Locations where storm water may be directly discharged into ground water, such as abandoned wells or sinkholes. Please note if none exist.

(E) Locations of specific points where storm water discharge will leave the project site.

(F) Name of all receiving waters. If the discharge is to a separate municipal storm sewer, identify the name of the municipal operator and the ultimate receiving water.

(G) Location, dimensions, detailed specifications, and construction details of all temporary and permanent storm water quality measures.

(H) Temporary stabilization plans and sequence of implementation of storm water quality measures.

(I) Temporary and permanent stabilization plans shall include the following:

(i) Specifications and application rates for soil amendments and seed mixtures.

(ii) The type and application rate for anchored mulch.

(J) Self-monitoring program plan and procedures.

(c) The SWCD or the DNR-DSC representative or other designated entity may upon finding reasonable cause require modification to the construction plan if it is determined that changes are necessary due to site conditions or project design changes. Revised plans, if requested, must be submitted to the appropriate entity within twenty-one (21) calendar days of a request for a modification. *(Water Pollution Control Board; 327 IAC 15-5-6.5; filed Oct 27, 2003, 10:15 a.m.: 27 IR 838; errata filed Feb 4, 2004, 1:45 p.m.: 27 IR 2284; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-7 General requirements for storm water quality control**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 7. (a) All storm water quality measures and erosion and sediment controls necessary to comply with this rule must be implemented in accordance with the construction plan and sufficient to satisfy subsection (b).

(b) A project site owner shall, at least, meet the following requirements:

(1) Sediment-laden water which otherwise would flow from the project site shall be treated by erosion and sediment control measures appropriate to minimize sedimentation.

(2) Appropriate measures shall be implemented to minimize or eliminate wastes or unused building materials, including garbage, debris, cleaning wastes, wastewater, concrete truck washout, and other substances from being carried from a project site by run-off or wind. Identification of areas where concrete truck washout is permissible must be clearly posted at appropriate areas of the site. Wastes and unused building materials shall be managed and disposed of in accordance with all applicable statutes and regulations.

(3) A stable construction site access shall be provided at all points of construction traffic ingress and egress to the project site.

(4) Public or private roadways shall be kept cleared of accumulated sediment that is a result of run-off or tracking. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment shall be redistributed or disposed of in a manner that is in accordance with all applicable statutes and regulations.

(5) Storm water run-off leaving a project site must be discharged in a manner that is consistent with applicable state or federal law.

(6) The project site owner shall post a notice near the main entrance of the project site. For linear project sites, such as a pipeline or highway, the notice must be placed in a publicly accessible location near the project field office. The notice must be maintained in a legible condition and contain the following information:

(A) Copy of the completed NOI letter and the NPDES permit number, where applicable.

(B) Name, company name, telephone number, e-mail address (if available), and address of the project site owner or a local contact person.

(C) Location of the construction plan if the project site does not have an on-site location to store the plan.

(7) This permit and posting of the notice under subdivision (6) does not provide the public with any right to trespass on a project site for any reason, nor does it require that the project site owner allow members of the public access to the project site.

(8) The storm water pollution prevention plan shall serve as a guideline for storm water quality, but should not be interpreted to be the only basis for implementation of storm water quality measures for a project site. The project site owner is responsible

for implementing, in accordance with this rule, all measures necessary to adequately prevent polluted storm water run-off.
(9) The project site owner shall inform all general contractors, construction management firms, grading or excavating contractors, utility contractors, and the contractors that have primary oversight on individual building lots of the terms and conditions of this rule and the conditions and standards of the storm water pollution prevention plan and the schedule for proposed implementation.
(10) Phasing of construction activities shall be used, where possible, to minimize disturbance of large areas.
(11) Appropriate measures shall be planned and installed as part of an erosion and sediment control system.
(12) All storm water quality measures must be designed and installed under the guidance of a trained individual.
(13) Collected run-off leaving a project site must be either discharged directly into a well-defined, stable receiving channel or diffused and released to adjacent property without causing an erosion or pollutant problem to the adjacent property owner.
(14) Drainage channels and swales must be designed and adequately protected so that their final gradients and resultant velocities will not cause erosion in the receiving channel or at the outlet.
(15) Natural features, including wetlands and sinkholes, shall be protected from pollutants associated with storm water run-off.
(16) Unvegetated areas that are scheduled or likely to be left inactive for fifteen (15) days or more must be temporarily or permanently stabilized with measures appropriate for the season to minimize erosion potential. Alternative measures to site stabilization are acceptable if the project site owner or their representative can demonstrate they have implemented erosion and sediment control measures adequate to prevent sediment discharge. Vegetated areas with a density of less than seventy percent (70%) shall be restabilized using appropriate methods to minimize the erosion potential.
(17) During the period of construction activities, all storm water quality measures necessary to meet the requirements of this rule shall be maintained in working order.
(18) A self-monitoring program that includes the following must be implemented:
(A) A trained individual shall perform a written evaluation of the project site:
(i) by the end of the next business day following each measurable storm event; and
(ii) at a minimum of one (1) time per week.
(B) The evaluation must:
(i) address the maintenance of existing storm water quality measures to ensure they are functioning properly; and
(ii) identify additional measures necessary to remain in compliance with all applicable statutes and rules.
(C) Written evaluation reports must include:
(i) the name of the individual performing the evaluation;
(ii) the date of the evaluation;
(iii) problems identified at the project site; and
(iv) details of corrective actions recommended and completed.
(D) All evaluation reports for the project site must be made available to the inspecting authority within forty-eight (48) hours of a request.
(19) Proper storage and handling of materials, such as fuels or hazardous wastes, and spill prevention and clean-up measures shall be implemented to minimize the potential for pollutants to contaminate surface or ground water or degrade soil quality.
(20) Final stabilization of a project site is achieved when:
(A) all land disturbing activities have been completed and a uniform (for example, evenly distributed, without large bare areas) perennial vegetative cover with a density of seventy percent (70%) has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures have been employed; and
(B) construction projects on land used for agricultural purposes are returned to its preconstruction agricultural use or disturbed areas, not previously used for agricultural production, such as filter strips and areas that are not being returned to their preconstruction agricultural use, meet the final stabilization requirements in clause (A).

*(Water Pollution Control Board; 327 IAC 15-5-7; filed Aug 31, 1992, 5:00 p.m.: 16 IR 24; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 840; errata filed Feb 4, 2004, 1:45 p.m.: 27 IR 2284; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-7.5 General requirements for individual building lots within a permitted project**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 7.5. (a) All storm water quality measures, including erosion and sediment control, necessary to comply with this rule must be implemented in accordance with the plan and sufficient to satisfy subsection (b).

(b) Provisions for erosion and sediment control on individual building lots regulated under the original permit of a project site owner must include the following requirements:

(1) The individual lot operator, whether owning the property or acting as the agent of the property owner, shall be responsible for erosion and sediment control requirements associated with activities on individual lots.

(2) Installation and maintenance of a stable construction site access.

(3) Installation and maintenance of appropriate perimeter erosion and sediment control measures prior to land disturbance.

(4) Sediment discharge and tracking from each lot must be minimized throughout the land disturbing activities on the lot until permanent stabilization has been achieved.

(5) Clean-up of sediment that is either tracked or washed onto roads. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules.

(6) Adjacent lots disturbed by an individual lot operator must be repaired and stabilized with temporary or permanent surface stabilization.

(7) For individual residential lots, final stabilization meeting the criteria in section 7(b)(20) of this rule will be achieved when the individual lot operator:

(A) completes final stabilization; or

(B) has installed appropriate erosion and sediment control measures for an individual lot prior to occupation of the home by the homeowner and has informed the homeowner of the requirement for, and benefits of, final stabilization.

*(Water Pollution Control Board; 327 IAC 15-5-7.5; filed Oct 27, 2003, 10:15 a.m.: 27 IR 843; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-8 Project termination**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 8. (a) The project site owner shall plan an orderly and timely termination of the construction activities, including the implementation of storm water quality measures that are to remain on the project site.

(b) The project site owner shall submit a notice of termination (NOT) letter to the commissioner and a copy to the appropriate SWCD or other designated entity in accordance with the following:

(1) Except as provided in subdivision (2), the project site owner shall submit an NOT letter when the following conditions have been met:

(A) All land disturbing activities, including construction on all building lots, have been completed and the entire site has been stabilized.

(B) All temporary erosion and sediment control measures have been removed.

The NOT letter must contain a verified statement that each of the conditions in this subdivision has been met.

(2) The project site owner may submit an NOT letter to obtain early release from compliance with this rule if the following conditions are met:

(A) The remaining, undeveloped acreage does not exceed five (5) acres, with contiguous areas not to exceed one (1) acre.

(B) A map of the project site, clearly identifying all remaining undeveloped lots, is attached to the NOT letter. The map must be accompanied by a list of names and addresses of individual lot owners or individual lot operators of all undeveloped lots.

(C) All public and common improvements, including infrastructure, have been completed and permanently stabilized and have been transferred to the appropriate local entity.

(D) The remaining acreage does not pose a significant threat to the integrity of the infrastructure, adjacent properties, or water quality.

(E) All permanent storm water quality measures have been implemented and are operational.

(c) Following acceptance of the NOT letter and written approval from the department for early release under subsection (b), the project site owner shall notify all current individual lot owners and all subsequent individual lot owners of the remaining

undeveloped acreage and acreage with construction activity that they are responsible for complying with section 7.5 of this rule. The remaining individual lot owners do not need to submit an NOI letter or NOT letter. The notice must contain a verified statement that each of the conditions in subsection (b)(2) have been met. The notice must also inform the individual lot owners of the requirements to:

(1) install and maintain appropriate measures to prevent sediment from leaving the individual building lot; and

(2) maintain all erosion and sediment control measures that are to remain on-site as part of the construction plan.

(d) The SWCD, DNR-DSC, other entity designated by the department or a regulated MS4 entity, or the department may inspect the project site to evaluate the adequacy of the remaining storm water quality measures and compliance with the NOT letter requirements. If the inspecting entity finds that the project site owner has sufficiently filed an NOT letter, the entity shall forward notification to the department. Upon receipt of the verified NOT letter by the department and receipt of written approval from the department, the project site owner shall no longer be responsible for compliance with this rule.

(e) After a verified NOT letter has been submitted for a project site, maintenance of the remaining storm water quality measures shall be the responsibility of the individual lot owner or occupier of the property. *(Water Pollution Control Board; 327 IAC 15-5-8; filed Aug 31, 1992, 5:00 p.m.: 16 IR 25; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 843; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-9 Standard conditions**

Authority: IC 13-1-3-4; IC 13-1-3-7; IC 13-7-7; IC 13-7-10-1
Affected: IC 13-1-3; IC 13-7

Sec. 9. The standard conditions for NPDES general permit rules under 327 IAC 15-4 shall apply to this rule. *(Water Pollution Control Board; 327 IAC 15-5-9; filed Aug 31, 1992, 5:00 p.m.: 16 IR 26; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-10 Inspection and enforcement**

Authority: IC 13-13-5-2; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2; IC 13-18-3-3; IC 13-18-3-13; IC 13-18-4-1; IC 13-18-4-3
Affected: IC 13-14-10; IC 13-15-7; IC 13-18-3; IC 13-18-4; IC 13-30

Sec. 10. (a) The department or its designated representative may inspect any project site involved in construction activities regulated by this rule at reasonable times. The department or its designated representatives may make recommendations to the project site owner or their representative to install appropriate measures beyond those specified in the storm water pollution prevention plan to achieve compliance.

(b) All persons engaging in construction activities on a project site shall be responsible for complying with the storm water pollution prevention plan and the provisions of this rule.

(c) The department shall investigate potential violations of this rule to determine which person may be responsible for the violation. The department shall, if appropriate, consider public records of ownership, building permits issued by local units of government, and other relevant information, which may include site inspections, storm water pollution prevention plans, notices of intent, and other information related to the specific facts and circumstances of the potential violation. Any person causing or contributing to a violation of any provisions of this rule shall be subject to enforcement and penalty under IC 13-14-10, IC 13-15-7, and IC 13-30.

(d) If remaining storm water quality measures are not properly maintained by the person occupying or owning the property, the department may pursue enforcement against that person for correction of deficiencies under 327 IAC 15-1-4.

(e) Construction plans and supporting documentation associated with the quality assurance plan must be made available to the department or its designated representatives within forty-eight (48) hours of such a request. *(Water Pollution Control Board; 327 IAC 15-5-10; filed Aug 31, 1992, 5:00 p.m.: 16 IR 26; filed Mar 23, 2000, 4:15 p.m.: 23 IR 1912; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 844; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-5-11 Notification of completion (Repealed)**

Sec. 11. *(Repealed by Water Pollution Control Board; filed Oct 27, 2003, 10:15 a.m.: 27 IR 863)*

**327 IAC 15-5-12 Duration of coverage**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 12. (a) A permit issued under this rule is granted by the commissioner for a period of five (5) years from the date coverage commences.

(b) Once the five (5) year permit term duration is reached, a general permit issued under this rule will be considered expired, and, as necessary for construction activity continuation, a new NOI letter would need to be submitted in accordance with subsection (c).

(c) To obtain renewal of coverage under this rule, the information required under sections 5 and 6 of this rule must be submitted to the commissioner ninety (90) days prior to the termination of coverage under this NPDES general permit rule, unless the commissioner determines that a later date is acceptable. Coverage under renewal NOI letters will begin on the date of expiration from the previous five (5) year permit term. *(Water Pollution Control Board; 327 IAC 15-5-12; filed Oct 27, 2003, 10:15 a.m.: 27 IR 844; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

## Rule 6. Storm Water Discharges Exposed to Industrial Activity

**327 IAC 15-6-1 Purpose**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 13-12-3-1; IC 13-18-1

Sec. 1. The purpose of this rule is to establish requirements for storm water discharges exposed to industrial activity that are composed entirely of storm water and allowable nonstorm water so that the public health, existing water uses, and aquatic biota are protected. *(Water Pollution Control Board; 327 IAC 15-6-1; filed Aug 31, 1992, 5:00 p.m.: 16 IR 26; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; filed Oct 27, 2003, 10:15 a.m.: 27 IR 845; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-6-2 Applicability of the general permit rule for storm water discharges exposed to industrial activity**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2; IC 13-18-3; IC 13-18-4
Affected: IC 4-21.5; IC 13-12-3-1; IC 13-18-1

Sec. 2. (a) Except as provided in subsections (c) through (j), the requirements under this rule apply to all facilities that meet the following requirements:

(1) Are not prohibited from regulation under a NPDES general permit rule under 327 IAC 15-2-6.

(2) Meet the NPDES general permit rule applicability requirements under 327 IAC 15-2-3.

(3) Have not received a conditional no exposure exclusion from storm water permitting under section 12 of this rule.

(4) Have a new or existing point source discharge composed entirely of storm water and the following allowable nonstorm water discharges exposed to industrial activity:

(A) Discharges from firefighting activities.

(B) Fire hydrant flushings.

(C) Potable water sources, including waterline flushings.

(D) Irrigation drainage.

(E) Landscape watering provided all pesticides, herbicides, and fertilizer have been applied in accordance with manufacturer's instructions.

(F) Routine external building washdown that does not use detergents.

(G) Pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred, unless all spilled material has been removed, and where detergents are not used.

(H) Uncontaminated ground water or spring water.

(I) Foundation or footing drains where flows are not contaminated with process materials, such as solvents.

(J) Uncontaminated air conditioning or compressor condensate.

(K) Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions of the facility, but not

# Appendix 2.4

# Rule 5 Individual Storm Water Permit Requirements

In Indiana, most construction projects subject to Rule 5 are administered through a general permit.

IDEM does reserve the right to require an Individual NPDES (National Pollutant Discharge Elimination System) Permit rather than a Rule 5 general permit. If the agency determines the storm water run-off from a project could impair the water quality of the receiving stream, identified as an Outstanding State Resource or Exceptional Use Waters. Permittees will be notified by IDEM if they need to apply for an individual storm water discharge permit.

An individual storm water permit is not required, unless IDEM determines that the general permit is not sufficient to protect water quality or other factors warrant more specific storm water control requirements on a project site. According to 327 IAC 15-2-9(c) [PDF], IDEM will notify a project site owner in writing if an individual storm water permit is needed. This written notification will include:

1. a brief statement of the reasons for the decision;
2. an application form;
3. a statement setting a time for the project site owner to file the application; and
4. a statement that on the effective date of the individual storm water permit, the general permit rule, as it applies to the project site owner, shall no longer apply.

If a project site owner is requested to obtain an individual storm water permit, several differences, in contrast to the Rule 5 requirements, are involved. An individual storm water permit will be a written document (not a rule), developed over several weeks or months. Before this permit is issued and becomes effective, it must have a 30-day public comment period, typically advertised through a notice placed in a local newspaper where the project site will be developed. In the public notice, the public can request, and be granted, a public hearing on the project site. Until the individual storm water permit becomes effective and a Construction Plan is approved, the project site owner can not begin land disturbing activities.

Currently, IDEM will be using the same application form as the one required in Rule 5. However, individual storm water permits also require the submittal of a completed Identification of Potentially Affected Persons [PDF] form with the application.

# Appendix 2.5

(B) The person(s) who performed the sampling or measurements.
(C) The dates the analyses were performed.
(D) The person(s) who performed the analyses.
(E) The analytical techniques or methods used.
(F) The results of all required analyses and measurements.

(3) Monitoring of any pollutant at the location(s) identified in the NOI letter more frequently than required under this rule, using approved analytical methods, the results of such monitoring shall be included in the calculation and reporting of the values required in the monthly discharge monitoring report. Such increased frequency shall also be indicated in this report.

(4) All records and information resulting from the monitoring activities required under this rule, including all records of analyses performed and calibration and maintenance of instrumentation and recording from continuous monitoring instrumentation, shall be retained for a minimum of three (3) years. When the original records are kept at another location, a copy of all such records shall be kept at the facility. The three (3) year period shall be extended:

(A) automatically during the course of any unresolved litigation regarding the discharge of pollutants by the facility or regarding promulgated effluent guidelines applicable to the facility; or

(B) as requested by the regional administrator or the Indiana department of environmental management.

*(Water Pollution Control Board; 327 IAC 15-12-7; filed May 25, 1994, 11:00 a.m.: 17 IR 2305; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-12-8 Standard conditions**

Authority: IC 13-1-3-4; IC 13-1-3-7; IC 13-7-7; IC 13-7-10-1
Affected: IC 13-1-3; IC 13-7

Sec. 8. In addition to the conditions set forth in this rule, the standard conditions for the NPDES general permit rule under 327 IAC 15-4 shall apply also to this rule. *(Water Pollution Control Board; 327 IAC 15-12-8; filed May 25, 1994, 11:00 a.m.: 17 IR 2306; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-12-9 Inspection and enforcement**

Authority: IC 13-1-3-4; IC 13-1-3-7; IC 13-7-7; IC 13-7-10-1
Affected: IC 13-1-3; IC 13-7

Sec. 9. (a) The commissioner and/or designated representative may inspect any facility regulated under this rule at any time.

(b) Any person violating any provision of this rule shall be subject to enforcement and penalty as set forth under 327 IAC 15-1-4. *(Water Pollution Control Board; 327 IAC 15-12-9; filed May 25, 1994, 11:00 a.m.: 17 IR 2306; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

**327 IAC 15-12-10 Duration of coverage**

Authority: IC 13-1-3-4; IC 13-1-3-7; IC 13-7-7; IC 13-7-10-1
Affected: IC 13-1-3; IC 13-7

Sec. 10. Coverage under this rule is granted by the commissioner for a period of five (5) years from the date coverage commences. To obtain renewal of coverage under this general permit rule, the information required under 327 IAC 15-3 shall be submitted to the commissioner within ninety (90) days of the termination of coverage under this NPDES general permit rule, unless the commissioner determines that a later date is acceptable. *(Water Pollution Control Board; 327 IAC 15-12-10; filed May 25, 1994, 11:00 a.m.: 17 IR 2306; readopted filed Jan 10, 2001, 3:23 p.m.: 24 IR 1518; readopted filed Nov 21, 2007, 1:16 p.m.: 20071219-IR-327070553BFA)*

## Rule 13. Storm Water Run-Off Associated with Municipal Separate Storm Sewer System Conveyances

**327 IAC 15-13-1 Purpose**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 1. The purpose of this rule is to establish requirements for storm water discharges from municipal separate storm sewer system (MS4) conveyances so that public health, existing water uses, and aquatic biota are protected. *(Water Pollution Control Board; 327 IAC 15-13-1; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3577)*

**327 IAC 15-13-2 Applicability**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 2. This rule applies to an MS4 entity that:
(1) is not required to obtain an individual NPDES permit under 327 IAC 5-4-6(a)(4), 327 IAC 5-4-6(a)(5), or 327 IAC 15-2-9(b);
(2) meets the general permit rule applicability requirements under 327 IAC 15-2-3;
(3) does not have coverage under an individual MS4 permit; and
(4) operates, maintains, or otherwise has responsibility for an MS4 conveyance within a designated MS4 area.
*(Water Pollution Control Board; 327 IAC 15-13-2; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3577)*

**327 IAC 15-13-3 MS4 area designation criteria**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 3. (a) An MS4 entity that meets one (1) of the following is designated for permit coverage under this rule:
(1) Located within, or contiguous to, a mapped 2000 United States Census Bureau urbanized area (UA) and is:
(A) a municipality, regardless of its United States Census Bureau population; or
(B) a university, college, military base, hospital, or correctional facility with a full-time equivalent enrollment, daily user population, or bed count occupancy (based on the most recent enrollment count or population data) greater than or equal to one thousand (1,000).
(2) A county that contains a mapped UA. Only the portion of the county that contains the mapped UA, as delineated by political township or section, township, and range boundaries, must be regulated. If only a portion of the county contains a mapped UA, the MS4 entity may elect to regulate, to the extent of its authority, any additional portion of the county, as delineated by political township or section, township, and range boundaries, under this rule.
(3) A documented significant contributor of pollutants to waters or a regulated MS4 area.
(4) A municipality with a population density, according to 2000 United States Census Bureau data, of five hundred (500) people per square mile or greater and United States Census Bureau population of ten thousand (10,000) or more.
(5) A municipality with a population density, according to 2000 United States Census Bureau data, of five hundred (500) people per square mile or greater, United States Census Bureau population greater than seven thousand (7,000) and less than ten thousand (10,000), and having a positive, ten (10) year population growth percentage greater than or equal to ten percent (10%).
(6) A municipality with a population density, according to 2000 United States Census Bureau data, of five hundred (500) people per square mile or greater, United States Census Bureau population greater than seven thousand (7,000) and less than ten thousand (10,000), and having a university or college full-time equivalent enrollment, military base population, hospital bed count occupancy, or correctional facility daily user population (based on the most recent enrollment, count, or population data) that places the total population greater than or equal to ten thousand (10,000).
(7) A university, college, military base, hospital, or correctional facility with a full-time equivalent enrollment, daily user population, or bed count occupancy greater than or equal to one thousand (1,000), located within a designated municipality, and having responsibility for a storm water conveyance.
(8) A conservancy district or homeowner's association with a population within their service area of greater than or equal to one thousand (1,000) people, located within a designated municipality or mapped UA, and having responsibility for a storm water conveyance.
(9) A public or private storm water utility that serves one (1) or more of the MS4 entities designated under subdivisions (1) through (8).
(b) An MS4 entity not already designated under subsection (a) may be designated for permit coverage if its discharge is to

a sensitive area or if other environmental programs are not adequately protecting water quality.

(c) Once an MS4 entity is designated under this section, it remains designated until the expiration of its permit unless any of the conditions for termination in section 20 of this rule are applicable or a waiver is granted in accordance with subsection (f).

(d) The department shall notify MS4 entities meeting the designation criteria of this section in writing. If the department does not notify an MS4 entity in writing, an MS4 entity meeting the designation criteria of this section must comply with the requirements of section 9(e) of this rule.

(e) A designated MS4 entity subject to this rule is also subject to the requirements of 327 IAC 15-2-9(b) and may be required to obtain an individual NPDES permit.

(f) A designated MS4 entity may request a waiver from permit coverage under this rule. Unless an MS4 entity's conveyance system is substantially contributing to the pollutant loadings of a regulated, physically interconnected MS4 entity or a department determination is made that requires storm water controls, MS4 entities within a mapped UA that have a conveyance system serving a population of less than one thousand (1,000) are conditionally granted a waiver. For all other MS4 entities, this waiver will only be granted under the following conditions:

(1) The MS4 entity's conveyance system serves a population of less than ten thousand (10,000).

(2) The MS4 entity's conveyance system is not contributing substantially to the pollutant loadings of a physically interconnected MS4 entity that is regulated by this rule.

(3) An evaluation of all waters that receive a discharge from the MS4 entity's conveyance system has been conducted by the department or another approved entity.

(4) For all evaluated waters, the department has determined that storm water controls are not needed based on wasteload allocations that are part of a United States Environmental Protection Agency approved or established total maximum daily load or equivalent process and are reflective of pollutants identified as sources of impairment.

(5) The department has determined that future discharges from the MS4 entity's conveyance system do not have the potential to result in exceedances of water quality standards, including impairment of designated uses or other significant water quality impacts, including habitat and biological impacts.

*(Water Pollution Control Board; 327 IAC 15-13-3; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3577; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-4 General permit boundary**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 4. (a) This general permit covers Indiana.

(b) For each MS4 entity, the permit covers all storm water discharges from conveyance systems for which it has jurisdiction or, in the case of designated counties, the portion of the county jurisdictional area depicted in a mapped UA, as specified under section 3(a)(2) of this rule, unless appropriate written, enforceable, legal documentation has been obtained to allow another entity to have permit responsibilities for systems and areas within another entity's jurisdiction. *(Water Pollution Control Board; 327 IAC 15-13-4; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3578)*

**327 IAC 15-13-5 Definitions**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-11-2; IC 13-18-4; IC 13-20-10; IC 14-32

Sec. 5. For purposes of this rule, the following definitions apply:

(1) "Best management practice" or "BMP" means any structural or nonstructural control measure utilized to improve the quality and, as appropriate, reduce the quantity of storm water run-off. The term includes schedules of activities, prohibitions of practice, treatment requirements, operation and maintenance procedures, use of containment facilities, land use planning, policy techniques, and other management practices.

(2) "Buffer strip" means an existing, variable width strip of vegetated land intended to protect water quality and terrestrial and aquatic habitat in an adjacent resource or area.

(3) "Canine park" means a designated public location where dogs are restricted and animal waste may accumulate. For the purposes of this rule, the term does not include kennels, municipal dog impoundments, or humane society buildings.

(4) "Class V injection well" means a type of well, which typically has a depth greater than its largest surface dimension, emplaces fluids into the subsurface, and does not meet the definitions of Class I through Class IV wells as defined under 40 CFR 146.5. While the term includes the specific examples described in 40 CFR 144.81, septic systems that serve more than one (1) single-family dwelling or provide service for nondomestic waste, dug wells, bored wells, improved sinkholes, french drains, infiltration sumps, and infiltration galleries, it does not include surface impoundments, trenches, or ditches that are wider than they are deep.
(5) "Combined sewer" means a sewer that is designed, constructed, and used to receive and transport combined sewage.
(6) "Combined sewer operational plan" or "CSOOP" means a plan that contains the minimum technology controls applicable to, and requirements for operation and maintenance of, a combined sewer system:
(A) before;
(B) during; and
(C) upon completion of;
the implementation of a long term control plan.
(7) "Commissioner" refers to the commissioner of the department of environmental management.
(8) "Constructed wetland" means a manmade shallow pool that creates growing conditions suitable for wetland vegetation and is designed to maximize pollutant removal.
(9) "Contiguity" means an entity's proximity to a designated MS4 area in such a way that it allows for direct discharges of storm water run-off into the regulated MS4 conveyance.
(10) "Conveyance" means any structural process for transferring storm water between at least two (2) points. The term includes piping, ditches, swales, curbs, gutters, catch basins, channels, storm drains, and roadways.
(11) "Daily user population" means a population for an entity that is present at that location on a daily basis.
(12) "Dechlorinated swimming pool discharge" means chlorinated water that has either sat idle for seven (7) days following chlorination prior to discharge to the MS4 conveyance or, by analysis, does not contain detectable concentrations (less than five-hundredths (0.05) milligram per liter) of chlorinated residual.
(13) "Department" refers to the department of environmental management.
(14) "Detention basin" means a type of storage practice used to detain or slow storm water run-off and then release it through a positive outlet.
(15) "Disposal" means the:
(A) discharge;
(B) deposit;
(C) injection;
(D) spilling;
(E) leaking; or
(F) placing;
of any solid waste or hazardous waste into or on any land or water so that the solid waste or hazardous waste, or any constituent of the waste, may enter the environment, be emitted into the air, or be discharged into any waters, including ground waters.
(16) "Dry well" means a type of infiltration practice that allows storm water run-off to flow directly into the ground via a bored or otherwise excavated opening in the ground surface.
(17) "Filter strip" means a type of vegetative practice used to filter storm water run-off through the use of planted or existing vegetation near disturbed or impervious surfaces.
(18) "Floatable" means any solid waste that, due to its physical characteristics, will float on the surface of water. For the purposes of this rule, the term does not include naturally occurring floatables, such as leaves or tree limbs.
(19) "Flood plain" means the area adjoining a river, stream, or lake that is inundated by the base flood as determined by 312 IAC 10.
(20) "Floodway" means the channel of a river or stream and those portions of the flood plain adjoining the channel that are reasonably required to efficiently carry and discharge the peak flow from the base flood as determined by 312 IAC 10.
(21) "Full-time equivalent enrollment" means a college or university enrollment of undergraduate students currently taking fifteen (15) credit hours of course work and graduate or professional students currently taking twelve (12) credit hours of course work. Each respective fifteen (15) or twelve (12) credit hours of course work equals one (1) full-time equivalent.
(22) "Garbage" means all putrescible animal solid, vegetable solid, and semisolid wastes resulting from the:

(A) processing;
(B) handling;
(C) preparation;
(D) cooking;
(E) serving; or
(F) consumption;
of food or food materials.

(23) "General permit rule boundary" means an area based upon existing geographic or political boundaries indicating the area within which an MS4 conveyance affected by this rule is located.

(24) "Grass swale" means a type of vegetative practice used to filter storm water run-off via a vegetated, shallow-channel conveyance.

(25) "Ground water" means such accumulations of underground water, natural or artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state. The term does not include manmade underground storage or conveyance structures.

(26) "Household hazardous waste" or "HHW" means solid waste generated by households that:
(A) is ignitable, as defined under 40 CFR 261.21;
(B) is toxic, as defined under 40 CFR 261.24;
(C) is reactive, as defined under 40 CFR 261.23;
(D) is corrosive, as defined under 40 CFR 261.22; or
(E) otherwise poses a threat to human health or the environment.

(27) "Hydrologic unit code" or "HUC" means a numeric United States Geological Survey code that corresponds to a watershed area. Each area also has a text description associated with the numeric code.

(28) "Illicit discharge" means any discharge to an MS4 conveyance that is not composed entirely of storm water, except naturally occurring floatables, such as leaves or tree limbs. Sources of illicit discharges include sanitary wastewater, septic tank effluent, car wash wastewater, oil disposal, radiator flushing disposal, laundry wastewater, roadway accident spillage, and household hazardous wastes.

(29) "Impervious surface" means any surface that prevents storm water to readily infiltrate into the soils.

(30) "Individual NPDES permit" means an NPDES permit issued to one (1) MS4 operator that contains requirements specific to that MS4 conveyance.

(31) "Infiltration basin or trench" means a type of infiltration practice used to filter storm water run-off into soils via the use of installed structures with porous material.

(32) "Infiltration gallery" means a type of infiltration practice used to filter storm water run-off into soils that utilizes one (1) or more vertical pipes leading to a horizontal, perforated pipe laid within a trench, often backfilled with gravel or some other permeable material.

(33) "Infiltration practices" means any structural BMP designed to facilitate the percolation of run-off through the soil to ground water. Examples include infiltration basins or trenches, dry wells, and porous pavement.

(34) "Initial receiving water" means a water that is the direct recipient of a discharge from an MS4 area after the discharge passes through another MS4 conveyance.

(35) "Larger common plan of development or sale" means a plan, undertaken by a single developer or a group of developers acting in concert, to offer lots for sale or lease; where such land is contiguous, or is known, designed, purchased, or advertised as a common unit or by a common name, such land shall be presumed as being offered for sale or lease as part of a larger common plan. The term also includes phased construction by a single entity for its own use.

(36) "Legally binding agreement" means a written, enforceable legal document used to describe responsibilities between joint permittees or other entities.

(37) "Load allocation" means the portion of a receiving waterbody's loading capacity that is attributed either to one (1) of its existing or future nonpoint sources of pollution or to natural background sources.

(38) "Long term control plan" or "LTCP" means a plan that is:
(A) consistent with the federal Combined Sewer Overflow Control Policy (59 FR 18688); and
(B) developed in accordance with the recommendations set forth in Combined Sewer Overflows Guidance for Long-Term Control Plan (EPA 832B95002).

(39) "Minimum control measure" or "MCM" refers to the following minimum measures required by this rule:

(A) Public education and outreach.
(B) Public participation and involvement.
(C) Illicit discharge detection and elimination.
(D) Construction site run-off control.
(E) Postconstruction run-off control.
(F) Pollution prevention and good housekeeping.

(40) "MS4 area" means a land area comprising one (1) or more places that receives coverage under one (1) NPDES storm water permit regulated by this rule or 327 IAC 5-4-6(a)(4) and 327 IAC 5-4-6(a)(5).

(41) "MS4 entity" means a public or private body that owns, operates, or maintains a storm water conveyance system, including a transportation agency operated by that body. The term can also include federal, state, city, town, county, district, association, or township public bodies and privately owned universities, colleges, or storm water utilities. For the purposes of this rule, the term does not include non-MS4 entity-owned shopping malls, office parks, apartment complexes, golf courses, churches, or hotels.

(42) "MS4 operator" means the person responsible for development, implementation, or enforcement of the MCMs for a designated MS4 area.

(43) "Municipal separate storm sewer system" or "MS4" means a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains, that is:

(A) owned or operated by a:

(i) federal, state, city, town, county, district, association, or other public body (created by or pursuant to state law) having jurisdiction over storm water, including special districts under state law such as a sewer district, flood control district, or drainage district, or similar entity, or a designated and approved management agency under Section 208 of the Clean Water Act (33 U.S.C. 1288) that discharges into waters of the state; or

(ii) privately owned storm water utility, hospital, university, or college having jurisdiction over storm water that discharges into waters of the state;

(B) designed or used for collecting or conveying storm water;

(C) not a combined sewer; and

(D) not part of a publicly owned treatment works (POTW) as defined at 40 CFR 122.2.

(44) "Municipal, state, federal, or institutional refueling area" means an operating gasoline or diesel fueling area whose primary function is to provide fuel to either municipal, state, federal, or institutional equipment or vehicles.

(45) "Mutual drain" means a drainage system that:

(A) is located on two (2) or more tracts of land that are under different ownership;

(B) was established by the mutual consent of all the owners; and

(C) was not established under or made subject to any drainage statute.

(46) "Nonpoint source" means a source of water pollution that does not meet the definition of point source. The term includes in-place pollutants, direct wet and dry deposition, ground water inflow, and overland run-off.

(47) "Notice of deficiency letter" or "NOD letter" means a written notification from the department indicating an MS4 entity's deficiencies in its NOI letter or SWQMP submittals.

(48) "Notice of intent letter" or "NOI letter" means a written notification indicating an MS4 entity's intention to comply with the terms of this rule in lieu of applying for an individual NPDES permit and includes information as required under sections 6 and 9 of this rule. It is the application for obtaining permit coverage under this rule.

(49) "Notice of sufficiency letter" or "NOS letter" means a written notification from the department indicating that an MS4 entity has sufficiently provided the required information in its NOI letter or SWQMP submittals.

(50) "Notice of termination letter" or "NOT letter" means a written notification from the department indicating that an MS4 entity has met the conditions to terminate its permit coverage under this rule.

(51) "Open space" means any land area devoid of any disturbed or impervious surfaces created by industrial, commercial, residential, agricultural, or other manmade activities.

(52) "Outfall" means a point source discharge via a conveyance of storm water run-off into a water of the state.

(53) "Outfall scouring" means the deterioration of a stream bed or lake bed from an outfall discharge to an extent that the excessive settling of solid material results and aquatic habitat is diminished.

(54) "Point source" means any discernible, confined, and discrete conveyance, including a pipe, ditch, channel, tunnel, conduit, well, or discrete fissure.

(55) "Pollutant of concern" means any pollutant that has been documented via analytical data as a cause of impairment in any waterbody, or to another MS4, to which the MS4 discharges.
(56) "Porous pavement" means a type of infiltration practice to improve the quality and reduce the quantity of storm water run-off via the use of manmade, pervious pavement which allows run-off to percolate through the pavement and into underlying soils.
(57) "Private drain" means a drainage system that:
(A) is located on land owned by one (1) person or by two (2) or more persons jointly; and
(B) was not established under or made subject to any drainage statute.
(58) "Programmatic indicator" means any data collected by an MS4 entity that is used to indicate implementation of one (1) or more minimum control measures.
(59) "Qualified professional" means an individual who is trained and experienced in storm water treatment techniques and related fields as may be demonstrated by state registration, professional certification, experience, or completion of coursework that enable the individual to make sound, professional judgments regarding storm water control or treatment and monitoring, pollutant fate and transport, and drainage planning.
(60) "Rain garden" means a vegetative practice used to alter impervious surfaces, such as roofs, into pervious surfaces for absorption and treatment of rainfall.
(61) "Receiving stream" or "receiving water" means a waterbody that receives a discharge from an outfall. The term does not include private drains, unnamed conveyances, retention and detention basins, or constructed wetlands used as treatment.
(62) "Redevelopment" means alterations of a property that change a site or building in such a way that there is disturbance of one (1) acre or more of land. The term does not include such activities as exterior remodeling.
(63) "Responsible individual" means the person responsible for development, implementation, or enforcement of the MCMs for a designated MS4 entity.
(64) "Retail gasoline outlet" means an operating gasoline or diesel fueling facility whose primary function is the resale of fuels. The term applies to facilities that create five thousand (5,000) or more square feet of impervious surfaces or generate an average daily traffic count of one hundred (100) vehicles per one thousand (1,000) square feet of land area.
(65) "Retention basin" means a type of storage practice, that has no positive outlet, used to retain storm water run-off for an indefinite amount of time. Run-off from this type of basin is removed only by infiltration through a porous bottom or by evaporation.
(66) "Riparian habitat" means a land area adjacent to a waterbody that supports animal and plant life associated with that waterbody.
(67) "Riparian zone" means a land area adjacent to a waterbody that is directly associated with that waterbody.
(68) "Sand" means mineral material with a size range between two (2) and one-sixteenth ($^1/_{16}$) millimeter diameter.
(69) "Sedimentation" means the settling and accumulation of unconsolidated material carried by storm water run-off.
(70) "Sensitive area" means a waterbody identified as needing priority protection or remediation based on:
(A) having threatened or endangered species or their habitat;
(B) usage as a public surface water supply intake;
(C) usage for full body contact recreation, such as bathing beaches; or
(D) exceptional use classification as found in 327 IAC 2-1-11(b), outstanding state resource water classification as found in 327 IAC 2-1-2(3) and 327 IAC 2-1.5-19(b).
(71) "Significant contributor of pollutants" means an MS4 entity or industrial facility that contributes pollutants into an MS4 conveyance in such a quantity or quality and to such a degree that it impacts the receiving MS4 operator's ability to comply with applicable state or federal law.
(72) "Soil and water conservation district" or "SWCD" means a political subdivision established under IC 14-32.
(73) "Solid waste" means any garbage, refuse, sludge for a waste treatment plant, sludge from a water supply treatment plant, sludge from an air pollution control facility, or other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations or from community activities. The term does not include:
(A) solid or dissolved material in:
(i) domestic sewage; or
(ii) irrigation return flows or industrial discharges;
that are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act Amendments

(33 U.S.C. 1342);

(B) source, special nuclear, or byproduct material (as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.);

(C) manures or crop residues returned to the soil at the point of generation as fertilizers or soil conditioners as part of a total farm operation; or

(D) vegetative matter at composting facilities registered under IC 13-20-10.

(74) "Spill" means the unexpected, unintended, abnormal, or unapproved dumping, leakage, drainage, seepage, discharge, or other loss of petroleum, hazardous substances, extremely hazardous substances, or objectionable substances. The term does not include releases to impervious surfaces when the substance does not migrate off the surface or penetrate the surface and enter the soil.

(75) "Standard Industrial Classification code" or "SIC code" means the four (4) digit code applicable to a particular industrial activity in accordance with the Standard Industrial Classification Manual published by the Office of Management and Budget of the Executive Office of the President of the United States.

(76) "Storage practices" means any structural BMP intended to store or detain storm water and slowly release it to receiving waters or drainage systems. The term includes detention and retention basins.

(77) "Storm drain marking" means any marking procedure that identifies a storm sewer inlet as draining directly to a receiving waterbody so as to avoid dumping pollutants. The procedures can include painted or cast messages and adhesive decals.

(78) "Storm water" means water resulting from rain, melting or melted snow, hail, or sleet.

(79) "Storm water quality management plan" or "SWQMP" means a comprehensive written document that addresses storm water run-off quality within an MS4 area. The SWQMP is divided into three (3) different submittal parts as follows:

(A) Part A-Initial Application.

(B) Part B-Baseline Characterization and Report.

(C) Part C-Program Implementation.

(80) "Stream reach characterization and evaluation report" or "SRCER" means a written report that characterizes and evaluates the pollutant sources on receiving waters from a combined sewer system discharge.

(81) "Total maximum daily load" or "TMDL" means the sum of the daily individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background minus the sum of a specified margin of safety and any capacity reserved for growth. A TMDL sets and allocates the maximum daily amount of a pollutant that may be introduced into a waterbody and still assure attainment and maintenance of water quality standards.

(82) "Traffic phasing plan" means a written plan that addresses the installation of appropriate pollution prevention practices that is directly related to the land disturbance associated with infrastructure constructed to reroute vehicular traffic within an active construction zone. The term does not include detours that are directed away from the active construction area.

(83) "Urbanized area" or "UA" means a land area comprising one (1) or more places that together have a residential population of at least fifty thousand (50,000) and an overall population density of at least five hundred (500) people per square mile.

(84) "Vegetative practices" means any nonstructural or structural BMP that, with optimal design and good soil conditions, utilizes various forms of vegetation to enhance pollutant removal, maintain and improve natural site hydrology, promote healthier habitats, and increase aesthetic appeal. Examples include grass swales, filter strips, buffer strips, constructed wetlands, and rain gardens.

(85) "Waste transfer station" means a place where solid wastes are segregated for additional off-site processing or disposal.

(86) "Wasteload allocation" means the portion of a receiving stream's loading capacity that is allocated to one (1) of its existing or future point sources of pollution.

(87) "Waterbody" means any accumulation of water, surface or underground, natural or artificial, including rivers, streams, creeks, ditches, swales, lakes, ponds, marshes, wetlands, and ground water. The term does not include any storage or treatment structures.

(88) "Watercourse" means the path taken by flowing surface water.

(89) "Waters" means:

(A) the accumulations of water, surface and underground, natural and artificial, public and private; or

(B) a part of the accumulations of water;

that are wholly or partially within, flow through, or border upon Indiana. The term does not include a private pond, or an off-stream pond, reservoir, or facility built for reduction or control of pollution or cooling of water before discharge, unless the

discharge from the pond, reservoir, or facility causes or threatens to cause water pollution.

(90) "Watershed" means an area of land from which water drains to a common point.

(91) "Wellhead protection area" has the meaning set forth at 327 IAC 8-4.1-1(27).

*(Water Pollution Control Board; 327 IAC 15-13-5; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3578; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-6 Notice of intent letter requirements**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 6. (a) Unless one (1) application is submitted for multiple MS4 entities, each MS4 entity shall submit an NOI letter with the following information, which will serve as the permit application:

(1) Contact information required under subsection (b).

(2) List of all known receiving waters or, if the discharge is to another MS4, the name of the MS4 entity and the initial receiving water. For the purposes of the NOI letter submittal, receiving waters include, at a minimum, waters listed on the United States Geological Survey National Hydrography Dataset or, if no waters are listed on this data base within a given MS4 area, the primary receiving water for the MS4 area drainage. As additional receiving waters are identified, the information must be provided in the corresponding annual report required in section 18 of this rule.

(3) Copy of the completed SWQMP-Part A: Initial Application certification submittal and checklist form.

(4) Proof of publication in the newspaper with the greatest circulation in the affected MS4 area. The notice must provide a listing of all entities intended to be covered under the permit. This statement must be included in the public notice, "(MS4 entity name and address) intends to discharge storm water into the (text name and numeric code of all 14-digit Hydrologic Unit Code area) watershed(s), and is submitting a Notice of Intent letter to notify the Indiana Department of Environmental Management of our intent to comply with the requirements under 327 IAC 15-13 to discharge storm water run-off associated with municipal separate storm sewer systems.".

(5) Certification, by completing and signing Appendix A of the NOI letter, that any applicable, legally binding agreements between MS4 area entities have been obtained concerning individual responsibilities for implementation of this rule.

(b) The contact information required under subsections (a)(1) and (c)(1) must include the following:

(1) Name of MS4 operator, primary contact individual (if different from the MS4 operator), or responsible individual for each MS4 entity.

(2) Title of the MS4 operator, primary contact individual (if different from the MS4 operator), or responsible individual or individuals.

(3) MS4 entity represented by the MS4 operator, primary contact individual (if different from the MS4 operator), or responsible individual or individuals.

(4) Mailing (and, if different, the physical) address of the MS4 operator, primary contact individual (if different from the MS4 operator), or responsible individual or individuals.

(5) Telephone and facsimile number of the MS4 operator, primary contact individual (if different from the MS4 operator), or responsible individual or individuals.

(6) E-mail address (if available) of MS4 operator, primary contact individual (if different from the MS4 operator), or responsible individual or individuals.

(c) The SWQMP-Part A: Initial Application required under subsection (a)(3) must contain the following:

(1) Written listing of the MS4 entities within an MS4 area covered by the NOI letter submittal. The listing must provide the name of each MS4 entity, a responsible individual for each MS4 entity, and contact information for each MS4 entity.

(2) Written schedule which, at a minimum, adheres to the compliance schedule in section 11 of this rule.

(3) Written proposed or estimated budget allocation for the MS4 area's storm water program with a summary of identified funding sources. When multiple MS4 entities are applying under a single NOI letter, the budget allocation must be, at a minimum, separated by MS4 entity.

(d) Multiple MS4 entities within an MS4 area may submit a single NOI letter provided they comply with the submittal requirements of this section. Coverage under a single NOI letter will only be allowed if all the MS4 entities seeking coverage consolidate, and provide, the required information in sections 7, 8, and 18 of this rule as single submittals, and the information is submitted to the department by the MS4 operator designated in subsection (b). MS4 operators may utilize materials from existing

local or state programs, or partner with an existing individual MS4 permittee, if all parties agree to coordinate responsibilities in accordance with subsection (a)(5).

(e) Multiple MS4 entities within an MS4 area may submit a separate NOI letter corresponding to each entity and still share responsibilities for implementation of one (1) or more of the requirements in this rule provided they comply with the submittal requirements of this section and coordinate responsibilities in accordance with subsection (a)(5).

(f) Where multiple MS4 entities submit one (1) or more NOI letters based on a watershed delineation and the created MS4 area contains undesignated MS4 entities, the undesignated MS4 entities shall not be subject to the provisions of this rule unless the applicability requirements of section 3 of this rule apply.

(g) Where the MS4 operator changes, or where a new operator is added after the submittal of an NOI letter, a new NOI letter must be completed and submitted in accordance with 327 IAC 15-2-8 and sections 6 and 9 of this rule. If no other conditions change except for the name of the MS4 operator, a written letter describing the name change and a statement that no other conditions, including those conditions in the SWQMP-Part A: Initial Application and legal agreements, have changed will be sufficient notification to the department.

(h) An MS4 entity within an MS4 area that does not have the legal authority or other regulatory mechanisms to implement one (1) or more of the six (6) minimum control measures required under this rule shall either obtain the legal authority or other regulatory mechanism, or work with a neighboring regulated MS4 entity, via legally binding agreements, to share responsibilities.

(i) All documents and information required by this section must meet the signatory requirements of 327 IAC 15-4-3(g).

(j) A qualified professional and the MS4 operator shall certify, with the stated paragraph found in 327 IAC 15-4-3(g)(3), a submitted SWQMP-Part A: Initial Application checklist form.

(k) The department shall review initially submitted NOI letters and SWQMP-Part A: Initial Applications for adequacy and shall assign each NOI letter an NPDES permit number. Either a written NOD letter requesting additional information or NOS letter containing the assigned NPDES permit number shall be returned to the MS4 operator within ninety (90) days of the NOI letter submittal. If the MS4 operator does not receive either a NOD letter or NOS letter within ninety (90) days of the NOI letter submittal, the NOI letter and SWQMP-Part A: Initial Application will be considered adequate.

(l) Responses to NOD letters shall be made by the recipient within thirty (30) days of the date on the NOD letter.

(m) Forms for the NOI letter, SWQMP, annual report, and required certifications shall be provided by the department. *(Water Pollution Control Board; 327 IAC 15-13-6; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3583; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-7 SWQMP-Part B: baseline characterization and report**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 7. (a) An MS4 operator shall characterize the water quality of all known waters that receive storm water outfall discharges within the MS4 area. This characterization may begin with the receiving waters identified in the NOI letter submittal, and, as receiving waters are identified, the characterization shall be expanded to those additional receiving waters and the subsequent information presented in the corresponding annual report required under section 18 of this rule. The water quality characterization must utilize existing or new information that may describe the chemical, biological, or physical condition of the MS4 area water quality. If monitoring is conducted as part of the characterization, the monitoring of receiving waters shall be either at, or in proximity to, all known, or representative, storm water outfall discharges. After the baseline characterization data is collected, the MS4 operator shall evaluate the data in the baseline characterization to determine which identified areas or specific discharge points are in need of additional water quality measures. This baseline characterization must include the following:

(1) An investigation of land usage and assessment of structural and nonstructural storm water BMP locations and conclusions, such as key observation or monitoring locations in the MS4 conveyances, derived from the land usage investigation.

(2) The identification of known sensitive areas, such as public swimming areas, surface drinking water intakes, waters containing threatened or endangered species and their habitat, or state outstanding resource and exceptional use waters. The identified sensitive areas should be given the highest priority for the selection of BMPs and the prohibition of new or significantly increased MS4 discharges.

(3) A review of known existing and available monitoring data of the MS4 area receiving waters, including, as applicable, data that can be correlated from SRCERs.

(4) The identification of areas having a reasonable potential for or actually causing storm water quality problems based on the available and relevant chemical, biological, physical, land use, and complaint data.

(5) Assessment results of BMP locations and, as appropriate, the structural condition of the BMP related to the BMP's effectiveness in improving storm water quality. As appropriate, this assessment should include recommendations for placement and implementation of additional BMPs within the MS4 area.

(b) An SWQMP-Part B: Baseline Characterization and Report addressing the requirements of subsection (a) must be developed and submitted to the department at the address specified in section 9(b) of this rule. The SWQMP-Part B: Baseline Characterization and Report and completed corresponding certification form must be submitted no later than one hundred eighty (180) days from the date the initial NOI letter submittal was received by the department or the expiration date of the previous five (5) year permit term.

(c) The department shall review the SWQMP-Part B: Baseline Characterization and Report for adequacy, and a written NOS letter or NOD letter shall be issued to the MS4 operator. If no letter is issued within ninety (90) days of submittal, the SWQMP-Part B: Baseline Characterization and Report is deemed sufficient.

(d) Responses to NOD letters shall be made by the recipient within thirty (30) days of the date on the NOD letter.

(e) Ongoing data collection related to the SWQMP-Part B: Baseline Characterization and Report must be submitted to the department with the corresponding annual report.

(f) A qualified professional and the MS4 operator shall certify, with the stated paragraph found in 327 IAC 15-4-3(g)(3), a submitted SWQMP-Part B: Baseline Characterization and Report checklist form. *(Water Pollution Control Board; 327 IAC 15-13-7; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3584)*

**327 IAC 15-13-8 Submittal of an SWQMP-Part C: program implementation**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 8. (a) An MS4 operator shall develop and implement an SWQMP-Part C: Program Implementation. The SWQMP-Part C: Program Implementation must contain the following:

(1) An initial evaluation of the storm water program for the MS4 area. This evaluation should include information on all known structural and nonstructural storm water BMPs utilized.

(2) A detailed program description for each minimum control measure (MCM) referenced in sections 12 through 17 of this rule.

(3) A timetable for program implementation milestones, which includes milestones for each of the MCMs referenced in sections 12 through 17 of this rule, and applicable SWQMP-Part B: Baseline Characterization and Report conclusions (BMP recommendations, additional protective measures for sensitive areas, and correcting identified water quality problems).

(4) As appropriate, a schedule for ongoing characterization of the receiving waters either at, or in proximity to, outfall locations identified in the SWQMP-Part B: Baseline Characterization and Report to evaluate BMP effectiveness and receiving water quality.

(5) A narrative and mapped description of the MS4 area boundaries that indicate responsible MS4 entity areas for each MCM. The narrative description must include the specific sectional or, as appropriate, the street name boundaries of the MS4 area.

(6) An estimate of the linear feet of MS4 conveyances within the MS4 area, segregated by MS4 type, for example, by open ditch or pipe.

(7) A summary of which structural BMP types will be allowed in new development and redevelopment for the MS4 area.

(8) A summary on storm water structural BMP selection criteria and, where appropriate, associated performance standards that must be met after installation to indicate BMP effectiveness.

(9) A summary of the current storm water budget, expected or actual funding source, and a projection of the budget for each year within the five (5) year permit term.

(10) A summary of measurable goals for, at a minimum, each MCM referenced in sections 12 through 17 of this rule. These measurable goals shall demonstrate results that relate to an environmental benefit.

(11) Completed certification forms, as appropriate, for each MCM. The certification forms only need to be completed and submitted during the initial five (5) year permit term.

(12) The identification of programmatic indicators. Programmatic indicators, grouped by corresponding MCM, must include those listed in subsection (b) that apply to the MS4 operator. Other relevant indicators may be used in place of those listed in subsection (b). If an indicator listed in subsection (b) is not applicable to the operator, or if another relevant indicator is used, the operator shall provide rationale for the nonapplicability or substitution. Programmatic indicators do not need to be fully implemented at the time of the SWQMP-Part C: Program Implementation submittal. Updated data for each of these indicators

must be submitted in each annual report.

(b) The programmatic indicators must address the following:

(1) Number or percentage of citizens, segregated by type of constituent as referenced in section 12(a) of this rule, that have an awareness of storm water quality issues.

(2) Number and description of meetings, training sessions, and events conducted to involve citizen constituents in the storm water program.

(3) Number or percentage of citizen constituents that participate in storm water quality improvement programs.

(4) Number and location of storm drains marked or cast, segregated by marking method.

(5) Estimated or actual linear feet or percentage of MS4 mapped and indicated on an MS4 area map.

(6) Number and location of MS4 area outfalls mapped.

(7) Number and location of MS4 area outfalls screened for illicit discharges.

(8) Number and location of illicit discharges detected.

(9) Number and location of illicit discharges eliminated.

(10) Number of and estimated or actual amount of material, segregated by type, collected from HHW collections in the MS4 area.

(11) Number and location of constituent drop-off centers for automotive fluid recycling.

(12) Number or percentage of constituents that participate in the HHW collections.

(13) Number of construction sites obtaining an MS4 entity-issued storm water run-off permit in the MS4 area.

(14) Number of construction sites inspected.

(15) Number and type of enforcement actions taken against construction site operators.

(16) Number of, and associated construction site name and location for, public informational requests received.

(17) Number, type, and location of structural BMPs installed.

(18) Number, type, and location of structural BMPs inspected.

(19) Number, type, and location of structural BMPs maintained or improved to function properly.

(20) Type and location of nonstructural BMPs utilized.

(21) Estimated or actual acreage or square footage of open space preserved and mapped in the MS4 area, if applicable.

(22) Estimated or actual acreage or square footage of pervious and impervious surfaces mapped in the MS4 area, if applicable.

(23) Number and location of new retail gasoline outlets or municipal, state, federal, or institutional refueling areas, or outlets or refueling areas that replaced existing tank systems that have installed storm water BMPs.

(24) Number and location of MS4 entity facilities that have containment for accidental releases of stored polluting materials.

(25) Estimated or actual acreage or square footage, amount, and location where pesticides and fertilizers are applied by a regulated MS4 entity to places where storm water can be exposed within the MS4 area.

(26) Estimated or actual linear feet or percentage and location of unvegetated swales and ditches that have an appropriately-sized vegetated filter strip.

(27) Estimated or actual linear feet or percentage and location of MS4 conveyances cleaned or repaired.

(28) Estimated or actual linear feet or percentage and location of roadside shoulders and ditches stabilized, if applicable.

(29) Number and location of storm water outfall areas remediated from scouring conditions, if applicable.

(30) Number and location of deicing salt and sand storage areas covered or otherwise improved to minimize storm water exposure.

(31) Estimated or actual amount, in tons, of salt and sand used for snow and ice control.

(32) Estimated or actual amount of material by weight collected from catch basin, trash rack, or other structural BMP cleaning.

(33) Estimated or actual amount of material by weight collected from street sweeping, if utilized.

(34) If applicable, number or percentage and location of canine parks sited at least one hundred fifty (150) feet away from a surface waterbody.

(c) An SWQMP-Part C: Program Implementation and completed corresponding certification form must be submitted to the department within three hundred sixty-five (365) days from the date the initial NOI letter submittal was received by the department or the expiration date of the previous five (5) year permit term.

(d) The department shall review submitted SWQMP-Part C: Program Implementations for adequacy. Either a written NOD letter requesting additional information or NOS letter shall be sent to the MS4 operator within ninety (90) days of the SWQMP-Part C: Program Implementation submittal. If no letter is issued within ninety (90) days of submittal, the plan is deemed sufficient.

(e) Responses to NOD letters must be made by the recipient within thirty (30) days of the date on the NOD letter.

(f) As conditions or allowed technologies change, the SWQMP-Part C: Program Implementation must be updated. When updates are created, relevant sections of the SWQMP-Part C: Program Implementation containing the updates must be submitted to the commissioner as an attachment to the corresponding annual report required under section 18 of this rule.

(g) A qualified professional and the MS4 operator shall certify, with the stated paragraph found in 327 IAC 15-4-3(g)(3), a submitted SWQMP-Part C: Program Implementation checklist form. *(Water Pollution Control Board; 327 IAC 15-13-8; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3585; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-9 Submittal of an NOI letter and other documents**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 9. (a) All information required under section 6 of this rule must be submitted to the commissioner. An MS4 entity that meets the designation criteria under section 3 of this rule shall submit the NOI letter, SWQMP-Part A: Initial Application, and other required documentation no later than ninety (90) days from the effective date of this rule unless:

(1) written permission for a later date has been granted by the commissioner; or

(2) the MS4 entity was not notified in writing at least one hundred eighty (180) days prior to the effective date of this rule.

(b) A termination request, the NOI letter, Parts A, B, and C of the SWQMP, and any other required information must be submitted to:

Indiana Department of Environmental Management
Office of Water Quality, Urban Wet Weather Section
100 North Senate Avenue, Room N1255
Indianapolis, Indiana 46204
Attention: Rule 13 Storm Water Coordinator

(c) The permit and the compliance schedules of this rule become effective upon receipt of the initial NOI letter by the department.

(d) The commissioner may deny coverage under this rule and require submittal of an application for an individual NPDES permit based on a review of the NOI letter or other information. This review may consider the location and size of the discharge, the quantity and nature of the pollutants discharged, and other relevant factors. Before completing the review, the department will inform the MS4 entity as to what information is being used for the review and provide the MS4 entity an opportunity to respond if the MS4 entity believes the information used is inaccurate or incomplete.

(e) An MS4 entity that either was not notified in writing at least one hundred eighty (180) days prior to the effective date of this rule or meets the designation criteria of section 3 of this rule after the effective date of this rule due to changing conditions or new facility construction shall submit the required information under section 6 of this rule within three hundred sixty-five (365) days of either:

(1) the date of receivership on the written notification;

(2) becoming aware of the relevant changed conditions; or

(3) upon the initiation of facility operations;

unless written permission for a later date has been granted by the commissioner.

(f) Any person who knowingly makes any false statement, representation, or certification in any document submitted or required to be maintained under this rule is subject to 327 IAC 15-4-3(i). *(Water Pollution Control Board; 327 IAC 15-13-9; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3587; errata filed Feb 6, 2006, 11:15 a.m.: 29 IR 1939)*

**327 IAC 15-13-10 MS4 permit implementation; coordination with total maximum daily load allocations**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 10. If a total maximum daily load (TMDL) is approved for any waterbody into which an MS4 conveyance discharges, the MS4 operator must review and appropriately modify Parts B and C of their SWQMP if the TMDL includes requirements for control of storm water discharges under the jurisdiction of the MS4 operator. *(Water Pollution Control Board; 327 IAC 15-13-10; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3587)*

**327 IAC 15-13-11 Compliance schedule**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 11. An MS4 operator shall comply with the following schedule for implementation of this rule:

| Rule Requirement | Compliance Deadline (from initial NOI letter receivership date) |
|---|---|
| Storm Water Quality Management Plan: | Components throughout term of permit |
| Part A: Initial Application submitted | With NOI letter |
| Part B: Baseline Characterization and Report submitted | 180 days |
| Part C: Program Implementation submitted | 1 year |
| Public Education and Outreach MCM implementation: | Throughout term of permit |
| Public education and outreach program development certification submitted | 1 year |
| Public Involvement/Participation MCM implementation: | Throughout term of permit |
| Public involvement and participation program development certification submitted | 1 year |
| Illicit Discharge Detection/Elimination MCM implementation: | Throughout term of permit |
| Illicit discharge plan and regulatory mechanism certification submitted | 1 year |
| 25% of storm water outfalls systems mapped | Each year after 1 year |
| All known storm water outfall systems, with pipe diameters 12 inches or greater or open ditches with 2 feet or larger bottom width, mapped | 5 years |
| Construction Site Run-Off Control MCM implementation: | Throughout term of permit |
| Construction site program plan and regulatory mechanism certification submitted | 1 year |
| Postconstruction Run-Off Control MCM implementation: | Throughout term of permit |
| Operational and maintenance plan certification submitted | 2 years |
| Postconstruction program plan and regulatory mechanism certification submitted | 2 years |
| Municipal operations pollution prevention and good housekeeping MCM implementation: | Throughout term of permit |
| Operations pollution prevention program development certification submitted | 1 year |

If an MS4 operator is unable to meet a compliance deadline under this section the operator shall submit a written request and justification for extending the deadline. The request must be submitted to the department no later than thirty (30) days prior to the due date. *(Water Pollution Control Board; 327 IAC 15-13-11; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3587)*

**327 IAC 15-13-12 Storm water quality management plan public education and outreach MCM**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 12. (a) An MS4 operator shall develop an SWQMP that includes methods and measurable goals that will be used to inform residents, visitors, public service employees, commercial and industrial facilities, and construction site personnel within the MS4 area about the impacts polluted storm water run-off can have on water quality and ways they can minimize their impact on storm water quality. The MS4 operator shall ensure, via documentation, that a reasonable attempt was made to reach all constituents within the MS4 area to meet this measure.

(b) MS4 operators are encouraged to utilize existing programs and outreach materials to meet this measure. MS4 operators shall identify and implement an informational program with educational materials for constituents. A certification form shall be completed and submitted to the department once the program has been developed and implemented or three hundred sixty-five (365) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the program shall be reviewed

for adequacy and accuracy and updated, as necessary.

(c) MS4 operators shall develop measurable goals for this MCM. An initial assessment of the MS4 area constituents must be conducted to determine initial constituent knowledge and practices as they relate to storm water quality. To comply with this measure, specific target outreach or reduction goal percentages and timetables must be identified. As applicable or, if not applicable, then appropriately justified, goals must address relevant targeted audience improvement in disposal practices, cast storm drain cover installations, school curricula or Web site implementation, outreach to every population sector, and educational material distribution.

(d) In combined sewer system municipalities designated under this rule, the current LTCP shall be reviewed, and any necessary language changes to ensure consistency with the SWQMP shall be included in the plan to ensure that this MCM requirement is met. *(Water Pollution Control Board; 327 IAC 15-13-12; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3588; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-13 Storm water quality management plan public participation and involvement MCM**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 13. (a) The MS4 operator shall develop an SWQMP that includes provisions to allow opportunities for constituents within the MS4 area to participate in the storm water management program development and implementation. An MS4 operator shall ensure, via documented efforts, that sufficient opportunities were allotted to involve all constituents interested in participating in the program process to meet this measure. Correctional facilities will not be required to implement the public participation and involvement MCM.

(b) An MS4 entity shall comply with applicable public notice requirements. An MS4 operator shall identify and implement a public participation and involvement program. A certification form shall be completed and submitted to the department once the program has been developed and implemented or three hundred sixty-five (365) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the program shall be reviewed for adequacy and accuracy and updated as necessary.

(c) An MS4 operator shall develop measurable goals for this MCM. An initial assessment of MS4 area constituents must be conducted to identify interested individuals for participation in the MS4 area storm water program. To comply with this measure, specific outreach and reduction goal percentages and timetables must be identified. As applicable or, if not applicable, then appropriately justified, goals must address relevant community participation in citizen panels, community clean-ups, citizen watch groups and drain marking projects, and public meeting notification.

(d) In combined sewer system municipalities designated under this rule, the current LTCP shall be reviewed, and any necessary language changes to ensure consistency with the SWQMP shall be included in the plan to ensure that this MCM requirement is met. *(Water Pollution Control Board; 327 IAC 15-13-13; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3588)*

**327 IAC 15-13-14 Storm water quality management plan illicit discharge detection and elimination MCM**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 14. (a) An MS4 operator shall develop an SWQMP that includes a commitment to develop and implement a strategy to detect and eliminate illicit discharges to the MS4 conveyance.

(b) An MS4 operator shall develop a storm sewer system map showing the location of all outfalls and MS4 conveyances in the particular MS4 area under the MS4 operator's control and the names and locations of all waters that receive discharges from those outfalls. A map developed under this subsection must meet the following:

(1) At a minimum, longitude and latitude for mapped outfall locations must be done in decimal degrees, or, if a global positioning system is utilized, mapping-grade accuracy data shall be collected, where an accuracy discrepancy is less than five (5) meters.

(2) The mapping requirement must be developed as follows:

(A) All known outfall conveyance systems with a pipe diameter of twelve (12) inches or larger and open ditches with a two (2) foot or larger bottom width must be mapped within the first five (5) year permit term according to the following:

(i) After the second year of permit coverage, mapping must depict the location of outfall conveyance systems for

at least twenty-five percent (25%) of the MS4 conveyances within the MS4 area.

(ii) For each additional year of the initial permit term, mapping must depict at least an additional twenty-five percent (25%) of the MS4 conveyances.

(B) Subsequent permit terms will require that all remaining outfall conveyance systems are mapped.

(3) The mapping requirements in subdivision (2) do not include private or mutual drains, yard swales that are not maintained by a regulated MS4 entity, or curbs and gutters.

(c) Through an ordinance or other regulatory mechanism, an MS4 operator shall prohibit illicit discharges into MS4 conveyances and establish appropriate enforcement procedures and actions.

(d) An MS4 operator shall develop a plan to detect, address, and eliminate illicit discharges, including illegal dumping, into the MS4 conveyance. This plan need not address the following categories of nonstorm water discharges or flows unless the MS4 operator identifies them as significant contributors of pollutants to its MS4 conveyance:

(1) Water line flushing.
(2) Landscape irrigation.
(3) Diverted stream flows.
(4) Rising ground waters.
(5) Uncontaminated ground water infiltration.
(6) Uncontaminated pumped ground water.
(7) Discharges from potable water sources.
(8) Foundation drains.
(9) Air conditioning condensation.
(10) Irrigation water.
(11) Springs.
(12) Water from crawl space pumps.
(13) Footing drains.
(14) Lawn watering.
(15) Individual residential car washing.
(16) Flows from riparian habitats and wetlands.
(17) Dechlorinated swimming pool discharges.
(18) Street wash water.
(19) Discharges from firefighting activities.

(e) The plan developed under subsection (d) must, at a minimum, locate problem areas via dry weather screening or other means, determine the source, remove or otherwise correct illicit connections, and document the actions taken. The dry weather screening or other means must utilize a field testing kit, or similar method, to analyze for pollutants of concern and other parameters, such as pH, conductivity, or nitrogen-ammonia, used to identify possible pollutant sources. All storm water outfalls in the regulated MS4 area under the MS4 operator's control must be screened for illicit discharges. The screening may be initiated gradually throughout successive five (5) year permit cycles. If the gradual approach is utilized, all storm water outfalls with a pipe diameter of twelve (12) inches or larger and open ditches with a two (2) foot or larger bottom width must be screened in the first five (5) year permit term. Subsequent permit terms will require that all remaining outfalls be screened.

(f) The plan developed under subsection (d) must identify all active industrial facilities within the MS4 area that discharge into an MS4 conveyance. This identification shall include the facility name, address, telephone number, and Standard Industrial Classification (SIC) code. Updated information regarding active industrial facilities must be submitted in each annual report.

(g) A certification form must be completed and submitted to the department once the plan has been developed and implemented or three hundred sixty-five (365) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the program shall be reviewed for adequacy and accuracy and updated as necessary.

(h) An MS4 operator shall educate public employees, businesses, and the general public about the hazards associated with illicit discharges and improper disposal of waste. This educational effort shall include the following:

(1) Informational brochures and guidances for specific audiences and school curricula.

(2) Publicizing and facilitating public reporting of illicit discharges and spills.

(i) An MS4 operator shall initiate, or coordinate existing, recycling programs in the regulated MS4 area for commonly dumped wastes, such as motor oil, antifreeze, and pesticides.

(j) An MS4 operator shall develop measurable goals for this MCM. To comply with this measure, specific outreach and reduction percentages and timetables must be identified. At a minimum, goals must address relevant collection system mapping, regulatory mechanism implementation, employee training, household hazardous waste programs, illicit discharge detection, and illicit discharge elimination.

(k) In combined sewer system municipalities designated under this rule, the current CSOOP and LTCP must be reviewed, and any necessary language changes to ensure consistency with the SWQMP must be included in the plans to ensure that this MCM requirement is met. *(Water Pollution Control Board; 327 IAC 15-13-14; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3589)*

**327 IAC 15-13-15 Storm water quality management plan construction site storm water run-off control MCM**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 15. (a) An MS4 operator shall develop an SWQMP that includes a commitment to develop, implement, manage, and enforce an erosion and sediment control program for construction activities that disturb one (1) or more acres of land within the MS4 area.

(b) Through an ordinance or other regulatory mechanism, the MS4 operator shall establish a construction program that controls polluted run-off from construction activities with a land disturbance greater than or equal to one (1) acre, or disturbances of less than one (1) acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one (1) or more acres of land. Except for state permitting process references and submittal deadlines of construction plans and permit applications in 327 IAC 15-5, this ordinance or other regulatory mechanism must contain, at a minimum, the requirements of 327 IAC 15-5. The MS4 operator may establish a permitting process and timetable for plan and application submittals that are different than that established under 327 IAC 15-5. The permitting process must include a requirement for the construction project site owner to submit a copy of the application directly to the department. A certification form shall be completed and submitted to the department once the ordinance or other regulatory mechanism is developed and a program has been implemented or three hundred sixty-five (365) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the regulatory mechanism and program shall be reviewed for adequacy and accuracy and updated as necessary. Until the MS4 operator program is implemented, NOI letters and construction plans for construction activities within the MS4 area will be submitted in accordance with 327 IAC 15-5-5 and 327 IAC 15-5-6 to the department and the local SWCD or department of natural resources, division of soil conservation, respectively.

(c) If the MS4 operator has not entered into a written agreement with the local SWCD to review and approve construction site plans or conduct construction site inspections, the MS4 operator shall provide an opportunity to the local SWCD to provide comments and recommendations to the MS4 operator on individual projects. This process may be accomplished by the MS4 operator establishing a local plan review and comment procedure, a project technical review committee, or other mechanism to solicit the input of the local SWCD.

(d) Failure of the SWCD to respond within a predetermined time period should not delay final action of the MS4 operator to approve plans or projects.

(e) In addition to any procedural requirements for submittal to the MS4 operator or MS4 designated entity, an NOI letter required under 327 IAC 15-5 must be submitted to the department for any projects within the MS4 area.

(f) The MS4 operator, or a designated MS4 entity, shall meet the following:

(1) Develop requirements for the implementation of appropriate BMPs on construction sites to control sediment, erosion, and other waste.

(2) Review and approve the construction plans submitted by the construction site operator before construction activities commence.

(3) Develop procedures for site inspection and enforcement to ensure that BMPs are properly installed.

(4) Establish written procedures to identify priority sites for inspection and enforcement based on, at a minimum, the nature and extent of the construction activity, topography, and the characteristics of soils and receiving water quality.

(5) Develop procedures for the receipt and consideration of public inquiries, concerns, and information submitted regarding local construction activities.

(6) Implement, at a minimum, a tracking process in which submitted public information, both written and verbal, is documented and then given to appropriate staff for follow-up.

(g) MS4 area personnel responsible for plan review, inspection, and enforcement of construction activities shall receive, at a minimum, annual training addressing such topics as appropriate control measures, inspection protocol, and enforcement procedures.

(h) An MS4 operator shall develop measurable goals for this MCM. To comply with this measure, specific outreach, compliance, and implementation goal percentages and timetables must be identified. At a minimum, goals must address relevant regulatory mechanism implementation, public informational request procedure implementation, site inspection procedure implementation, and construction site operator compliance improvement.

(i) For those construction activities operated by the MS4 operator or MS4 municipalities within the MS4 area, construction plans must be submitted to the local SWCD, the department of natural resources, division of soil conservation, or other entity designated by the department for review and approval. If the MS4 operator does not receive either a notice of deficiency or an approval within thirty-five (35) days of the submittal, the plan will be considered adequate. After a one (1) year period of compliance, the MS4 operator or the designated MS4 entity need not submit the plans and may review MS4-operated project construction plans internally with the written authorization of the department of natural resources, division of soil conservation.

(j) In addition to the requirements of 327 IAC 15-5-6.5, the MS4-operated project construction plans must include a traffic phasing plan for those projects that have the potential to alter vehicular traffic routes.

(k) In addition to the requirements of 327 IAC 15-5-6.5(a)(7), the MS4-operated project storm water pollution prevention plan must address the following areas outside of right-of-ways:

(1) Utility relocation areas.

(2) Material hauling and transportation routes/roads.

(3) Borrow pits.

(4) Temporary staging and material stockpile areas.

(5) Temporary disposal areas for waste materials.

*(Water Pollution Control Board; 327 IAC 15-13-15; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3590; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-16 Storm water quality management plan postconstruction storm water run-off control MCM**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2

Affected: IC 13-18-4

Sec. 16. (a) An MS4 operator shall develop an SWQMP that includes a commitment to develop, implement, manage, and enforce a program to address discharges of postconstruction storm water run-off from new development and redevelopment areas that disturb one (1) or more acres of land or disturbances of less than one (1) acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one (1) or more acres of land within the MS4 area.

(b) Through the use of an ordinance or other regulatory means, an MS4 operator shall implement planning procedures to promote improved water quality. These planning procedures must include, at a minimum, the postconstruction requirements of 327 IAC 15-5-6.5(a)(8). Where appropriate, and to the extent of the MS4 operator's authority, the procedures may also include the following:

(1) Buffer strip and riparian zone preservation.

(2) Filter strip creation.

(3) Minimization of land disturbance and surface imperviousness.

(4) Minimization of directly connected impervious areas.

(5) Maximization of open space.

(6) Directing the community's physical growth away from sensitive areas and toward areas that can support it without compromising water quality.

A certification form that combines the completed requirements of this subsection and subsection (e) shall be completed and submitted to the department once the ordinance or other regulatory means has been developed and a program has been implemented or seven hundred thirty (730) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the program shall be reviewed for adequacy and accuracy and updated as necessary.

(c) Where appropriate, an MS4 operator shall use any combination of storage, infiltration, filtering, or vegetative practices to reduce the impact of pollutants in storm water run-off on receiving waters. In addition to the combination of practices, the following requirements shall be utilized:

(1) Infiltration practices will not be allowed in wellhead protection areas.

(2) Discharges from an MS4 area will not be allowed directly into sinkholes or fractured bedrock without treatment that results in the discharge meeting Indiana ground water quality standards as referenced in 327 IAC 2-11.

(3) Any storm water practice that is a Class V injection well must ensure that the discharge from such practices meets Indiana ground water quality standards as referenced in 327 IAC 2-11.

(4) As site conditions allow, the rate at which water flows through the MS4 conveyances shall be regulated to reduce outfall scouring and stream bank erosion.

(5) As site conditions allow, a vegetated filter strip of appropriate width shall be maintained along unvegetated swales and ditches.

(6) New retail gasoline outlets, new municipal, state, federal, or institutional refueling areas, or outlets and refueling areas that replace their existing tank systems shall be required by MS4 ordinance or other regulatory means to design and install appropriate practices to reduce lead, copper, zinc, and polyaromatic hydrocarbons in storm water run-off.

(d) MS4 area personnel responsible for plan review, inspection, and enforcement of postconstruction BMPs shall receive, at a minimum, annual training addressing such topics as appropriate control measures, inspection protocol, and enforcement procedures.

(e) An MS4 operator shall develop and implement a written operational and maintenance plan for all storm water structural BMPs. A certification form that combines the completed requirements of this subsection and subsection (b) shall be completed and submitted to the department once the plan has been developed and implemented or seven hundred thirty (730) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the program shall be reviewed for adequacy and accuracy and updated as necessary.

(f) An MS4 operator shall develop measurable goals for this measure. To comply with this measure, specific reduction percentages and timetables must be identified. At a minimum, goals must address relevant regulatory mechanism implementation, planning and structural BMP strategies, new impervious surface reduction, and discharge quality improvement. *(Water Pollution Control Board; 327 IAC 15-13-16; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3591; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-17 Storm water quality management plan municipal operations pollution prevention and good housekeeping MCM**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 17. (a) An MS4 operator shall develop an SWQMP that includes a commitment to develop and implement a program to prevent or reduce pollutant run-off from municipal operations within the MS4 area.

(b) To the extent of their authority, an MS4 operator shall develop and implement a program to ensure that existing municipal, state, or federal operations are performed in ways that will reduce contamination of storm water discharges. A certification form must be completed and submitted to the department once the program has been developed and implemented or three hundred sixty-five (365) days from the date the initial NOI letter submittal was received by the department, whichever is earlier. In subsequent permit terms, the certification form does not need to be completed and submitted. At a minimum, every five (5) years the program shall be reviewed for adequacy and accuracy and updated as necessary. This program must include the following:

(1) Written documentation of maintenance activities, maintenance schedules, and long term inspection procedures for BMPs to reduce floatables and other pollutants discharged from the separate storm sewers. Maintenance activities shall include, as appropriate, the following:

(A) Periodic litter pick up as defined in the MS4 area SWQMP.

(B) Periodic BMP structure cleaning as defined in the MS4 area SWQMP.

(C) Periodic pavement sweeping as defined in the MS4 area SWQMP.

(D) Roadside shoulder and ditch stabilization.

(E) Planting and proper care of roadside vegetation.

(F) Remediation of outfall scouring conditions.

(2) Controls for reducing or eliminating the discharge of pollutants from operational areas, including roads, parking lots, maintenance and storage yards, and waste transfer stations. Appropriate controls shall include the following:

(A) Covering or otherwise reducing the potential for polluted storm water run-off from deicing salt or sand storage piles.

(B) Establishing designated snow disposal areas that have minimal potential for pollutant run-off impact on MS4 area

receiving waters.

(C) Providing facilities for containment of any accidental losses of concentrated solutions, acids, alkalies, salts, oils, or other polluting materials.

(D) Standard operating procedures for spill prevention and clean-up during fueling operations.

(E) BMPs for vehicular maintenance areas.

(F) Prohibition of equipment or vehicle wash waters and concrete or asphalt hydrodemolition waste waters into storm water run-off except under the allowance of an appropriate NPDES wastewater permit.

(G) Minimization of pesticide and fertilizer use. Pesticides shall be used, applied, handled, stored, mixed, loaded, transported, and disposed of via office of the Indiana state chemist's guidance requirements.

(H) Proper disposal of animal waste. If applicable, it is recommended that canine parks be sited at least one hundred fifty (150) feet away from a surface waterbody.

(3) Written procedures for the proper disposal of waste or materials removed from separate storm sewer systems and operational areas. All materials removed from separate storm sewer systems and operational areas, including dredge spoil, accumulated sediments, floatables, and debris, must be:

(A) reused or recycled; or

(B) disposed of in accordance with applicable solid waste disposal regulations.

(4) Written documentation that new flood management projects are assessed for their impacts on water quality and existing flood management projects are examined for incorporation of additional water quality protection devices or practices.

(5) Written documentation that appropriate MS4 entity employees have been properly trained, with periodic refresher sessions, on topics such as proper disposal of hazardous wastes, vegetative waste handling, fertilizer and pesticide application, and the function of implemented BMPs.

(c) An MS4 operator shall develop measurable goals for this MCM. To comply with this measure, specific reduction percentages and timetables must be identified. As applicable or, if not applicable, then appropriately justified, goals must address relevant catch basin cleaning and street sweeping procedures, employee training, recycling program implementation, pesticide, fertilizer and sand or salt usage reductions, floatables reduction, and maintenance schedule for BMPs.

(d) In combined sewer system municipalities designated under this rule, the current CSOOP and LTCP will need to be reviewed, and any necessary language changes to ensure consistency with the SWQMP must be included in the plans to ensure that this MCM requirement is met. *(Water Pollution Control Board; 327 IAC 15-13-17; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3592)*

**327 IAC 15-13-18 Reporting requirements**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 18. (a) An MS4 operator regulated under this rule shall submit an annual report to the department with the following information:

(1) Progress towards development, implementation, and enforcement of all MCMs, including updated programmatic indicator data.

(2) Summary of complaints received and follow-up investigation results related to storm water quality issues.

(3) Updated measurable goals.

(4) Storm water BMPs installed or initiated.

(5) Follow-up or additional water quality characterization.

(6) Updated active industrial facilities list.

(7) Implementation problems encountered, including BMP changes due to ineffectiveness or infeasibility.

(8) Funding sources and expenditures.

(9) Changes to MS4 area boundaries, including land areas added to the MS4 area via annexation or other similar means.

(10) Identified storm water quality improvement projects.

(11) Updated receiving water information.

The initial annual report shall be postmarked no later than three hundred sixty-five (365) days from the date the SWQMP-Part C: Program Implementation submittal was received by the department. Subsequent report submittals during the first five (5) year permit term shall be provided no later that three hundred sixty-five (365) days from the previous report in years three (3), four (4), and five (5). In subsequent permit terms, reports must be submitted in years two (2) and four (4).

(b) An MS4 operator shall submit a monthly construction site project summary to the department containing a listing of all project names associated with section 15 of this rule, the project address, project duration, and an indication of enforcement actions undertaken. If no projects occur within a given month, a report does not need to be submitted. Reports must be postmarked no later than the last day of the following month. The commissioner may develop criteria for an alternative acceptable timetable for submission of this summary.

(c) The summary required under subsection (b) must address those projects for which there has been:

(1) an NOI letter submittal, or its equivalent, to the MS4 entity; or

(2) a Notice of Termination letter, or its equivalent, processed by the MS4 entity.

(d) An MS4 operator shall certify by signature on the annual report form that information provided is true and accurate. *(Water Pollution Control Board; 327 IAC 15-13-18; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3593; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-19 Permit duration**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 19. (a) The permits under this rule are valid for five (5) years from the date the initial NOI letter was received by the department. Renewal application for the permit is required at least sixty (60) days prior to the expiration date. Coverage under renewal NOI letters will begin on the date of expiration from the previous five (5) year permit term.

(b) If MS4 entity conditions change within an MS4 area, written notification of the changes must be submitted to the commissioner.

(c) For a complete renewal application to be sufficient, a new NOI letter and SWQMP-Part A: Initial Application must be submitted in accordance with sections 6 and 9 of this rule.

(d) Permits may be reissued on a watershed basis to take into account surface water quality monitoring strategies and sampling data analyses for individual drainage areas.

(e) Subsequent permits will require the MS4 operator to maintain and, where possible, improve their performance in implementing the six (6) MCMs. *(Water Pollution Control Board; 327 IAC 15-13-19; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3594)*

**327 IAC 15-13-20 Permit termination**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 20. (a) An MS4 entity may request the department to terminate permit coverage under this rule if:

(1) based on physical changes in the MS4 area, the permit is no longer needed;

(2) based on a lack of cooperation between MS4 entities, a new general permit NOI letter is needed; or

(3) based on documented reductions in population, population density, occupancy, or enrollment that result in numbers below minimum designation criteria and a request based on this subdivision will only be considered once a permit under this rule has expired.

(b) The department may terminate permit coverage under this rule and require an MS4 entity to apply for an individual permit if one (1) of the six (6) cases referenced in 327 IAC 15-2-9(b) is applicable. *(Water Pollution Control Board; 327 IAC 15-13-20; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3594)*

**327 IAC 15-13-21 Standard conditions**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-14-10; IC 13-18-4; IC 13-30

Sec. 21. The standard conditions for the NPDES general permit rule under 327 IAC 15-4 shall apply to this rule. *(Water Pollution Control Board; 327 IAC 15-13-21; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3594; errata filed Sep 8, 2003, 3:15 p.m.: 27 IR 191)*

**327 IAC 15-13-22 Inspection and enforcement**

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-14-10; IC 13-18-4; IC 13-30

Sec. 22. (a) The commissioner may inspect an MS4 entity regulated under this rule at any time. Any documentation required in sections 6 through 20 of this rule or related to implementation of this rule must be available at the physical address corresponding to the MS4 operator or the primary contact individual for review by the commissioner during normal business hours.

(b) At a minimum, records shall be established and maintained at the address referenced in subsection (a) for the five (5) years of the permit term. The five (5) year period will be extended:

(1) automatically during the course of any unresolved litigation regarding the discharge of pollutants by the MS4 operator, or other MS4 entity regulated by the MS4 area permit, or regarding promulgated effluent guidelines applicable to the MS4 area; or

(2) as requested by the regional administrator of the United States Environmental Protection Agency or the commissioner..

(c) The commissioner may request data to facilitate the identification or quantification of pollutants that may be released to the environment from an MS4 conveyance or to determine effectiveness of the MCMs.

(d) The commissioner, or an authorized representative, upon providing appropriate credentials, may inspect an MS4 entity regulated under this rule at any time. As it pertains to sections 15 and 16 of this rule, the department of natural resources, division of soil conservation staff, or their designated representative, upon providing appropriate credentials, may inspect an MS4 entity regulated under this rule at any time. Record keeping and reporting requirements for sections 15 and 16 of this rule shall conform to 327 IAC 15-5.

(e) All persons or MS4 entities responsible for the MS4 conveyances shall be responsible for complying with the SWQMP for the MS4 area and the provisions of this rule. Any person or MS4 entity causing or contributing to a violation of any provisions of this rule shall be subject to IC 13-30 and IC 13-14-10.

(f) All projects within a regulated MS4 area meeting the applicability requirements of 327 IAC 15-5 are subject to inspection and enforcement by the department or their designated representative for violations associated with 327 IAC 15-5. *(Water Pollution Control Board; 327 IAC 15-13-22; filed Jul 7, 2003, 2:15 p.m.: 26 IR 3594)*

## Rule 14. On-Site Residential Sewage Discharging Disposal Systems within the Allen County On-Site Waste Management District

### 327 IAC 15-14-1 Purpose

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4

Sec. 1. The purpose of this rule is to establish requirements for point source discharges of treated sewage from on-site residential sewage discharging disposal systems within the Allen County on-site waste management district so that the public health, existing water uses, and aquatic biota are protected. *(Water Pollution Control Board; 327 IAC 15-14-1; filed Dec 18, 2003, 10:39 a.m.: 27 IR 1563)*

### 327 IAC 15-14-2 Applicability

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-18-4; IC 13-18-12-9

Sec. 2. This rule applies to on-site residential sewage discharging disposal systems located within the Allen County on-site waste management district that have been installed to repair or replace a sewage disposal system that fails to meet public health and environmental standards and for which an operating permit has been issued pursuant to IC 13-18-12-9. Such systems shall discharge one thousand (1,000) gallons or less per day of treated sanitary wastewater. *(Water Pollution Control Board; 327 IAC 15-14-2; filed Dec 18, 2003, 10:39 a.m.: 27 IR 1563)*

### 327 IAC 15-14-3 Definitions

Authority: IC 13-14-8; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3-1; IC 13-18-3-2
Affected: IC 13-11-2; IC 13-18-4; IC 36-11

Sec. 3. In addition to the definitions contained in IC 13-11-2, 327 IAC 5, and 327 IAC 15-1-2, the following definitions apply throughout this rule:

# Appendix 2.6

# CHAPTER 56: STORMWATER MANAGEMENT

Section

## STORMWATER MANAGEMENT USER FEE

### § 56.01 DEFINITIONS.

For the purpose of this chapter, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

***BOARD.*** Stormwater Board charged with administering the storm sewer/stormwater program pursuant to I.C. 36-9-23 and 36-9-1-8. For the time period in which the interim user fee (as defined in § 56.05) is in effect the New Albany Sewer Board will serve as the Stormwater Board. A separate Stormwater Board shall be established to manage the program after the transition from the interim user fee structure.

***ERU (EQUIVALENT RESIDENTIAL UNIT).*** The national accepted average of impervious area square footage of a detached single-family residential property equal to 2,500 square feet. This is the unit to which the base rate is applied.

***IDEM.*** Indiana Department of Environmental Management.

***IMPERVIOUS AREA.*** Surface areas of residential and non-residential properties which water will not penetrate and from which stormwater runoff will be produced. This includes, but is not limited to, rooftops, sidewalks, parking lots, pavements, concrete, compacted aggregate or gravel and asphalt.

***NON-RESIDENTIAL DEVELOPED PROPERTY.*** All tracts of real property either zoned or developed for:

(1) Residential use intended for occupancy by more than two families per residential structure (e.g., apartment houses with three or more units under a single roof);

(2) Commercial uses;

(3) Non-profit non-residential uses (e.g., governmental organizations, churches and fraternal organizations); and

(4) Industrial uses.

***NPDES.*** National Pollutant Discharge Elimination System.

***RESIDENTIALLY DEVELOPED PROPERTY.*** All tracts of real property either zoned or developed for residential use in structures designed and permitted for habitation by one or two families (i.e., single-family homes or two-family homes (duplex units)).

***SFR (SINGLE-FAMILY RESIDENTIAL).*** All tracts of real property with improvements intended for occupancy by one or two families for residential purposes (i.e., single-family homes or duplex units), regardless of the number of sewer taps and fees it incurs.

***STORMWATER SYSTEM.*** A system of constructed and naturally occurring above ground and below ground facilities or infrastructure intended to collect, treat, convey and otherwise manage runoff from rain, snow and other precipitation including, but not limited to, drains, inlets, conduits, culverts, manholes, channels, ditches, drainage easements, retention and detention basins, infiltration facilities, lakes, ponds, streams, creeks, rivers and other related components.

***VACANT/UNIMPROVED PROPERTY.*** All tracts of real property that are wholly vacant and unimproved, regardless of the zoning classification assigned to the property or the uses permitted thereon by applicable law, rules and regulations.

(Ord. G-05-52, passed 11-2-2005)

## § 56.02 PURPOSE.

This chapter establishes a stormwater management user fee to fund and support the city's efforts to address the issues presented in the recital provisions of Ord. G-05-52. The user fees include general public (institutional, agency, federal, state and local government and the like) and/or property owner user fees.

(Ord. G-05-52, passed 11-2-2005)

## § 56.03 USER FEE.

(A) All owners of real property in the city shall be charged for the use of the stormwater system based on the amount of stormwater and rate of flow of stormwater that is projected to discharge into the stormwater system from the property.

(B) By this chapter, which may be amended from time to time by resolution of the Council, the city hereby sets and establishes a system of fees that is intended to assess users their fair and equitable share of the costs for use of the stormwater system for each property within the city. These fees shall be established in an amount sufficient to defray the reasonable costs for operation, maintenance and construction of necessary improvements or additions to the stormwater system. The subsequent amendments or adjustments shall take into consideration the amount of funds reasonably necessary to meet the level and cost of service necessary to manage and operate the stormwater system, including any previously unforeseen inflationary pressures, system expansion, increases in state and federal program mandates or related issues that may necessitate management program expansion.

(Ord. G-05-52, passed 11-2-2005)

## § 56.04 PROPERTY AFFECTED.

Except as provided in this chapter, all residentially developed property, non-residential developed property and vacant/unimproved property located within the limits of the city shall be subject to the stormwater service charges established by this chapter regardless of whether the properties are privately or publicly owned.

(Ord. G-05-52, passed 11-2-2005)

## § 56.05 FEES ESTABLISHED.

(A) Subject to the provisions of this chapter, each and every owner and/or operator of residentially developed property, non-residential developed property, and vacant/unimproved property shall have imposed upon them a stormwater user fee. The stormwater user fee shall be a monthly service charge and shall be determined by the provisions of this chapter and the applicable ERU and ERU rate established hereunder, which provisions may be amended from time to time in accordance with the provisions of this chapter or by resolution of the Council.

(B) The Board shall have the authority and discretion to adjust this definition of ERU from time to time by resolution to reflect development trends within the city or further equitably divide the costs of supporting the operation and maintenance of the stormwater system. In adjusting this definition, the Board shall take into consideration the source of the data from which the subject ERU is to be established, the general acceptance and use of the source on the part of other stormwater systems, and the reliability and general accuracy of the source. The Board may also utilize information obtained from property tax assessor's rolls or site examination, mapping information, aerial photographs and other reliable information in order to determine impervious surface areas.

(C) (1) An interim monthly stormwater fee is hereby established. These rates set forth in the table below will remain effective until the Council establishes by resolution a final stormwater management user fee schedule. The interim monthly rate is to be paid by each owner and/or user and shall be paid according to the following schedule:

| ***Zoning Classification*** | ***Monthly Charge*** | ***Final Rate Structure Implementation Priority*** |
|---|---|---|
| Residential or vacant | $2 | N/A - flat base rate |
| Institutional/agency | $60 | Third |
| Industrial | $60 | Second |
| Commercial | $18 | First |

(2) This rate structure will remain effective until a final rate is implemented for the type of property listed above. This interim rate structure will remain effective no longer than:

(a) Six months for commercial;

(b) Nine months for industrial and institutional; and

(c) Twelve months for residential or vacant property.

(D) At a time when the city has the data and administrative capacity to implement a final user fee and the Council enacts a final user fee schedule by resolution, the interim fee schedule defined in division (C) above shall become null and void and shall be replaced with the final fee schedule. The final fee schedule shall incorporate the following rate structure provisions:

(1) Residentially developed properties and unimproved properties shall be billed on a per unit basis at a flat fee of $3.17 per month, established for an equivalent residential unit (ERU), effective June 1, 2006.

(2) The fee for non-residential developed properties shall be calculated based on the total impervious area of the property divided by the then-effective average impervious area for an ERU multiplied by a rate of $3.17 per month established for an ERU, effective June 1, 2006. The impervious area estimate shall be based on construction plans as approved through the building permit process or other sources at the discretion of the Board.

(3) Notwithstanding any other provision of this chapter, the Board shall propose to the Common Council any changes to the base rate, rate structure or any other levees, fees or taxes on the public.

(E) Rates and charges incurred under this section shall be prepared and collected by the city in accordance with those provisions regulating the preparation and issuance of bills for sewer service generally. The monies collected under this section shall be used expressly for the benefit of the stormwater system and may not be distributed to the general fund or other unrelated funds.

(Ord. G-05-52, passed 11-2-2005; Ord. G-06-21, passed 6-5-2006)

## § 56.06 COLLECTION.

(A) The billing and collection of stormwater user fees shall be administered by the Board. The stormwater user fees for residentially developed properties and non-residential developed properties shall be billed as frequently as monthly with payment due as of the date stated in the billing. The Common Council is authorized to amend the city's contract with Indiana-American Water Company for the purpose of affecting those billings. The Board shall determine a policy and procedure for billings and collections from all properties without Indiana-American Water Company service. The Common Council shall have authority to enter into agreement with Indiana-American Water Company to provide for suspension of drinking water service in the event of partial or incomplete payment of fees required by this chapter.

(B) For billings and collections administered directly by the city (i.e., not through the Indiana-American Water Company contract), in the event that a partial payment is received, the payment shall be applied pro-rata to each account billed on a consolidated statement by city services in the proportion that the account bears to the total consolidated statement of all current charges for all accounts. All bills for stormwater user fees shall become due and payable in accordance with the rules and regulations in effect, or subsequently adopted by, the Board.

(C) The Board shall have authority to annually place tax liens on properties in default of fees required by this chapter. The Board shall provide notice of any intended tax liens subject to the provisions of applicable Indiana law. Removal of the property tax lien will only occur upon full payment of the stormwater user fees or other payment arrangements approved by the Board. In the alternative, the Board may take appropriate legal action to collect unpaid charges.

(D) The interim user fee defined in § 56.05(C) shall be billed and collected through the existing sanitary sewer billing. The Board shall consider migrating to billing through the county tax bill over the long term and take into account the cost of billing, administration and collection rates.

(E) The threshold for retroactive billing shall be six months. Vacant or unidentified property that has not been charged stormwater user fees may be billed retroactively up to six months.

(Ord. G-05-52, passed 11-2-2005)

## § 56.07 CREDITS; ADJUSTMENTS.

In order to recognize property owners' efforts to reduce stormwater impacts and the resulting decrease in the city's level of service, the city may develop a policy for credits and adjustments to lessen the stormwater user fee for certain properties. This policy for credits and adjustments shall be adopted by resolution of the Board. The Board may also elect to adjust (either upwards or downwards) the user fee rate for selected properties that do not meet the city's minimum stormwater management standards. Property owners may also elect to compensate the city for the additional level of service necessary to address the increased impact on stormwater resulting from a particular property.

(Ord. G-05-52, passed 11-2-2005)

## § 56.08 REVENUE ADMINISTRATION.

(A) All revenues generated by or on behalf of the stormwater management program shall be deposited in a non-reverting stormwater revenue fund and used exclusively for the stormwater management program.

(B) Revenues generated by or on behalf of the stormwater management program pursuant to this chapter shall not exceed the estimated cost of service required to implement the city's identified stormwater quantity and quality level of service. While contingency planning and budgeting is permissible, revenues cannot exceed long-term program cost of service estimates.

(C) To the extent that the stormwater user fees collected are insufficient to construct needed stormwater drainage facilities, the cost of the same may be paid from the city funds as may be determined by the Board and the Common Council. However, revenues from the city's sanitary sewer utility shall not be utilized for stormwater drainage expenses without the prior expressed written consent of the City of New Albany Sewer Board.

(D) The Stormwater Utility Fund shall be used for the following purposes:

(1) Acquisition of property by gift, purchase or condemnation necessary to construct, operate and maintain stormwater management facilities;

(2) Costs of administration and implementation of the stormwater management program;

(3) Engineering and design, debt service and related financing expenses, planning, construction costs for new stormwater facilities and enlargement or improvement of existing facilities;

(4) Operation and maintenance of the stormwater system, including the monitoring and inspection of stormwater control devices and facilities;

(5) Water quality monitoring and water quality programs;

(6) Inspection and enforcement activities;

(7) Elected official, appointed official, stakeholder and general public education and outreach relating to stormwater;

(8) Billing, revenue collection and associated administrative costs; and

(9) Other activities that are reasonably required to manage and operate the stormwater system.

(Ord. G-05-52, passed 11-2-2005)

## § 56.09 POLICY FAIRNESS AND EQUITABILITY.

The Board shall develop, periodically update and make available to the public a document that expresses in the necessary detail the city's policies governing the stormwater user fee rate structure, billing administration and other related issues.

(Ord. G-05-52, passed 11-2-2005)

## § 56.10 ENFORCEMENT.

The Board and Common Council are authorized to take appropriate legal action to require compliance with this chapter.

(Ord. G-05-52, passed 11-2-2005)

## § 56.11 APPEALS.

(A) Any person, firm, corporation or organization notified of non-compliance with this chapter who or that is required to perform monitoring, analyses, reporting and/or corrective actions that is aggrieved by a decision of a city employee or contractor issuing the decision, may appeal the decision in writing to the Board within ten days following the effective date of the decision.

(B) Upon receipt of the request, the Board shall request a report and recommendation from the subject city employee or contractor and shall set the matter for administrative hearing at the earliest practicable date.

(C) At the hearing, the Board may hear additional evidence, and may revoke, affirm or modify the earlier decision. The decision shall be final, subject to appeal to a court of competent jurisdiction.

(D) The threshold for retroactive credits and adjustments shall be six months and shall not be applied to properties in the interim user fee rate structure billing period with exception to vacant or unidentified property that has not been charged stormwater user fees.

(Ord. G-05-52, passed 11-2-2005)

## CONSTRUCTION SITE RUNOFF CONTROL

### § 56.20 TITLE, PURPOSE AND GENERAL PROVISIONS.

(A) *Title*. This subchapter shall be known as the "Construction Site Runoff Control Ordinance" of the City of New Albany, Indiana, and may be so cited.

(B) *Purpose*. The purpose of this subchapter is to provide regulations and measures that will address the issue of clean stormwater in the city and to establish procedures by which these requirements are to be administered and enforced.

(C) *Jurisdiction.*

(1) This subchapter shall govern all properties within the jurisdictional boundaries of the city, including areas of shared development review through a fringe with Floyd County, Indiana, as established by an interlocal agreement adopted by both jurisdictions.

(2) The city requires that all development or redevelopment activities that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre as part of a larger common plan of development or sale, shall obtain a stormwater quality management permit (SWQMP).

(3) (a) The following activity is exempt from the provisions of this subchapter: Agricultural land management activities.

(b) This exemption applies only to permitting procedures and does not apply to any discharge of sediment or other form of water pollution that may leave a site. These discharges may be defined as illicit discharges.

(Ord. Z-06-09, passed 4-3-2006)

### § 56.21 OBJECTIVES.

(A) *Protection of the short-term and long-term public health, safety and general welfare.* This objective will be achieved by:

(1) Providing for regulation and management of the city's stormwater system, including public

and private facilities in the city's jurisdiction; and

(2) Protecting and preserving water quality and fish and wildlife habitat within the city.

(B) *Compliance with state and federal stormwater regulations developed pursuant to the Clean Water Act Amendments of 1987 and subsequent amendments.* The objectives of these regulations include:

(1) Managing the quality of water discharged to the Municipal Separate Storm Sewer System (MS4) by controlling the contribution of pollution and pollutants associated with new development and redevelopment; and

(2) Protecting or enhancing stormwater quality to a level of "designated use" as defined by the Clean Water Act §§ 305(b) and 303(d), being 33 U.S.C. §§ 1315(b) and 1313(d).

(C) *Control.* To control the discharge of sediment and construction site materials into the stormwater system and onto adjacent properties by:

(1) Minimizing erosion and sedimentation;

(2) Reducing the velocity of flows from the project site; and

(3) Protecting all points of discharge from outlets such as pipes, drains, culverts, conduits and channels.

(D) *Developing plans.* To guide the construction of stormwater management facilities by developing stormwater master plans that address quantity and quality.

(E) *Preservation.* To encourage the preservation of floodplains, floodways and open spaces to protect and benefit the community's quality of life and natural resources.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.22 DEFINITIONS.

Definitions established in § 56.46 of this chapter shall apply, in addition to the following definitions, abbreviations and acronyms.

***BEST MANAGEMENT PRACTICES (BMPs).*** Those measures described in the latest edition of The Indiana Department of Natural Resource's guidance documents, including the *Handbook for Erosion Control in Developing Areas,* 1985 or the *Indiana Stormwater Quality Manual*. This shall also include related documents published and distributed by the city.

***CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL (CPESC).*** A national certification sponsored by the Soil and Water Conservation Society (SWCS) and the International Erosion Control Association (IECA). Applicants go through a process including peer reviews and written exams. ***CERTIFIED PROFESSIONALS*** can design and evaluate erosion and sediment control and/or storm water control plans as well as educate others in sound approaches for preventing off-site impacts from development activities.

***CERTIFIED PROFESSIONAL IN STORMWATER QUALITY CONTROL (CPSQC).*** A national certification sponsored by the Soil and Water Conservation Society (SWCS) and the International Erosion Control Association (IECA). Applicants go through a process including peer reviews and written exams. ***CERTIFIED PROFESSIONALS*** can design and evaluate erosion and sediment control and/or storm water control plans as well as educate others in sound approaches for preventing off-site impacts from development activities.

***EUTROPHICATION.*** A natural process of nutrients and sediment building up over time in a body of water until it gradually fills in and disappears from the landscape. Human activities within a watershed can greatly accelerate this process.

***FLOCCULATING.*** Agitation of chemically treated water to induce coagulation. Very small suspended particles collide and agglomerate into a larger heavier "floc" that settle out by gravity. ***FLOCCULATION*** is a principal mechanism in removing turbidity from water.

***HYDROLOGIC PERIMETER.*** The watershed(s) perimeter for subject property.

***HYDROLOGIC UNIT CODE (HUC).*** A number unique to a specific watershed, enabling agencies to have common terms of reference and agree on the boundaries of a watershed. These commonly understood boundaries foster understanding of how landscapes function, where water quality problems should be addressed, and who needs to be involved in the planning process.

***PERIMETER CONTROL PLAN (PCP).*** A component of the stormwater quality management permit that illustrates the steps taken around the perimeter of the project site to prevent sediment discharge and other construction pollutants from leaving the site.

***PERIMETER OUTFALL(S).*** The watershed discharge point(s) for subject property.

***PERMITTEE.*** The person responsible for the land-disturbing activity and who shall have ownership interest in the subject property.

***QUALIFIED PROFESSIONAL.*** An individual who is trained and experienced in stormwater treatment techniques and related fields as may be demonstrated by state registration, professional certification, experience or completion of coursework that enable the individual to make sound, professional judgments regarding stormwater control or treatment and monitoring, pollutant fate and transport and drainage planning.

***STORMWATER POLLUTION PREVENTION PLAN (SWPPP).*** A component of the stormwater quality management permit that illustrates how the discharge of sediment and other construction pollutants will be maintained on the site.

***STORMWATER QUALITY MANAGEMENT PERMIT (SWQMP).*** A legal document that allows the permit holder to break ground or disturb soil on an entire construction site within the provisions of a Perimeter Control Plan and a Stormwater Pollution Prevention Plan. The permit addresses erosion prevention, sediment control and non-sediment pollution prevention activities.

(Ord. Z-06-09, passed 4-3-2006)

**§ 56.23 AUTHORITY AND RIGHT-OF-ENTRY.**

(A) Designated representatives from the city shall have the right-of-entry on or upon the property of any person subject to this subchapter and any permit/document issued hereunder, at all reasonable times.

(B) The city or its designated representatives shall be provided ready access to all parts of the premises for the purposes of inspection, monitoring, sampling, inventory, records examination and copying and the performance of any other duties necessary to determine compliance with this subchapter.

(C) Where a property, site or facility has security measures in place which require proper identification and clearance before entry into its premises, the person shall make necessary arrangements with its security personnel so that, upon presentation of suitable identification, designated representatives from the city shall be permitted to enter without delay for the purposes of performing specific responsibilities.

(D) Designated representatives from the city shall have the right to set up on a person's property such devices necessary to conduct sampling and/or metering of the person's stormwater operations or discharges.

(E) Any temporary or permanent obstruction to safe and easy access to the areas to be inspected and/or monitored shall be removed promptly by the person at the written or verbal request of the city. The costs of clearing the access shall be borne by the owner/operator.

(F) The City Stormwater Engineer, or a designated representative, may inspect the facilities of any person in order to ensure compliance with this subchapter. The inspection shall be made with the consent of the owner, manager or signatory official. If the consent is refused, denied or not promptly addressed, the city may seek issuance of an administrative search warrant.

(G) The city has the right to determine and impose inspection schedules necessary to enforce the provisions of this subchapter. Inspections shall include, but are not limited to:

(1) An initial inspection prior to stormwater management plan approval;

(2) An inspection prior to burial of any underground drainage structure;

(3) Inspections as necessary to ensure effective control of sediment prior to discharge to the municipal separate storm sewer system;

(4) Inspections to verify that action plans identified in previous site visits were successfully implemented; and

(5) A final inspection when all work, including installation of storm management facilities, has been completed.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.24 PERMIT APPLICATION PROCESS.

(A) This SWQMP alone does not authorize or grant permission to begin development or

redevelopment on subject property. It does not supersede other permits required by the city.

(B) All project site owners, as applicable in § 56.20(C), shall submit an application for a SWQMP on forms provided by the city.

(C) Applications must include a notice of intent (NOI), Perimeter Control Plan (PCP), Stormwater Pollution Prevention Plan (SWPPP) and any other necessary information or documentation requested by the city. The NOI requirements are included in division (E) of this section.

(D) The PCP and SWPPP are components of the SWQMP. While both plans may be approved simultaneously, the provisions of a PCP shall be implemented, inspected and accepted by the city prior to implementing the SWPPP and before other construction proceeds.

(E) The project site owner must notify the city and the Indiana Department of Environmental Management (IDEM) within 48 hours prior to the commencement of construction activities through the submittal of an updated NOI. Upon completion of construction activities, stabilization of the project site and removal of all temporary erosion protection and sediment control measures, the applicant shall submit a notice of termination (NOT). The city, or its designated representative, shall inspect the project site to verify that the requirements of the NOT have been met. Once the city verifies the NOT, the city will forward a copy of the verified NOT to IDEM.

(1) Submittal for a SWQMP application shall include a NOI letter, as required by 327 I.A.C. 15-5 and 327 I.A.C. 15-13, with proof of publication of a public notice, construction plans, a Stormwater Pollution Prevention Plan and any other necessary information or documentation requested by the city.

(2) The NOI letter, proof of publication of public notice and construction plans for the SWQMP shall be submitted to the city.

(F) The city reserves the right to require a checklist of necessary items to be completed and included with the SWQMP application submittal. Upon submittal, the SWQMP application shall be rejected in its entirety should any item on the checklist be incomplete.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.25 PERIMETER CONTROL PLAN REQUIREMENTS.

(A) A PCP shall be approved by the city prior to breaking ground or disturbing soil in order to install sediment control practices at the hydrologic perimeter/outfall(s) of a construction site.

(B) Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control devices have been installed and have been stabilized.

(C) The PCP does not give permission to the permit holder to break ground or disturb soil on the entire construction site, as is granted through the approval and issuance of a SWQMP.

(D) Contractors shall install sediment control measures in accordance with the PCP and regularly inspect and maintain the facilities throughout construction.

(E) The PCP shall:

(1) Include measures to minimize erosion and prevent sediment from leaving the site during initial disturbance activities and prior to temporary or permanent erosion prevention and/or sediment control practices;

(2) Address downstream outfall points;

(3) Address prevention of sediment deposition on properties adjacent to the project site. Consider applicable BMPs relevant to the type of flow, site terrain, soil type and other factors;

(4) Only utilize buffer strips for sheet flow and shall be at least, but not limited to, 25 feet in width;

(5) Include locations and descriptions of construction entrances and exits that comply, at a minimum, with BMP standards; and

(6) Protect outlets such as pipes, drains, culverts, conduits or channels and significantly minimize erosion and sedimentation by implementing BMPs to reduce the velocity of flows from the project site.

(F) The Indiana Department of Natural Resource's guidance documents, including the *Handbook for Erosion Control in Developing Areas*, 1985, or the *Indiana Stormwater Quality Manual* should be reviewed and considered when preparing the PCP.

(G) The city reserves the right to develop or adopt other guidance documents to serve as design and implementation standards. These documents may be applied by the city as standards by which designs are to be prepared and controls implemented.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.26 PERIMETER AND OUTFALL INSPECTIONS.

(A) Upon implementation of the PCP, a perimeter and outfall protection inspection will be performed to ensure that the contractor installed the sediment control measures in accordance with the PCP approved by the city. The inspection shall include participation by the city, the permittee and the permittee's contractor.

(B) Inspection shall be performed within seven normal business days after the submittal of a written request to the city, but prior to any disturbance or clearing of soil permitted under the SWQMP. The inspector shall either approve the portion of work completed or shall notify the permittee where the work fails to comply with the approved PCP. If the inspection is not performed within seven normal business days of receipt of written notice, then it shall be considered approved for site-wide work, but open to future comments from the city.

(C) Inspection of perimeter protection BMPs shall consist of a visual checklist for each type of BMP to ensure that each was designed and installed according to site specific conditions.

(D) The PCP shall consider and address any seasonal variations which may hinder the

effectiveness of the BMPs. Seasonal variations may include changes in flow, hydrology, temperature and vegetation. BMPs shall be designed according to these variations and maintained to the appropriate level of service.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.27 STORMWATER POLLUTION PREVENTION PLAN REQUIREMENTS.

(A) Construction plan sheets and an accompanying narrative report shall be submitted describing existing and proposed site conditions.

(B) Included are the following:

(1) An index indicating the location in the construction plans of all information required by this division;

(2) Description of the nature and purpose of the project;

(3) Legal description of the project site. The description should be to the nearest quarter section, township and range, and include the civil township;

(4) Soil properties, characteristics, limitations, and hazards associated with the project site and the measures that will be integrated into the project to overcome or minimize adverse soil conditions;

(5) General construction sequence of how the project site will be built, including phases of construction;

(6) Fourteen-digit watershed hydrologic unit code (HUC);

(7) A reduced plat or project site map showing the lot numbers, lot boundaries and road layout and names. The reduced map must be legible and submitted on a sheet or sheets no larger than 11 inches by 17 inches for all phases or sections of the project site;

(8) A general site plan exhibit with the proposed construction area superimposed on ortho-aerial map at a scale of one inch equals 100 feet. The exhibit should provide two-foot contour information and include all roads and buildings within a minimum 500-foot radius beyond the project boundaries;

(9) Identification of any other state or federal water quality permits that are required for construction activities associated with the owner's project site;

(10) Temporary stabilization plans and sequence of implementation;

(11) Permanent stabilization plans and sequence of implementation;

(12) Temporary and permanent stabilization plans shall include the following:

(a) Specifications and application rates for soil amendments and seed mixtures; and

(b) The type and application rate for anchored mulch.

(13) Anticipated inspection and maintenance requirements for permanent and temporary measures. This shall include the expected frequency of routine inspections and maintenance activities (such as removal of waste concrete);

(14) A description of potential pollutant sources associated with the construction activities that may reasonably be expected to add a significant amount of pollutants to stormwater discharges, including:

(a) Waste concrete management;

(b) Material delivery, handling and storage;

(c) Sanitary/septic waste management;

(d) Solid waste/trash and debris management;

(e) Spill prevention control and countermeasures;

(f) Vehicle and equipment cleaning, fueling and maintenance; and

(g) Sensitive and vegetated area preservation.

(15) Material delivery, handling and storage associated with construction activities shall meet the spill prevention and spill response requirements of 327 I.A.C. 2-6.1;

(16) The SWPPP shall include provisions for addressing the following issues as applicable to the site-specific construction activities:

(a) Dewatering operations;

(b) Contaminated soil management;

(c) Hazardous materials and waste management;

(d) Pesticides, herbicides and fertilizer use;

(e) Collection system maintenance;

(f) Drainage system flushing; and

(g) Over-water activities.

(17) The city reserves the right to develop or adopt other guidance documents to serve as design and implementation standards;

(18) Vicinity map depicting the project site location in relationship to recognizable local landmarks, cities and major roads, such as a USGS topographic quadrangle map or county or municipal road map;

(19) An existing project site layout that must include the following information:

(a) Location, name and normal water level of all wetlands, lakes, ponds and water courses on, or adjacent to, the project site;

(b) Location of all existing structures on the project site;

(c) One-hundred year floodplains, floodway fringes and floodways. Please note if none exists;

(d) Soil map of the predominant soil types, as determined by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey or as determined by a soil scientist. A soil legend must be included with the soil map;

(e) Identification and delineation of vegetative cover, such as grass, weeds, brush and trees, on the project site;

(f) Location of storm, sanitary, combined sewer and septic tank systems and outfalls;

(g) Location of regulated drains, farm drains, inlets and outfalls, if any exist of record;

(h) Land use of all adjacent properties; and

(i) Existing topography at a contour interval appropriate to indicate drainage patterns.

(20) Final project site layout, including the following information:

(a) Location of all proposed site improvements, including roads, utilities, lot delineation and identification, proposed structures and common areas;

(b) One-hundred year floodplains, floodway fringes and floodways. Please note if none exists; and

(c) Proposed final topography at a contour interval appropriate to indicate drainage patterns.

(21) Plans shall include the following information:

(a) Provisions for operation and maintenance of measures identified in the PCP;

(b) Make clear the erosion prevention and sediment controls which are most appropriate to the specific site conditions;

(c) Illustrate the location and extent of erosion prevention and sediment controls;

(d) Sequencing and schedule information, structural and nonstructural Best Management Practices (BMPs), temporary and permanent stabilization measures;

(e) Anticipated inspection and maintenance requirements for permanent and temporary measures. This shall include the expected frequency of routine inspections and maintenance activities (such as removal of sediment and construction debris);

(f) Provisions for construction phasing. This shall be designed so that stripping and clearing

of the site exposes only the area necessary for immediate activities and minimizes the amount of soil exposed at any one time. This includes rough grading, construction of utilities, infrastructure and buildings and final grading and landscaping. Phasing shall identify an expected date when clearing of the area will begin and the estimated duration of exposure. The sequence of phased clearing and the installation of temporary and permanent erosion control measures shall be identified;

(g) Provisions for stabilizing denuded areas and soil stockpiles within 15 days of final grade;

(h) Provisions for stabilizing cut and fill slopes.

1. Minimization of erosion shall be the objective when designing and constructing cut and fill slopes. Length, steepness, soil type, upslope tributary area, groundwater and other relevant factors shall all be taken into account.

2. Stabilization practices such as rock rip-rap, geosynthetic material or other methods approved by the city shall be used on cut and fill slopes at three to one (3:1) (horizontal to vertical) or greater.

3. Cut and fill slopes, except those indicated in division (B)(21)(h)4. below, shall be stabilized with permanent or temporary soil stabilization measures within 15 days of either achieving final grade, or within 15 days to any area that will remain dormant for over 60 days.

4. Any cut and fill slopes with a grade of 18% or greater shall be either temporarily or permanently stabilized within 48 hours.

(i) Erosion prevention measures shall be designed to minimize the suspension of sediment from the soil. The controls may function independently or in combination with sediment control measures, to prevent sediment laden runoff from leaving the construction site. Acceptable erosion prevention practices shall be defined by the city guidance documents; and

(j) Sediment control measures shall be designed to remove sediment, by settling, flocculating, filtering or other means, from storm runoff prior to discharge from the construction site. The controls may function independently or in combination with erosion prevention measures to prevent sediment laden runoff from leaving the construction site. Acceptable sediment control practices shall be defined by city guidance documents.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.28 REQUIREMENTS FOR INDIVIDUAL LOTS.

(A) Although no permit is required for individual lots disturbing less than one acre within a larger permitted project, a formal stormwater review shall be required prior to the issuance of an improvement location permit.

(B) All stormwater management measures necessary to comply with this subchapter must be implemented in accordance with the permitted plan for the larger project.

(C) The city requires the following surveyed information be submitted for review and approval prior to the issuance of an improvement location permit.

(1) Dimensions, elevations, drainage patterns and swales and location of existing buildings and natural features which are pertinent to this subchapter;

(2) Proposed drainage patterns;

(3) Location of the construction access to the site; and

(4) Location of perimeter erosion and sediment control measures prior to land disturbance.

(D) Temporary erosion prevention and sediment control measures may be removed for completion of the finish grade. Prior to removal of temporary erosion prevention and sediment control measures, permanent stabilization shall be in place a minimum of seven calendar days for sod and 45 calendar days for seed and straw.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.29 NOTICE OF TERMINATION.

(A) The project site owner shall plan an orderly and timely termination of the construction activities, including the implementation of stormwater quality measures that are to remain on the project site.

(B) The project site owner shall submit a notice of termination (NOT) letter to the city in accordance with the following:

(1) The project site owner shall submit a NOT letter when the following conditions have been met:

(a) All land disturbing activity, including construction on all building lots, has been completed and the entire site has been stabilized; and

(b) All temporary erosion and sediment control measures have been removed.

(2) The NOT letter must contain a certified statement that each of the conditions in this section have been met.

(3) The project site owner may submit a NOT letter to obtain early release from compliance with this subchapter, if the following conditions are met:

(a) The remaining 95% is built and stabilized with contiguous areas not exceeding one acre;

(b) A map of the project site, clearly identifying all remaining undeveloped lots, is attached to the NOT letter. The map must be accompanied by a list of names and addresses of individual lot owners or individual lot operators of all undeveloped lots;

(c) All public and common improvements, including infrastructure, have been completed and permanently stabilized and have been transferred to the city or another appropriate local entity;

(d) The remaining acreage does not pose a significant threat to the integrity of the

infrastructure, adjacent properties or water quality; and

(e) All permanent stormwater quality measures have been implemented and are operational.

(4) The city or a representative designated by the Stormwater Board may inspect the project site to evaluate the adequacy of the remaining stormwater quality measures and compliance with the NOT letter requirements. If the inspection finds that the project site owner has sufficiently filed a NOT letter, the city shall forward notification to IDEM. Upon receipt of the certified NOT letter and receipt of written approval from IDEM, the project site owner shall no longer be responsible for compliance with this subchapter.

(5) After a certified NOT letter has been submitted for a project site, maintenance of the remaining stormwater quality measures shall be the responsibility of the individual lot owner as well as occupier of the property.

(C) Acceptance of site conditions shall be made by the city or its designated representative based upon an inspection. If any of the following items are deemed to be insufficient, not appropriate and/or inconsistent with the SWPPP or objectives stated in this subchapter, the NOT application shall not be approved:

(1) Pipes, channels, catch basins, water quality treatment devices and other infrastructure are clear of sediment, obstructions and debris and are designed and operating as appropriate for final site conditions;

(2) Slopes are permanently stabilized;

(3) Temporary erosion prevention or sediment control devices (such as silt fence and staking, outlet protection and the like) have been removed (as appropriate) and any resulting soil disturbance stabilized;

(4) Temporary pollution prevention practices have been demobilized or removed and affected areas stabilized;

(5) Sediment has been removed and slopes stabilized for permanent flood control and water quality control practices;

(6) Detention pond grading is stabilized and/or excess sediment removed so that actual volume is at least equal to designed volume and condition; and

(7) Other items as deemed to be important by the city.

(D) As-built requirements.

(1) A SWQMP shall be considered open and active until a time when the city accepts the site conditions and as-built requirements have been completed.

(2) Prior to issuance of a certificate of occupancy, the as-built condition of critical stormwater management facilities must be reviewed and approved.

(3) The volume, capacity, slope, configuration, condition, as-built plans and topographic

information, as well as all pipe size, material, lengths, for all detention, retention and water quality practices shall be certified by a professional engineer or land surveyor licensed in the State of Indiana. This information shall be provided to the city in the form of an as-built drawing or other electronic format accepted by the city. The as-built certification shall indicate if final conditions are consistent with, or exceed, the SWQMP provisions.

(4) If it is determined that information provided in the as-built drawing, certification, inspection or survey of the site do not meet or exceed the SWQMP requirements, the city reserves the right to withhold certification of occupancy. Furthermore, other enforcement mechanisms may be applied to the person certifying the as-built information.

(5) If, upon inspection by the city or designated representative, it is determined that there is an item that must be addressed to receive acceptance of site conditions, then the inspections and maintenance shall continue as described in the SWQMP.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.30 INSPECTIONS AND MAINTENANCE.

(A) *Permittee-performed inspections and maintenance.*

(1) Permittee-performed inspections (self inspections) must be performed by a qualified professional.

(2) Inspections shall be performed at all control measures every seven days and within 24 hours of a one-half inch rain event. The inspections will determine the overall effectiveness of the SWPPP and grading plan, needed maintenance activities and the need for additional control measures.

(3) All inspections shall be documented in written form and be made available to the city or submitted at the time interval specified in the approved permit.

(4) Inspections shall be performed consistent with a visual maintenance checklist approved by the city.

(5) Documentation of permittee performed inspections and inspection findings shall be kept on site, if appropriate facilities (such as a project trailer or building) are available.

(6) Documentation of permittee performed inspections and inspection findings shall be made available within 48 hours of a request by the city or designated representative. Failure to post or timely submit documentation, as requested, shall indicate that inspections were not performed and the city has discretion to implement enforcement procedures.

(B) *Oversight inspections.*

(1) The city, or the city's designated representative, has the authority to periodically inspect the site of land disturbing activities for which permits have been issued. The city may make inspections of the site at its discretion and shall either approve the portion of the work completed or shall notify the permittee wherein the work fails to comply with the SWPPP as approved or is ineffective (regardless of consistency with an approved plan).

(2) The city or its designated representative's inspections and findings will be presented and reviewed with the permittee at the time of inspection (as available to site personnel), and be available in the city permit file within seven normal business days.

(3) In order to obtain inspections, the permittee shall make a written request at least two normal business days before the following activities:

(a) PCP inspection. After perimeter protection, erosion prevention and sediment control practices have been installed, but prior to disturbance of the remaining site; and

(b) Upon completion of the project in order to receive approval to cease permittee inspections in compliance with the SWQMP.

(4) The city or its designated representative may identify any repairs, sediment/debris removal or replacement of all or portions of the stormwater system(s) necessary to comply with the objectives of this subchapter and the SWQMP.

(5) The city or its designated representative may develop and require the implementation of an action plan to prevent the premature system failure that exceeds the SWQMP provisions, but are necessary to prevent stormwater pollution from leaving the site.

(C) *Qualified professional registration and certification.*

(1) A qualified professional is required to perform routine inspections and direct and/or supervise maintenance activities to ensure that the SWQMP provisions are being implemented properly.

(2) All qualified professionals performing inspections or overseeing maintenance activities under this subchapter must be registered with the city prior to execution of those actions. All applicants must file an application with the city. Applicants must demonstrate knowledge of:

(a) Construction practices;

(b) Operational standards;

(c) Cause and failure indicators; and

(d) Maintenance measures used to prevent and correct failures.

(3) Applicants who can demonstrate one or more of the following will be considered for registration:

(a) Professional engineer license in good standing in the State of Indiana with demonstrated experience in erosion prevention and sediment control on construction sites;

(b) Professional land surveyor license in good standing in the State of Indiana with demonstrated experience in erosion prevention and sediment control on construction sites;

(c) Landscape architect license in good standing in the State of Indiana with demonstrated experience in erosion prevention and sediment control on construction sites;

(d) Certified Professional in Erosion and Sediment Control (CPESC) in good standing;

(e) Certified Professional in Stormwater Quality Control (CPSQC) in good standing;

(f) Erosion Prevention and Sediment Control (EPSC) Inspector Certification in good standing from Louisville and Jefferson County Metropolitan Sewer District;

(g) Similar certification of any other similar program in the State of Indiana or in the United States so long as that program requires the applicant to pass a written test; and

(h) Documentation demonstrating the above will be required by the city before registration is granted.

(D) *Suspension and revocation.* The city shall suspend or revoke the registration of a qualified professional for activities not consistent with the policies and procedures identified in this subchapter. This may include registration suspension for submittal of false or misleading information or for repeated incompetence or negligent actions. The city shall issue a written warning and evaluate subsequent actions before suspending or revoking the registration.

(E) *Appeals.*

(1) The city shall give written notice to a qualified professional whose registration is subject to an action for suspension or revocation.

(2) The city shall provide the qualified professional an opportunity at an informal meeting with the city to demonstrate why no action is warranted.

(3) Any qualified professional whose registration is revoked or suspended may appeal that decision to the city's Stormwater Board.

(F) *Reinstatement.* A qualified professional whose registration has been suspended or revoked may apply for reinstatement upon completing the requirements established in this section after a period of at least one year.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.31 ENFORCEMENT AND PENALTIES.

(A) Enforcement and penalties shall be governed according to § 56.50 of this chapter.

(B) At the Stormwater Board's discretion, it may withhold or delay any permit application, inspection requests, appeals, or other plan approvals from person(s) that have unresolved enforcement matters.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.32 APPEALS.

(A) The Stormwater Board shall be charged with addressing appeals to violations and related matters of this subchapter.

(B) In order to have an appeal considered, the applicant shall submit a written request. The Board shall have the authority to grant appeals to violations of this subchapter or overwrite decisions made by the city provided they are consistent with the objectives and policies of this subchapter. The Board does not have the authority to permit actions by the applicant that are based in lack of proper planning or implementation of site development as defined in this subchapter and other measures applied to the city.

(C) The Board will be made available to review accepted request(s) for appeals on an as-needed basis. The decisions of the Board are final and conclusive, but may be reviewed through the appropriate court actions. The Board shall make its findings within five normal business days after the appeal hearing.

(D) Upon issuance of a decision, citation or notice of violation of this subchapter, it shall be conclusive and final unless the accused violator submits a written notice of appeal to the city within ten normal business days of the violation notice being served. If the city does not issue a decision within ten normal business days of the written notice of appeal, then the violation is considered upheld. If the city does not reverse the decision, the aggrieved party may appeal to the Stormwater Board, by filing a written request for hearing within ten normal business days of the city's decision on the appeal. The request for hearing shall state the specific reasons why the decision of the city is alleged to be in error, and shall be accompanied by a cost bond in the amount of $500 with sufficient surety to secure the costs of the appeal, including the cost of court reporters, transcripts, plan reviews and other costs.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.33 COMPATIBILITY AND SEVERABILITY.

(A) Should any section, division, clause or provision of this subchapter be declared by a court of competent jurisdiction to be unconstitutional or invalid, the decision shall not affect the validity of the subchapter as a whole or any part thereof other than the part declared to be unconstitutional or invalid, each section clause and provision being declared severable.

(B) If any provisions of this subchapter and any other provisions of law impose overlapping or contradictory regulations, or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes higher standards or requirements shall govern.

(C) Provisions in § 56.32 of this subchapter are hereby declared to be severable. If any provisions in § 56.32 of this subchapter and any other provisions of law impose overlapping or contradictory regulations, or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes higher standards or requirements shall govern.

(Ord. Z-06-09, passed 4-3-2006)

## § 56.34 PERMIT FEES.

(A) The City of New Albany shall collect administration fees for plan review and site inspections associated with Stormwater Quality Management Plan (SWQMP) permit issuance as outlined below.

(B) (1) Fees shall be based on the amount of disturbed acreage associated with any proposed project. Applications will not be accepted for review without payment of the appropriate fee. The fees below shall include inspection for perimeter control, grading and stormwater quality management permits.

| ***Residential Developments*** | ***Initial*** | ***Re-Submissions*** |
|---|---|---|
| 1 to 4 lots | $450 | $35 |
| 5 to 25 lots | $600 | $50 |
| 26 to 75 lots | $1,100 | $100 |
| 76 to 150 lots | $1,600 | $150 |
| More than 150 lots | $2,600 | $250 sites w/ un-permitted construction underway two times the above |
| ***Non-Residential Developments*** | ***Initial*** | ***Re-Submissions*** |
| Up to 5.0 acres | $600 | $50 |
| 5.1 to 10.0 acres | $1,300 | $120 |
| 10.1 to 25.0 acres | $2,100 | $200 |
| 25.1 or more acres | $2,600 | $250 sites w/ un-permitted construction underway two times the above |

(2) Disturbed acres are defined as the area of the project in which the surface of the land is disturbed by excavations, embankments, land development, residential lot construction, mineral extraction and moving, depositing or storing of soil, rock, earth or other earthmoving activity.

(C) Applications will not be accepted for review without payment of the appropriate fee, as collected by city staff and as directed by the Stormwater Board.

(D) Contracted services shall be compensated for plan review and inspections administered on behalf of the city as outlined below.

| ***Residential Developments*** | ***Initial*** | ***Re-Submissions*** |
|---|---|---|
| 1 to 4 lots | $350 | $35 |
| 5 to 25 lots | $500 | $50 |
| 26 to 75 lots | $1,000 | $100 |
| 76 to 150 lots | $1,500 | $150 |
| More than 150 lots | $2,500 | $250 |
| ***Non-Residential*** | ***Initial*** | ***Re-Submissions*** |

| *Developments* | | |
|---|---|---|
| Up to 5.0 acres | $500 | $50 |
| 5.1 to 10.0 acres | $1,200 | $120 |
| 10.1 to 25.0 acres | $2,000 | $200 |
| 25.1 or more acres | $2,500 | $250 |

(Ord. G-07-10, passed 3-22-2007)

## STORMWATER ILLICIT DISCHARGE CONTROL

### § 56.45 TITLE, PURPOSE AND GENERAL PROVISIONS.

(A) *Title*. This subchapter shall be known as the "Stormwater Illicit Discharge Control Ordinance" of New Albany, Indiana and may be so cited.

(B) *Purpose*. The purpose of this subchapter is to provide regulations and measures that will address the issue of clean stormwater in the city and to establish procedures by which these requirements are to be administered and enforced.

(C) *Jurisdiction*. This subchapter shall govern all properties within the jurisdictional boundaries of the city, including areas of shared development review through a fringe with Floyd County, Indiana as established by an interlocal agreement adopted by both jurisdictions.

(D) *Goals and objectives.*

(1) Protection of the short-term and long-term public health, safety, general welfare. This objective will be achieved by:

(a) Providing for regulation and management of the city's stormwater system, including public and private facilities in the city's service area;

(b) Protecting and preserving water quality and fish and wildlife habitat within the city and in downstream receiving waters; and

(c) Protecting those downstream from stormwater quality impairment(s);

(2) Compliance with state and federal stormwater regulations developed pursuant to the Clean Water Act Amendments of 1987 and subsequent amendments through 2004. The objectives of these regulations include:

(a) Controlling the quality of water discharged by controlling the contribution of pollutants to the stormwater system by stormwater discharges associated with residential, commercial and industrial activity;

(b) Prohibiting illicit discharges to stormwater; and

(c) Controlling the discharge of spills and dumping or any disposal of materials other than stormwater into the stormwater system.

(Ord. G-06-10, passed 4-3-2006)

## § 56.46 DEFINITIONS.

For the purpose of this subchapter, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

***ACCIDENTAL DISCHARGE.*** A discharge or release prohibited by this subchapter which occurs by chance and without planning or thought prior to occurrence.

***APPEALS COMMITTEE.*** Comprised of Stormwater Board members.

***CITY STORMWATER ENGINEER.*** The person, persons or entity designated by the Stormwater Board. The engineer shall be qualified through applicable professional licensure and/or have related stormwater expertise, experience or other qualifications acceptable by a majority vote of the Common Council.

***CLEAN WATER ACT.*** The Federal Water Pollution Control Act (33 U.S.C. §§ 1251 *et seq.*), and any subsequent amendments thereto.

***CONSTRUCTION ACTIVITY.*** Land disturbance activities subject to state NPDES general construction permits related to "Rule 13" or "Rule 5" or local permits. Such activities include, but are not limited to, clearing and grubbing, grading, excavating and demolition.

***ILLICIT DISCHARGE.*** Any discharge to a Municipal Separate Storm Sewer System (MS4) that is not composed entirely of stormwater except discharges pursuant to a National Pollutant Discharge Elimination System permit (other than the city's NPDES stormwater permit) or otherwise defined by this subchapter.

***INDUSTRIAL ACTIVITY.*** Activities subject to NPDES Industrial Permits as defined in 40 C.F.R. § 122.26(b)(14).

***NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER DISCHARGE PERMIT.*** A permit issued by the Indiana Department of Environmental Management (IDEM) under delegated authority by the United States Environmental Protection Agency (USEPA), whether the permit is applicable on an individual, group or general area-wide basis.

***MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4).*** Any facility designed or used for collecting and/or conveying stormwater, including, but not limited to, any roads with drainage systems, highways, municipal streets, curbs, gutters, inlets, catch basins, piped storm drains, pumping facilities, structural stormwater controls, ditches, swales, natural and human-made or altered drainage channels, reservoirs and other drainage structures, and which is:

(1) Owned or maintained by the city;

(2) Not a combined sewer; and

(3) Not part of a publicly-owned treatment works.

***NON-STORMWATER DISCHARGE.*** Any discharge to the storm drainage system that is not composed entirely of stormwater.

***PERSON.*** Except to the extent exempted from this subchapter, any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, city, county or other political subdivision of the state, any interstate body or any other legal entity.

***POLLUTANT.*** Anything of a chemical or component nature which causes or contributes to pollution.

***POLLUTION.*** The contamination or other alteration of any water's physical, chemical or biological properties by the addition of any constituent.

***PREMISES.*** Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

***SHALL.*** Indicative that something must happen or somebody is obliged to do something because of a rule or law.

***STANDARD OF PRACTICE FOR RESIDENTIAL CONSTRUCTION STORMWATER MANAGEMENT.*** A document that defines the management practices for erosion prevention, sediment control and other construction site waste management by which homebuilders may use as guidance and minimum expectations to be achieved during inspections by the city. In the event that this document is not published, then the *Indiana Stormwater Quality Manual* developed by the Indiana Department of Natural Resources (IDNR) may be used as equivalent or if it is not published then the *Indiana Handbook for Erosion and Sediment Control in Urban Areas* developed by IDNR may be used as equivalent.

***STORMWATER BOARD.*** Persons defined in § 56.01.

***STORMWATER ENFORCEMENT OFFICER.*** Designated or contracted by the Stormwater Board.

***STORMWATER RUNOFF*** or ***STORMWATER.*** Any surface flow, runoff and drainage consisting entirely of water from any form of natural precipitation and resulting from the precipitation.

***STRUCTURAL STORMWATER CONTROL*** or ***BEST MANAGEMENT PRACTICE (BMP).*** A structural stormwater management facility or device that controls stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow.

***UNDILUTED DISCHARGES.*** A discharge that has not been mixed with that of another source such as a septic tank or other source.

***USEPA.*** An acronym for United States Environmental Protection Agency.

***WATERS OF THE STATE.*** Any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells and other bodies of surface and subsurface water, natural or artificial,

lying within or forming a part of the boundaries of the State of Indiana which are not entirely confined and retained completely upon the property of a single person.

(Ord. G-06-10, passed 4-3-2006)

## § 56.47 AUTHORITY AND RIGHT-OF-ENTRY.

(A) Designated city staff shall have right-of-entry on or upon the property of any person subject to this subchapter and any permit/document issued hereunder, at all reasonable times. The staff shall be provided access, as described in this section, to all parts of the premises for the purposes of inspection, monitoring, sampling, inventory, records examination and copying and the performance of any other duties necessary to determine compliance with this subchapter.

(B) Where a property, site or facility has security measures in force which require proper identification and clearance before entry into its premises, the person shall make necessary arrangements with its security personnel so that, upon presentation of suitable identification, the designated city staff will be permitted to enter without delay for the purposes of performing specific responsibilities.

(C) Designated city staff shall have the right to set up on the person's property the devices necessary to conduct sampling and/or metering of the person's stormwater operations or discharges.

(D) Any temporary or permanent obstruction to safe and easy access to the areas to be inspected and/or monitored shall be removed promptly by the person at the written or verbal request of the city staff. The costs of clearing the access shall be borne by the person.

(E) The City Stormwater Engineer or his or her designee may inspect the facilities of any user in order to ensure compliance with this subchapter. The inspections shall be made with the consent of the person or signatory official. If consent is refused, denied or not promptly addressed, the designated city staff may seek issuance of an administrative search warrant.

(F) The city has the right to determine and impose inspection schedules necessary to enforce the provisions of this subchapter. Inspections may include, but are not limited to, the following:

(1) An initial inspection prior to stormwater management plan approval;

(2) An inspection prior to burial of any underground drainage structure;

(3) Erosion control inspections as necessary to ensure effective control of sediment prior to discharge to the municipal separate storm sewer system;

(4) A finish inspection when all work, including installation of storm management facilities, has been completed; and

(5) An inspection to determine the effectiveness or operational viability of a permanent or long-term stormwater quality management practice.

(Ord. G-06-10, passed 4-3-06)

## § 56.48 ILLICIT DISCHARGES.

(A) *Prohibition of illegal discharges.*

(1) Pursuant to the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Program, illicit discharges to the MS4 are defined as illegal. This is being done by identifying both allowable and illegal non-stormwater discharges in a manner that is in the best interest of the city.

(2) Except as hereinafter provided, all non-stormwater discharges into the MS4 are prohibited and declared to be unlawful.

(3) It is unlawful for any person to connect any pipe, open channel or any other conveyance system that discharges anything except stormwater or unpolluted water, which is approved by the City Stormwater Engineer based on exemptions listed in division (B) of this section, to the stormwater system.

(4) It is unlawful for any person to discharge waters from residential construction activities that are not complying with the standard of practice for residential construction stormwater management as approved and advertised by the City Stormwater Engineer.

(5) In addition to illicit discharges, the discharge of spills and the dumping and/or disposal of materials other than stormwater, including, but not limited to, industrial and commercial wastes, commercial car wash wastes, sewage, garbage, yard waste, trash, petroleum products (including used motor vehicle fluids, leaf litter, grass clippings and animal wastes), into the MS4, whether directly or indirectly, are prohibited, unless authorized under an NPDES permit.

(B) *Allowable discharges.* Unless the City Stormwater Engineer has identified a discharge as an unacceptable source of pollutants to the "Waters of the State of Indiana", the following non-stormwater discharges into the MS4 are lawful:

(1) Discharges from emergency fire-fighting activities;

(2) Diverted stream flows;

(3) Rising ground waters;

(4) Uncontaminated groundwater infiltration to separate storm sewer systems (as defined by 40 C.F.R. § 35.2005(20));

(5) Uncontaminated pumped ground water;

(6) Discharges from potable water sources as required for system maintenance;

(7) Drinking water line flushing;

(8) Air conditioning condensate;

(9) Uncontaminated landscape irrigation;

(10) Uncontaminated irrigation water;

(11) Lawn watering;

(12) Uncontaminated springs;

(13) Uncontaminated water from crawl space pumps;

(14) Uncontaminated water from footing drains and pumps;

(15) Individual residential car washing;

(16) Flows from riparian habitats and wetlands;

(17) Dechlorinated swimming pool discharges;

(18) Controlled flushing stormwater conveyances (contained and treated by appropriate Best Management Practices (BMPs));

(19) Discharges made from residential construction sites fully and completely utilizing guidance provided by *Standard of Practice for Residential Construction Stormwater Management*;

(20) Discharges within the constraints of an NPDES permit from the Indiana Department Environmental Management (IDEM); and

(21) Discharges approved at the discretion of the City Stormwater Engineer.

(C) *Illegal discharges.*

(1) It shall be unlawful for any person to improperly dispose any contaminant into the MS4. Contaminants include those identified by applicable state and federal laws and regulations.

(2) It is not the intent of the city to impose penalties for discharges that have no significant adverse impact, as defined by the USEPA and Indiana state law, on safety, health, the welfare of the environment or the functionality of the stormwater drainage/collection system.

(Ord. G-06-10, passed 4-3-2006)

## § 56.49 ACCIDENTAL DISCHARGES.

(A) In the event of any discharge of a hazardous substance in amounts that could cause a threat to public drinking supplies, a spill having a significant adverse impact as defined by the USEPA and Indiana state law, or any other discharge that could constitute a threat to human health or the environment, as may be asserted by the city, the owner or operator of the facility shall give notice to the City Stormwater Engineer and IDEM as soon as practicable, but in no event later than two hours of discovery of the accidental discharge or the discharger becomes aware of the circumstances.

(B) If an emergency response by governmental agencies is needed, the owner or operator should also call 911 immediately to report the discharge. Furthermore, as required by the Indiana Spill Rule (327 I.A.C. 2-6.1-7) reports must be made within two hours of discovery. A written report must be provided to the city Stormwater Engineer within five days of the time the discharger becomes aware of the circumstances, unless this requirement is waived by the City Stormwater Engineer for good cause shown on a case-by-case basis, containing the following information:

(1) A description of the discharge;

(2) The exact dates and times of discharge; and

(3) Steps being taken to eliminate and prevent recurrence of the discharge.

(C) The discharger shall take all reasonable steps to minimize any adverse impact to the MS4 or the waters of state, including accelerated or additional monitoring necessary to determine the nature and impact of the discharge. It shall not be a defense for the discharger in an enforcement action to claim that it would have been necessary to halt or reduce the business or activity of the facility in order to maintain water quality and minimize any adverse impact that the discharge may cause.

(Ord. G-06-10, passed 4-3-2006)

## § 56.50 ENFORCEMENT AND PENALTIES.

(A) The person responsible for any connection in violation of this subchapter shall immediately cause the illegal connection to be disconnected and redirected, if necessary, to the city's sanitary sewer system upon approval by the City Stormwater Engineer. The person shall provide to the city written confirmation, satisfactory to the City Stormwater Engineer, that the connection has been disconnected, and, if necessary, redirected to the city sanitary sewer.

(B) Any person responsible for illicit discharges or noncompliance with BMPs at industrial and/or construction sites, and who fails to correct any prohibited condition or discontinue any prohibited activity at the order of the City Stormwater Engineer shall be liable to the city for expenses incurred in abating pollution. This may include expenses incurred in testing, measuring, sampling, collecting, removing, treating, disposing of the polluting materials, preventing further noncompliance and/or illicit discharges and legal counsel fees of any such proceedings.

(C) The city may institute appropriate actions or proceedings by law or equity for the enforcement of this subchapter. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, and other appropriate forms of remedy or relief. Each day of noncompliance is considered a separate offense. Nothing herein contained shall prevent the city from taking such other lawful action as necessary to prevent or remedy any violation, including application for injunctive relief. Any of the following enforcement remedies and penalties, available to be applied independently or in a sequence deemed necessary, shall be to the city in response to violations of this subchapter. If the person, property or facility has or is required to have a stormwater discharge permit from IDEM, the city shall alert the appropriate state authorities of the violation.

(1) *Notice of violation (NOV).* Whenever designated city staff find that any person owning or occupying a premises has violated or is violating this subchapter or order issued hereunder, the enforcement official shall serve, by personal service or by registered or certified mail, upon the person a

written NOV. Within 30 calendar days of the receipt of this notice, or shorter period as may be prescribed in the NOV, an explanation of the violation and a plan for the satisfactory correction and prevention thereof, which shall include specific required actions, shall be submitted to the city Stormwater Engineer or his or her designee. Submission of this plan shall, in no way, relieve liabilities for violations occurring before or after receipt of the NOV.

(2) *Revocation of permit.* The city Stormwater Engineer shall revoke and require the return of a permit or certificate by notifying the permit holder in writing, stating the reason for the revocation. Permits or certificates shall be revoked for any substantial departure from the approved application plans or specifications, refusal or failure to comply with the requirements of state or local law or for false statements or misrepresentations made in securing the permit or certificate. Any permit or certificate mistakenly issued in violation of any applicable state or local law may also be revoked.

(3) *Stop work order.* The City Stormwater Engineer may issue a stop work order and require that all construction cease except those actions that are necessary to eliminate the illicit discharge. Unacceptable or untimely actions to eliminate the illicit discharge shall be used as grounds to revoke permits for the construction site as described in division (C)(2) of this section.

(4) *Compliance order.* If any person shall violate the provisions of this subchapter, the city shall give notice to the owner or to any person in possession of the subject property ordering that all unlawful conditions existing thereupon be abated within a schedule defined from the date of the notice.

(a) The enforcement official shall have the authority to establish elements of a stormwater pollution prevention plan and to require any business to adopt and implement such a plan as may be reasonably necessary to fulfill the purposes of this chapter. The enforcement official may establish the requirements of BMPs for any premises.

(b) The notice and order may be given, provided that if in the opinion of the City Stormwater Engineer, the unlawful condition is such that it is of imminent danger or peril to the public, then the city shall, with or without notice, proceed to abate the same, and the cost thereof shall be charged against the property. The city, as described further in this division, may recover the cost of such actions from the property owner.

(5) *Penalties.* Any person that has been found to have been in violation of any provision of this subchapter, may be assessed a penalty not to exceed the amount presented in this division.

(a) The penalty shall increase by 25% of the previous penalty amount for every subsequent, but separate offense made by the same person. The penalty shall be in addition to other enforcement actions of this section.

(b) The penalty may be assessed for each day, beyond schedules applied in compliance orders or other schedules issued to the property owner or other person responsible, for unauthorized activity defined in this section.

(c) In determining the amount of the penalty the Board shall consider the following:

1. The degree and extent of the harm to the natural resources, to the public health or to the public or private property resulting from the violation;

2. The duration and gravity of the violation;

3. The effect on ground or surface water quality;

4. The cost of rectifying the damage;

5. The amount of money saved by noncompliance;

6. Whether the violation was committed willfully or intentionally;

7. The cumulative effect of other enforcement actions applied for the same offense;

8. The prior record of the violator in complying or failing to comply with the stormwater quality management program; and

9. The costs of enforcement to the city.

(d) The maximum penalties will be determined by the type of offense. This indicates the maximum that may be imposed for a first offense and does not reflect the increases described above for repeat offenses.

1. Development without permit: $2,500. To engage in any development, use, construction, remodeling or other activity of any nature upon land or improvements thereon, subject to the jurisdiction of this subchapter without all required permits, certificates or other forms of authorization as set forth in this subchapter.

2. Development inconsistent with permit: $2,500. To engage in any development, use, construction, remodeling or other activity of any nature in any way inconsistent with any approved plan, permit, certificate or other form of authorization granted for the activity.

3. Violation by act or omission: $2,500. To violate, by act or omission, any term, variance, modification, condition or qualification placed by the city or its agent departments upon any required permit, certificate, or other form of authorization of the use, development or other activity upon land or improvements thereon.

4. Illicit discharge: $2,500. Any person who is found to have improperly disposed of any substance defined as an illicit discharge, not an allowable discharge or causes the city to be in noncompliance with any applicable environmental permit.

5. Household products: $500. Any person who is found to have improperly disposed of any substance not included in Section 3(a) or 3(b) that was purchased over-the-counter for household use, in quantities considered normal for household purposes, which upon discharge to the MS4 or drainage network would have an adverse impact on water quality or cause the city to be in noncompliance with any applicable environmental permit.

(e) In the event there are penalties assessed by the state against the city caused by any person, the person shall be assessed the equivalent amount of penalty. This shall include, but is not limited to, penalties for improper disposal or illegal dumping, or illicit connection into the MS4.

(6) *Administrative fee.* Any person who undertakes any development activity requiring a stormwater management plan hereunder without first submitting the plan for review and approval shall pay to the city, in addition to any permit or inspection fee, an administrative fee of up to $2,500.

(7) *Order to clean and abate/restore.* Any violator may be required to clean and/or restore land to its condition prior to the violation.

(8) *Cost recovery.* If corrective action is not taken in the time specified, the city may take the corrective action. The cost of the corrective action, abatement and/or restoration shall be borne by the property owner. If the invoice is not paid within 90 calendar days, the enforcement official shall have the authority to place a lien upon and against the property. If the lien is not satisfied within 90 calendar days, the enforcement official is authorized to take all legal measures available to enforce the lien as a judgment, including, without limitation, enforcing the lien in an action brought for a money judgment, by delivery to the assessor or a special assessment against the property.

(9) *Injunctions and/or proceedings at law or in equity.*

(a) Any violation of this subchapter or of any condition, order, requirement or remedy adopted pursuant hereto may be restrained, corrected, abated, mandated or enjoined by other appropriate proceeding pursuant to state law.

(b) The Stormwater Board shall pursue, through a court of competent jurisdiction, any penalties that are not paid in full.

(10) *Fee or utility credit revocation or adjustment.* This enforcement tool is intended to be available or used if there are, at any time, provisions for a funding mechanism managed by the city. This enforcement tool permits that credits (reductions), adjustments (increases) or other measures to modify fees or utility charges may be revoked or added, in full or in part, if any provisions of this subchapter are violated.

(11) *Civil actions.* In addition to any other remedies provided in this section, any violation may be enforced by civil action brought by the city's Attorney. Monies recovered under this division shall be paid to the city to be used exclusively for costs associated with implementing or enforcing the provisions of this subchapter. In any such action, the city may seek, as appropriate, any or all of the following remedies:

(a) A temporary and/or permanent injunction;

(b) Assessment of the violator for the costs of any investigation, inspection or monitoring survey which lead to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this division;

(c) Costs incurred in removing, correcting or terminating the adverse effects resulting from the violation; and

(d) Compensatory damages for loss or destruction to water quality, wildlife, fish and aquatic life.

(12) *Emergency orders and abatements.* The enforcement official may order the abatement of any discharge from any source to the stormwater conveyance system when, in the opinion of the enforcement official, the discharge causes or threatens to cause a condition that presents an imminent danger to the public health, safety or welfare, or the environment or a violation of a NPDES permit. In emergency situations where the property owner or other responsible party is unavailable and time constraints are such that service of a notice and order to abate cannot be effected without presenting an

immediate danger to the public health, safety or welfare, or the environment or a violation of a NPDES permit, the city may perform or cause to be performed such work as shall be necessary to abate the threat or danger. The costs of any such abatement shall be borne by the property owner and shall be collectable in accordance with the provisions of this division.

(13) *Violations deemed a public nuisance.* In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this subchapter is a threat to public health, safety, welfare and environment and is declared and deemed a nuisance, and may be abated by injunctive or other equitable relief as provided by state and local law.

(14) *Remedies not exclusive.* The remedies listed in this subchapter are not exclusive of any remedies available under any applicable federal, state or local law and the city may seek cumulative remedies.

(15) *Citizen actions.* Any citizen may commence a civil action, against any person who is alleged to be in violation of this subchapter, to the extent permitted by the Clean Water Act (33 U.S.C. § 1365), including an action against the city for an alleged failure to perform or administer any act or duty under this subchapter that is not discretionary. No action may be taken against the city if it has commenced and is diligently pursuing corrective or administrative actions, or if the city is prosecuting a civil or criminal action against an alleged violator in a court of appropriate authority or jurisdiction within the state.

(Ord. G-06-10, passed 4-3-2006)

**§ 56.51 APPEALS.**

(A) The Stormwater Board shall be charged with addressing appeals to violations and related matters of this subchapter.

(B) In order to have an appeal considered, the applicant shall submit a written request. The Stormwater Board shall have the authority to grant appeals to violators of this subchapter or overwrite decisions made by the City Stormwater Engineer or stormwater enforcement officer, provided they are consistent with the objectives and policies of this subchapter. The Stormwater Board does not have the authority to permit actions by the applicant that are based in lack of proper planning or implementation of site development as defined in this subchapter and other measures applied to the city.

(C) The Stormwater Board will be made available to review accepted request(s) for appeals on an as-needed basis. The decisions of the Stormwater Board are final and conclusive, but may be reviewed through the appropriate court actions. The Stormwater Board shall make its findings within five normal business days after the appeal hearing.

(D) Upon issuance of a decision, citation or notice of violation of this subchapter, it shall be conclusive and final, unless the accused violator submits a written notice of appeal to the city within ten normal business days of the violation notice being served. If the City Stormwater Engineer or stormwater enforcement officer does not issue a decision within ten normal business days of the written notice of appeal then the violation is considered upheld. If the City Stormwater Engineer or stormwater enforcement officer does not reverse the decision, the aggrieved party may appeal to the Stormwater Board or successor, by filing a written request for hearing within ten normal business days of the City Stormwater Engineer's decision on the appeal. The request for hearing shall state the specific reasons

why the decision of the City Stormwater Engineer is alleged to be in error and shall be accompanied by a cost bond in the amount of $500 with sufficient surety to secure the costs of the appeal, including the cost of court reporters, transcripts, plan reviews and other costs.

(Ord. G-06-10, passed 4-3-2006)

### § 56.52 COMPATIBILITY AND SEVERABILITY.

(A) Should any section, division, clause or provision of this subchapter be declared by a court of competent jurisdiction to be unconstitutional or invalid, the decision shall not affect the validity of the subchapter as a whole or any part thereof, other than the part declared to be unconstitutional or invalid, each article, section, clause and provision being declared severable.

(B) If any provisions of this subchapter and any other provisions of law impose overlapping or contradictory regulations or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes higher standards or requirements shall govern.

(C) Provisions in § 56.50 are hereby declared to be severable. If any provisions in § 56.50 and any other provisions of law impose overlapping or contradictory regulations, or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes higher standards or requirements shall govern.

(Ord. G-06-10, passed 4-3-2006)

## POST-CONSTRUCTION RUNOFF CONTROL

### § 56.60 TITLE, PURPOSE AND GENERAL PROVISIONS.

(A) *Title.* This subchapter shall be known as the "Post-Construction Runoff Quality Control Ordinance" of the city and may be so cited.

(B) *Purpose.* The purpose of this subchapter is to provide regulations and measures that will address the issue of stormwater quality in the city and to establish procedures by which these requirements are to be administered and enforced.

(C) *Jurisdiction.*

(1) This subchapter shall govern all properties within the jurisdictional boundaries of the city, including areas of shared development review through a fringe with Floyd County, Indiana as established by an interlocal agreement adopted by both jurisdictions.

(2) The city requires that all development or redevelopment activities that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre that are part of a larger common plan of development or sale, shall obtain a stormwater quality management permit (SWQMP).

(3) (a) The following activities are exempt from the provisions of this subchapter:

1. Agricultural land management activities; and

2. Renovations and amendments to existing buildings disturbing less than one acre.

(b) This exemption applies only to permitting procedures and does not apply to any discharge of sediment or other form of water pollution that may leave a site. These discharges may be enforced as illicit discharges by other sections of the city code.

(Ord. G-06-12, passed 4-20-2006)

## § 56.61 GOALS AND OBJECTIVES.

(A) *Protection of the short-term and long-term public health, safety and general welfare.* This objective will be achieved by:

(1) Providing for regulation and management of the city's stormwater system, including public and private facilities in the city's jurisdiction; and

(2) Protecting and preserving water quality and fish and wildlife habitat within the city.

(B) *Compliance with state and federal stormwater regulations developed pursuant to the Clean Water Act Amendments of 1987 and subsequent amendments.* The objectives of these regulations include:

(1) Managing the quality of water discharged to the municipal separate storm sewer system by controlling the contribution of pollution and pollutants associated with new development and redevelopment; and

(2) Protecting or enhancing stormwater quality to a level of "designated use", as defined by the Clean Water Act §§ 305(b) and 303(d), being 33 U.S.C. §§ 1315(b) and 1313(d).

(C) *Damage.* To minimize damage to public facilities and utilities.

(D) *Maintenance costs.* To ensure the use of the public and private stormwater management system so as not to result in excessive maintenance costs to the city.

(E) *Preservation of natural areas.* To encourage the use of natural and aesthetically pleasing designs that maximize the preservation of natural areas.

(F) *Plan development.* To guide the construction of stormwater management facilities by developing stormwater master plans that address quantity and quality.

(G) *Preservation of floodplains and the like.* To encourage the preservation of floodplains, floodways and open spaces to protect and benefit the community's quality of life and natural resources.

(Ord. G-06-12, passed 4-20-2006)

## § 56.62 DEFINITIONS.

Definitions established in §§ 56.22 and 56.46 of this chapter shall apply in addition to the following definitions, abbreviations and acronyms.

***DETENTION.*** To store excess stormwater runoff prior to discharging it into the conveyance system.

***FIRST FLUSH.*** The first one-half-inch of rainfall over the drainage area to the BMP.

***RETENTION.*** To store excess stormwater runoff prior to ground infiltration.

(Ord. G-06-12, passed 4-20-2006)

## § 56.63 AUTHORITY AND RIGHT-OF-ENTRY.

(A) Designated representatives from the city shall have the right-of-entry on or upon the property of any person, at all reasonable times, subject to this subchapter and any permit/document issued hereunder.

(B) The city or its designated representatives shall be provided ready access to all parts of the premises for the purposes of inspection, monitoring, sampling, inventory, records examination and copying and the performance of any other duties necessary to determine compliance with this subchapter.

(C) Where a property, site or facility has security measures in place which require proper identification and clearance before entry into its premises, the person shall make necessary arrangements with its security personnel so that, upon presentation of suitable identification, designated representatives from the city shall be permitted to enter without delay for the purposes of performing specific responsibilities.

(D) Designated representatives from the city shall have the right to set up on a person's property the devices necessary to conduct sampling and/or metering of the person's stormwater operations or discharges.

(E) Any temporary or permanent obstruction to safe and easy access to the areas to be inspected and/or monitored shall be removed promptly by the person at the written or verbal request of the city. The costs of clearing the access shall be borne by the owner/operator.

(F) The City Engineer, or a designated representative, may inspect the facilities of any person in order to ensure compliance with this subchapter. The inspection shall be made with the consent of the owner, manager or signatory official. If such consent is refused, denied or not promptly addressed, the city may seek issuance of an administrative search warrant.

(G) The city has the right to determine and impose inspection schedules necessary to enforce the provisions of this subchapter. Inspections may include, but are not limited to:

(1) An initial inspection prior to stormwater management plan approval;

(2) An inspection prior to burial of any underground drainage structure;

(3) Inspections as necessary to ensure effective control of sediment prior to discharge to the municipal separate storm sewer system;

(4) Inspections to verify that action plans identified in previous site visits were successfully implemented; and

(5) A final inspection when all work, including installation of storm management facilities, has been completed.

(Ord. G-06-12, passed 4-20-2006)

## § 56.64 POST-CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN.

(A) SWQMP requirements established in §§ 56.20 through 56.33 of this chapter shall be amended to include review of a Post-Construction Stormwater Pollution Prevention Plan (SWPPP). The post-construction SWPPP shall include the following information:

(1) A description of the proposed land use including amount of impervious area, directly connected impervious area and nature of the development;

(2) Location, dimensions, detailed specifications and construction details of all post-construction stormwater quality best management practices (BMPs), as defined in the city guidance documents;

(3) A sequence describing when each post-construction stormwater quality BMP will be installed; and

(4) A long-term operation and maintenance agreement containing maintenance guidelines for all post-construction stormwater quality measures to facilitate their proper long-term function. This agreement shall be made available to future parties, including property owners, who will assume responsibility for the operation and maintenance of the post-construction stormwater quality measures.

(B) The post-construction SWPPP shall include provisions for buffers.

(1) The waterway buffer will be used to define areas where land disturbance activities shall be permitted, but construction of any building or structure shall not be permitted.

(2) A waterway buffer shall be applied to all waterways serving more than 25 acres of tributary area or presented on a United State Geological Survey map as a blue line stream.

(3) Automatic exemptions are granted so long as, erosion prevention and sediment control, water quality and cut-fill policies are adequately addressed. Exemptions shall be granted for:

(a) Roads and utilities crossing waterways; and

(b) Pedestrian trails and walkways proximate to waterways.

(4) The waterway buffer shall be defined as the area contained within a boundary established 25 feet beyond the floodplain boundary as defined by FEMA or city master planning or 50 feet from the top of waterway bank as defined by geomorphic shape (not by the current water surface elevation); whichever is larger.

(5) The waterway buffer and floodplain may be used for application of water quality devices. This may only be permitted if erosion prevention and sediment control, water quality and cut-fill policies are adequately addressed as determined by the city according to the provisions of this subchapter.

(C) A licensed professional engineer in the State of Indiana shall stamp all construction plans and long-term maintenance documentation. This shall include all proposed improvements or modifications to existing or new stormwater infrastructure and other related improvements or modifications.

(Ord. G-06-12, passed 4-20-2006)

## § 56.65 BMP DESIGN REQUIREMENTS AND CRITERIA.

(A) The city reserves the right to develop or adopt other guidance documents to serve as design and implementation standards. Other guidance documents distributed by the city should be reviewed and considered when preparing the post-construction SWPPP. These documents may be applied as standards by which designs are to be prepared and controls implemented.

(B) The city shall have authority to implement this subchapter by appropriate regulations, guidance or other related materials. In this regard, technical, administrative or procedural matters may be modified as needed to meet the objectives defined herein, so long as the modifications as to technical, administrative or procedural matters are not contrary or beyond the intent of the objectives defined above.

(1) Regulations, guidance or other related materials that may be given authority by this subchapter may include, but are not limited to: best management practice (BMP) manuals, design regulations and requirements, submittal checklists, review checklists, inspection checklists, certifications, stormwater management manuals and operation and maintenance manuals.

(2) Materials may include information deemed appropriate by the city including guidance and specifications for the preparation of grading plans, selecting environmentally sound practices for managing stormwater, minimum specifications and requirements, more complete definitions and performance standards.

(3) The above referenced documents may restrict or prevent the use of specific products, techniques or management practices (that are to be accepted by the public or are deemed to have a negative impact on public infrastructure or the MS4) that have been identified as unacceptable for performance, maintenance or other technically based reasons.

(4) Documents referenced above may be updated periodically to reflect the most current and effective practices and shall be made available to the public. However, the failure to update the manual shall not relieve any applicant from the obligation to comply with this subchapter, and shall not prevent the city from imposing the most current and effective practices.

(C) The post-construction SWPPP shall include provisions for stormwater quality BMPs functioning independently or in combination. Acceptable stormwater quality BMPs shall be defined by policy and guidance documents as approved by the Stormwater Board.

(D) The post-construction SWPPP shall include provisions for stormwater quality BMPs that are designed to achieve the following design/performance objectives:

(1) Reduce total suspended solids (TSS) from the first flush as defined by land use characteristics and contributing area; or, capture and treatment of at least 0.5-inch precipitation applied over the contributing area;

(2) Reduce or buffer increases in stormwater runoff temperature caused by contact with impervious surfaces;

(3) Reduce or buffer increases in stormwater runoff volume and flow rate caused by increases in directly connected impervious area and overall impervious area; and

(4) Storm water detention/retention facilities shall be designed to address the rate at which flow is released over the entire runoff discharge period and the volume of discharge over the critical design-storm period if defined by city stormwater master plans. The outlet structure shall be designed as a v-notch weir or other multiple stage configurations capable of controlling the discharge rates for the first flush, two-, ten- and 25-year design-storm events. The outlet structure shall be designed to safely bypass the 100-year storm event.

(E) Soil bioengineering, "green" and other "soft" slope and stream bank stabilization methods shall receive preference over rip rap, concrete and other hard armoring techniques. "Hard" alternatives shall only be permitted when their necessity can be demonstrated given site-specific conditions.

(F) Retention-supportive data must be submitted to justify the type of facility selected. If the facility is designed to retain (volume control) all or a significant portion of runoff (as opposed to temporarily detain), then appropriate soils analyses findings shall be submitted to the city. This submission shall also discuss the impacts the facility will have on local karst topography as found through a geotechnical investigation of the site. The facility may be designed to infiltrate runoff to groundwater rather than transmit it downstream under conditions up to a ten-year storm event. It must be able to bypass all other storms including 100-year event with a discharge rate equivalent to or less than pre-development conditions without negatively impacting the 100-year floodplain above or below the site. If data indicates that the facility can not retain a significant portion of the runoff (95%), then the facility must be designed to detain runoff.

(G) If available, each post-construction SWPPP shall be evaluated for consistency with the stormwater master plan or watershed study for the major watershed or watersheds within which the project site is located. The individual project evaluation will determine if stormwater quantity and quality management practices can adequately serve the property and limit impacts to downstream public and private properties. The presence of a regional facility(s) will be considered in determining the extent to which quantity and/or quality controls will be necessary.

(H) The city reserves the right to require superceding or additional treatment criteria or objectives for specific pollutant(s) as necessary to meet overall storm water quality management program objectives or directives under a watershed improvement or total maximum daily load (TDML) program as administered by the USEPA or the State of Indiana.

(I) On-site BMP coordination with regional BMPs.

(1) All properties are expected to implement on-site stormwater quality control measures, but the extent of application may be reduced given the availability, proximity and nature of regional stormwater quality BMPs.

(2) The extent and type of on-site stormwater quality management practices implemented shall be proportionate to the land use, pollutant discharge potential and proximity to regional stormwater quality management practices.

(Ord. G-06-12, passed 4-20-2006)

## § 56.66 BMP OWNERSHIP AND EASEMENTS.

(A) Any stormwater management facility or BMP which services individual property owners shall be privately owned. General routine maintenance (controlling vegetative growth and removing debris) shall be provided by the owner(s). The owner shall maintain a perpetual, non-exclusive easement that allows for access for inspection and emergency maintenance by the city. The city has the right, but not the duty, to enter premises for emergency repairs.

(B) Any stormwater management facility or BMP which services an individual residential subdivision in which the facility or BMP is within designated open areas or serves as an amenity with an established homeowners association shall be privately owned and maintained consistent with provisions of this subchapter. The owner shall maintain a perpetual, nonexclusive easement which allows access for inspection and emergency maintenance by the city. The city has the right, but not the duty, to enter premises for emergency repairs.

(C) Any stormwater management facility or BMP which services commercial and industrial development shall be privately owned and maintained. The owner shall maintain a perpetual, nonexclusive easement which allows access for inspection and emergency maintenance by the city. The city has the right, but not the duty, to enter premises for emergency repairs.

(D) All regional stormwater management control facilities proposed by the owners, if approved and accepted by the city for dedication as a public regional facility, shall be publicly owned and/or maintained. All other stormwater management control facilities and BMPs shall be privately owned and/or maintained unless accepted for maintenance by the city.

(E) The city may require dedication of privately-owned stormwater facilities, which discharge to the city stormwater system. This shall be at the approval of the Stormwater Board and Common Council.

(Ord. G-06-12, passed 4-20-2006)

## § 56.67 REGIONAL FACILITIES MANAGEMENT.

(A) The objective of a regional stormwater management facility, pond or other device, is to address the stormwater management concerns in a given watershed with greater economy and efficiency than possible through individual facilities. The intended result is fewer stormwater management

facilities to maintain in the affected watershed while sustaining efficiency.

(B) The city encourages regional stormwater quantity and/or quality management practices, serving 25 to 250 acres of tributary area, which may be consistently and efficiently managed and maintained. These types of practices will be encouraged in order to replace or reduce the implementation of on-site stormwater quantity and/or quality management practices, as determined to be appropriate by the city.

(C) Where a regional stormwater management facility has been established by one or more local governments, or by an authority operating on behalf of one or more local governments, a development or property may participate in said program in lieu of runoff control required by this subchapter. This may be permitted; provided that:

(1) Runoff from the development drains to an approved existing or proposed public regional stormwater management facility that will be operational within one year;

(2) Participation in the form of contribution of funds, contribution of land, contribution of stormwater management facility construction work, or a combination of these, the total value of which shall be in accordance with a fee schedule adopted by the city;

(3) The city finds that the stormwater quality management plans are in compliance with all other applicable requirements and articles; and

(4) Each fiscal or in-kind contribution from a development owner participating in a regional stormwater quality management facility shall be used for acquisition, design, construction or maintenance of one or more such facilities in the same watershed in which the development is located.

(D) Detention facilities may, and are encouraged to, be designed to serve multiple purposes. For example, runoff may be detained under wet-weather conditions, but also serve as common or recreational areas during dry-weather conditions. Where multi-purpose facilities are provided, or where flat grades or poorly draining soils are encountered, provisions for adequate low-flow storm water management system may be required. Where the retention/detention facility is planned to be used as a lake, pond or stormwater quality management practice with a permanent pool, water budget calculations shall be performed and submitted to demonstrate that an adequate pool is expected during dry summer months.

(Ord. G-06-12, passed 4-20-2006)

## § 56.68 STORMWATER QUALITY MANAGEMENT PLAN PERMIT CLOSURE.

(A) The SWQMP requirements established in §§ 56.20 through 56.33 of this chapter shall be amended to include permit closure requirements for the post-construction SWPPP. It shall be considered open and active until a time when the city accepts the site conditions, as-built requirements are completed and a long-term operation and maintenance agreement has been accepted.

(B) Acceptance of site conditions shall be made by the city through inspection. If any of the following items are deemed to be insufficient, not appropriate and/or inconsistent with the post-construction SWPPP or objectives stated in this subchapter, then approval will not be granted.

(C) The permitee shall submit a written request for permit closure.

(D) The city shall have 21 normal business days to perform an inspection and respond to the request. If the city does not respond within the 21 normal business days, then the request shall be automatic approval.

(E) As-built requirements.

(1) Prior to issuance of a certificate of occupancy, recording of the final plat or final release of bond, the as-built condition (including: invert elevations, size, shape and location) of critical storm water management features must be identified and approved.

(2) The volume, slopes, configuration, condition and topographic information of all detention, retention and water quality practices shall be certified by a professional engineer licensed in the State of Indiana. This information shall be provided to the city, in the form of an as-built drawing or other electronic form accepted by the city. The as-built certification shall indicate if final conditions are consistent with, or exceed, the SWQMP provisions.

(3) If it is determined that information provided in the as-built drawing, certification, inspection or survey of the site does not meet or exceed the SWQMP provisions, the city reserves the right to withhold certification of occupancy or final bond. Furthermore, other enforcement mechanisms may be applied to the permittee or persons making certifying statements.

(F) Long-term operation and maintenance agreements shall include a maintenance plan for all stormwater quality BMPs in new development or redevelopment that require more than general maintenance (e.g., periodic mowing).

(1) The plan will be developed to ensure that the stormwater quality BMP(s) is (are) kept functional. The maintenance agreement will specify minimum operation and maintenance requirements and intervals to be performed by the property owner.

(2) The plan shall address schedules for inspections and techniques for operation and maintenance including vegetation clearing or mowing and removing accumulated trash, debris, sediment pollutants and other forms of pollution.

(3) The agreement shall be noted on the final plat with the appropriate notation on the particular lot(s).

(4) The agreement shall be included with property ownership title documents and shall be binding on the owner, its administrators, executors, assigns, heirs and any other successors in interest.

(5) The format for the long-term operational and maintenance agreement shall be provided through example by the city, through guidance documents.

(6) Stormwater detention and retention maintenance. Care must be taken to ensure that any required facilities do not become nuisances or health hazards. Detention and retention facilities should be designed to require minimal maintenance and maintenance expectations must be clearly stated in the long-term operation and maintenance agreement.

(7) When a stormwater quality BMP serves more than one parcel, an owners' association or

binding contract for the purpose of operation and maintenance is required. The owners' association shall be responsible for operation and maintenance as directed by this subchapter.

(G) Single entity ownership. Where the permanent stormwater runoff control facilities are designed to manage runoff from property in a single entity ownership, the maintenance responsibility for the stormwater control facilities shall be with the single entity owner.

(1) A ***SINGLE ENTITY*** shall be defined as an association, public or private corporation, partnership firm, trust, estate or any other legal entity allowed to own real estate exclusive of an individual lot owner.

(2) The stated responsibilities of the entity shall be documented in the long-term operation and maintenance agreement. Terms including owning, operating and maintaining the facilities shall be submitted with plans in application for a SWQMP for an adequacy determination. Approval of a SWQMP shall be conditioned upon the approval of these terms. These terms shall be in writing, shall be in recordable form, and shall, in addition to any other terms deemed necessary by the city, contain a provision permitting inspection at any reasonable time by the city of all facilities deemed critical in the public welfare.

(3) Upon approval of the stormwater quality BMPs by the city, the facility owner(s) shall demonstrate the ability to guarantee and apply the financial resources necessary for long-term maintenance requirements. The funding mechanism shall be in a form approved by the city. The city will only approve funding mechanism(s) for long-term maintenance responsibilities that can be demonstrated to be permanent or transferable to another entity with equivalent longevity.

(4) In the event that proposed funding is through an owners' association, then it must be demonstrated that the association may not dissolve unless long-term operation and maintenance activities are accepted by another entity with equivalent longevity and adequate funding. Furthermore, the owners association's responsibility must be stated in the association's declaration, covenants or by-laws, as appropriate.

(5) Unless made specifically clear in the preliminary stages of the site design and construction plan review procedure, it will be assumed that all stormwater detention, retention, treatment or storage facilities and/or devices shall be owned, operated and maintained by a single entity as defined above.

(H) Where the city has accepted an offer of dedication of the permanent stormwater quality BMPs, the city shall be responsible for operation and maintenance.

(Ord. G-06-12, passed 4-20-2006)

## § 56.69 OVERSIGHT INSPECTIONS AND AUTHORITY.

(A) *Owner-performed inspections and maintenance.*

(1) Owner-performed inspections (self inspections) shall be performed by a qualified professional.

(2) Inspection and maintenance shall be performed at all stormwater quality BMPs on at least an annual basis and as otherwise determined in the long-term operation and maintenance agreement.

(3) All inspections shall be documented in written form and be made available to the city or submitted at the time interval specified in the approved long-term operation and maintenance agreement.

(4) Inspections shall be performed consistent with a visual maintenance checklist approved by the city if not defined in the long-term operation and maintenance agreement.

(5) Documentation of owner performed inspections and inspection findings shall be kept on site, if appropriate facilities are available.

(6) Documentation of owner performed inspections and inspection findings shall be made available within seven calendar days of a request by the city or designated representative. Failure to timely submit documentation, as requested, will be assumed to indicate that inspections were not performed and may result in corresponding enforcement procedures.

(B) *Oversight inspections.*

(1) The city, or the city's designated representative, has the authority to periodically inspect the stormwater quality BMPs. The city may make inspections of the site at its discretion and shall either approve the condition of the BMP or shall notify the permittee wherein the condition fails to comply with the long-term operation and maintenance agreement.

(2) The city or its designated representative's inspections and findings will be presented and reviewed with the permittee at the time of inspection (as available to site personnel) and be available in the city public records within seven normal business days.

(3) The city or its designated representative may identify any repairs, sediment/debris removal or replacement of all or portions of the stormwater quality BMP(s) necessary to comply with the objectives of this subchapter, long-term maintenance agreement.

(4) The city or its designated representative may develop and require the implementation of an action plan to prevent the premature BMP failure that exceeds the long-term operation and maintenance agreement provisions, but are necessary to prevent stormwater pollution from leaving the site; this may coincide with revisions to the long-term operation and maintenance agreement.

(C) *Qualified professional registration and certification.*

(1) A qualified professional is required to perform routine inspections and direct and/or supervise maintenance activities to ensure that the long-term operation and maintenance agreement provisions are being implemented properly.

(2) All qualified professionals performing inspections or overseeing maintenance activities under this subchapter shall be registered with the city prior to execution of those actions. All applicants shall file an application with the city. Applicants shall demonstrate knowledge of:

(a) Stormwater quality treatment practices;

(b) Operational standards;

(c) Cause and failure indicators; and

(d) Maintenance measures used to prevent and correct failures.

(3) Applicants who can demonstrate one or more of the following will be considered for registration:

(a) Professional engineer license in good standing in the State of Indiana with demonstrated experience in stormwater quality treatment management practices;

(b) Certified Professional in Stormwater Quality Control (CPSQC) in good standing;

(c) Similar certification of any other similar program in the State of Indiana or in the United States so long as that program requires the applicant to pass a written test; and

(d) Documentation demonstrating the above will be required by the city before registration is granted.

(4) Suspension and revocation. The city may suspend or revoke the registration of a qualified professional for activities not consistent with the policies and procedures identified in this subchapter. This may include registration suspension for submittal of false or misleading information or for repeated incompetence or negligent actions. The city shall issue a written warning and evaluate subsequent actions before suspending or revoking the registration;

(5) Appeals.

(a) The city shall give written notice to a qualified professional whose registration is subject to an action for suspension or revocation.

(b) The city shall provide the qualified professional an opportunity at an informal meeting with the city to demonstrate why no action is warranted.

(c) Any qualified professional whose registration is revoked or suspended may appeal that decision to the city's Stormwater Board.

(6) Reinstatement. A qualified professional whose registration has been suspended or revoked may apply for reinstatement upon completing the requirements established in this section after a period of at least one year.

(Ord. G-06-12, passed 4-20-2006)

## § 56.70 ENFORCEMENT AND PENALTIES.

(A) Enforcement and penalties shall be governed according to § 56.50 of this chapter.

(B) At the Stormwater Board's discretion, it may withhold any future permits, inspection requests, appeals or other plan approvals from person(s) that have unresolved enforcement matters.

(C) The city may require the posting of a maintenance bond to secure the structural integrity of said facilities as well as the functioning of the facilities in accordance with the approved post-construction SWPPP for a term of 24 months from the date of acceptance of dedication. A cash

contribution can be used as the financial assurance in lieu of a maintenance bond although the contribution shall be equivalent to the amount that would be estimated for the maintenance bond. The maintenance bond shall be calculated as 20% of the estimated construction cost and may be reduced to 10% after 12 months if there are no concerns by the city.

(Ord. G-06-12, passed 4-20-2006)

## § 56.71 APPEALS.

(A) The Stormwater Board shall be charged with addressing appeals to violations and related matters of this subchapter.

(B) In order to have an appeal considered, the applicant shall submit a written request. The Board shall have the authority to grant appeals to violations of this subchapter or overwrite decisions made by the city provided they are consistent with the objectives and policies of this subchapter. The Board does not have the authority to permit actions by the applicant that are based in lack of proper planning or implementation of site development as defined in this subchapter and other measures applied to the city.

(C) The Board will be made available to review accepted request(s) for appeals on an as-needed basis. The decisions of the Board are final and conclusive, but may be reviewed through the appropriate court actions. The Board shall make its findings within five business days after the appeal hearing.

(D) Upon issuance of a decision, citation or notice of violation of this subchapter, it shall be conclusive and final unless the accused violator submits a written notice of appeal to the city within ten normal business days of the violation notice being served. If the city does not issue a decision within ten normal business days of the written notice of appeal then the violation is considered upheld. If the city does not reverse the decision, the aggrieved party may appeal to the Stormwater Board, by filing a written request for hearing within ten normal business days of the city's decision on the appeal. The request for hearing shall state the specific reasons why the decision of the city is alleged to be in error, and shall be accompanied by a cost bond in the amount of $500 with sufficient surety to secure the costs of the appeal, including the cost of court reporters, transcripts, plan reviews and other costs.

(Ord. G-06-12, passed 4-20-2006)

## § 56.72 COMPATIBILITY AND SEVERABILITY.

(A) Should any section, division, clause or provision of this subchapter be declared by a court of competent jurisdiction to be unconstitutional or invalid, the decision shall not affect the validity of the subchapter as a whole or any part thereof other than the part declared to be unconstitutional or invalid, each section, clause and provision being declared severable.

(B) If any provisions of this subchapter and any other provisions of law impose overlapping or contradictory regulations, or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes higher standards or requirements shall govern.

(C) Provisions in § 56.70 of this chapter are hereby declared to be severable. If any provisions in § 56.70 and any other provisions of law impose overlapping or contradictory regulations, or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes

higher standards or requirements shall govern.

(Ord. G-06-12, passed 4-20-2006)

# Appendix 2.7

# City of New Albany
# Stormwater Board Policy
# 2009

This Policy documents and communicates to the General Public, City Staff and Elected Officials the Stormwater Board's intentions for conducting business. It provides overriding guidance and procedures for the framework in which the Board will administer its duties and hold itself accountable.

## 1. Mission

### A. Enabling Authority and Responsibilities

The City of New Albany Common Council adopted the following ordinances related to stormwater management. The Mission of the Board is to administer these ordinances.

i. **Stormwater Board Establishment Ordinance**
(Ordinance No. G-06-07) – Chapter 33, Code of Ordinances

ii. **Stormwater User Fee Ordinance**
(Ordinance No. G-05-52) - Chapter 56, Code of Ordinances

iii. **User Fee Regular Rate Established**
Chapter 56, Code of Ordinances

iv. **Construction Runoff Quality Management Ordinance**
(Ordinance No. G-06-03) - Chapter 56, Code of Ordinances

v. **Post-Construction Runoff Quality Management Ordinance**
(Ordinance No. G-06-04) - Chapter 56, Code of Ordinances

vi. **Illicit Discharge Detection and Elimination Ordinance**
(Ordinance No. G-06-02) - Chapter 56, Code of Ordinances

vii. **Drainage Ordinance**
(Ordinance No. G-98-230) - Chapter 54, Code of Ordinances

### B. Goals & Objectives Summary

The Stormwater Board's primary functions are to implement stormwater related City ordinances by:

1) providing fiduciary oversight of the stormwater user fee.
2) overseeing implementation of the stormwater quantity / drainage program.
3) overseeing implementation of the stormwater quality program and related permits.

### C. Public comments

i. The Board will receive comments, suggestions and complaints from the public regarding stormwater quality and quantity.

ii. The Board will put tools in place that provide for the centralized collection, documentation of comments from the public, elected officials, City staff and related stakeholders for distribution to the appropriate City staff member. Effective November 1, 2006 that mechanism will be comments received through the City's Stormwater Web site at: www.newalbanystormwater.org

iii. The Board will routinely review the comments in summary form as developed by City Staff. This evaluation will be used to help direct the management of the overall stormwater program and its ability and effectiveness in address concerns of the citizens of New Albany.

D. **Level of Service**

i. Stormwater Drainage and Flood Control

(1) Stormwater Master Plan

(a) A stormwater master plan for quantity will be established and maintained to support Board decisions to select and prioritize maintenance and capital projects.

(b) The master plans will be performed on a watershed basis and update at least every five years.

(2) Drainage Infrastructure Sizing Goals

(a) Detention and Retention Ponds

(i) Detain or retain the first 0.5-inches, 2-, 10- and 25-year 24-hour design storm event.

(ii) Emergency bypass of the 100-year 24-hour design storm event.

(b) Curb, Gutter and catch basin systems convey the 10-year 24-hour design storm event.

(c) Bridges, culverts, channels and cross-drains convey the 25-year 24-hour design storm event.

(d) Critical Service roads, such as those servicing hospitals, emergency shelters and emergency egress routes, are to be protected so as not to be inundated by more than three (3) inches of water over one-half the roadway width under the 100-year 24-hour design storm event.

(e) Other new roads are to be protected so as not to be inundated by more than six (6) inches of water overtopping under the 25-year 24-hour design storm event.

(f) Other existing road protection roads are to be protected so as not to be inundated by more than nine (9) inches of water overtopping under the 25-year 24-hour design storm event.

ii. Stormwater Quality

(1) “Rule 13” Permit

(a) The Board will routinely review the IDEM mandated Stormwater Quality Management Plan (SWQMP) and its elements.

(b) The Board will guide the City in the preparation for and implementation of SWQMP elements on a schedule and in a manner it deems meets the expectation of IDEM and the citizens of New Albany.

(c) The Board will update the SWQMP on a schedule required by IDEM and communicate its intentions to the Mayor and Common Council regarding any changes in SWQMP approach or methodology.

(2) Stormwater Master Plan

(a) A stormwater master plan for quality will be established and maintained to support Board decisions to select and prioritize maintenance and capital projects.

(b) The stormwater quality master plan will be conducted in conjunction with or with consideration of the SWQMP and stormwater quantity master plans.

(c) The master plans will be performed on a watershed basis and updated at least every five years.

(d) The master plans will focus on development of the following elements for inclusion in five year budget forecasting:

(i) Repair and replacement program with consideration for City resources and capabilities.

(ii) Preventative maintenance program with consideration for City resources and capabilities.

(iii) Capital improvement projects.

iii. Project Prioritization and Backlog Management

(1) Drainage issues will be implemented in a prioritized manner. The basic framework for prioritizing drainage improvement efforts will consider:

(a) Location within defined easements.

(b) Location within defined public right-of-way.

(c) Likely frequency of drainage issue.

(d) Number of properties potentially affected.

(e) Number of residential structures potentially affected.

(f) Issues that have been identified by public complaints or comments.

(2) The Board will not authorize maintenance or capital projects for areas outside of a defined drainage easement or public right-of-way unless flooding or drainage (standing water) are caused by a failure of public drainage system and only in such a case that the resulting system can be maintained through an easement or public right-of-way.

(a) General maintenance of ditches, swales and other drainage system infrastructure that are not in drainage easements or public right-of-way shall be the responsibility of the property owner.

(b) Project Prioritization Criteria – Projects receiving funds from sources outside of the revenue generated from the stormwater utility shall be exempt from any prioritization.

(c) Maintenance Project Prioritization Criteria - These criteria will be applied to projects that can be implemented by City crews or contracted services for less than $75,000 per project.

## Maintenance Prioritization Criteria Table

| Criteria (1-10 points) | | Weight |
|---|---|---|
| ***Properties Potentially Impacted*** | | 15 |
| • 1-5 | 2 | |
| • 6-20 | 5 | |
| • 20-100 | 8 | |
| • 100+ | 10 | |
| ***Road Impact Potential*** | | 15 |
| • None | 0 | |
| • Minor Potential | 2 | |
| • Shoulder Undermined/Collapse | 7 | |
| • Road Collapse | 10 | |
| ***Public Health and Safety*** | | 15 |
| • None | 0 | |
| • Low | 2 | |
| • Medium | 5 | |
| • High | 10 | |
| ***Property Flooding*** | | 15 |
| None | 0 | |
| Non-structural | 5 | |
| Structural | 10 | |
| ***Age of Problem*** | | 12 |
| • Days (1-7) | 2 | |
| • Weeks (1-4) | 5 | |
| • Months (1-12) | 8 | |
| • Years | 10 | |
| ***Master Plan Implications*** | | 10 |
| • No Implications | 0 | |
| • Identified in Master Plan (Generally) | 5 | |
| • Identified in Master Plan (Specifically) | 10 | |
| ***Water Quality Permitting*** | | 10 |
| • Not Referenced in Water Quality Permit | 0 | |

| Criteria (1-10 points) | | Weight |
|---|---|---|
| • Specifically in Water Quality Permit | 10 | |
| ***# of Calls/Complaints (separate people)*** | | 8 |
| • 1-3 | 2 | |
| • 4-10 | 5 | |
| • 10-20 | 10 | |

(d) Capital Project Prioritization Criteria - These criteria will be applied to projects that are too large or complex to be implemented by City crews or are projects with a contracted value greater than $75,000.

## Capital Prioritization Criteria Table

| Criteria (1-10 points) | | Weight |
|---|---|---|
| ***Properties Impacted*** | | 30 |
| • Minor <100 Properties | 5 | |
| • Major >100 Properties | 10 | |
| ***Water Quantity Impacts*** | | 22 |
| • None | 0 | |
| • Potential Localized Flooding Danger (without Structures) | 5 | |
| • Structure Damage Potential | 9 | |
| • Master Plan Element | 10 | |
| ***Water Quality Impacts*** | | 18 |
| • None | 0 | |
| • Master Plan Element | 8 | |
| • Potential Drinking Water Impact | 10 | |
| • Water Quality Permit Element (Specifically) | 10 | |
| ***Constructability/Feasibility*** | | 15 |
| • Property Acquisition Needed | 2 | |
| • Utility Conflicts | 3 | |
| • Karst or Sensitive Feature Impact | 5 | |
| • Within available properties, without utility conflicts, and accessible | 10 | |
| ***Permit Feasibility (COE, IDEM, etc.)*** | | 15 |
| • Unsure | 0 | |
| • Low (3 or more permit issues) | 2 | |
| • Medium (1-2 permit issues) | 5 | |
| • High (none required) | 10 | |

## 2. Administration

### A. Board Membership

The Board membership is prescribed by Ordinance G-06-20 consistent with IC 36-9-23:

*Section 4.* The membership of the New Albany Stormwater Board shall hereinafter consist of the following:

a. The Mayor of New Albany, or his/her designee, who shall serve as chairman at all times during his/her tenure in such office.

b. One (1) member appointed by majority vote of the members of this Common Council, provided that such member shall be a registered professional engineer, and further provided that such member shall not otherwise be a paid or unpaid official or employee of the City. Such member shall serve an initial term of two (2) years.

c. One (1) member appointed by the majority vote of the members of this Common Council, provided that such member shall not otherwise be a paid or unpaid official or employee of the City. Such member shall serve an initial term of three (3) years.

*Section 5.* Following the expiration of such initial terms of the members appointed by this Common Council, each such member shall thereafter be appointed to a term of three (3) years. Following expiration of any such term, the previously appointed and serving members shall continue to serve until this Common Council designates their replacement in accordance with the terms of this ordinance.

*Section 6.* The members of the Board shall be entitled to such compensation as is fixed by the Mayor of New Albany, subject to approval of City Common Council. Each of the members shall be entitled to the payment for reasonable expenses in the performance of their duties.

Board Membership effective September 2009:

- Mr. Roger Harbison – Chairman, Mayor's Delegate
- Mr. Gary Brinkworth – Common Council's Engineer Appointee
- Mr. Gordon Martin – Common Council's Appointee

### B. Secretary

The Board shall select a Secretary who need not be a member of the Board. The Board may combine the offices of secretary and treasurer into a single office of secretary-treasurer. The secretary is entitled to compensation as fixed by the Mayor of New Albany, subject to approval of City Common Council. The secretary serves at the pleasure of the Board.

The Board Secretary effective January 1, 2009 is Ms. Kelly Welsh.

C. **Treasurer**

The Board shall select a Treasurer who need not be a member of the Board. The Board may combine the offices of secretary and treasurer into a single office of secretary-treasurer. The treasurer is entitled to compensation as fixed by the Mayor of New Albany, subject to approval of City Common Council. The treasurer serves at the pleasure of the Board.

The Board Treasurer effective September 29, 2006 is Ms. Kay Garry.

D. **Legal Council**

The Board shall select Legal Counsel who is not be a member of the Board and serves at the pleasure of the Board.

The Board Legal Counsel effective January 2008 is Mr. Lee Buchanan.

E. **Vice-Chairman**

The Board shall select a vice-chairman from the members appointed by City Common Council.

The Board Vice-Chairman effective January 2009 is Mr. Gary Brinkworth.

F. **Board Meetings**

i. Regular Board meetings will be held on the second and fourth Thursday of every month at 10:15 am in the City-County Building at 311 W. 1st Street, New Albany, IN. In the event of holidays, emergencies or disasters meetings may be rescheduled or canceled.

ii. Special or Executive Board meetings will be held and advertised in accordance with state law.

iii. General Meeting Agenda

The following will be used as a base meeting agenda. Specific issues will be added to the Agenda with approval of the Board Chairman.

(1) Call Meeting to Order

(2) Approval of Minutes

(3) Public Comment Period

(4) Communication from Council and Mayor

(5) Communication from Staff

(a) Secretary

(b) Treasurer

(c) User Fee Billing Administrator

(d) Drainage

(e) Stormwater Quality

(6) Old Business

(7) Appeals

i. User Fee

ii. Technical

iii. Enforcement

(8) New Business

(9) Adjournment

iv. Public Comment Period

(1) Verbal Comments

(a) The public will be offered the opportunity to speak at the beginning of Board meetings. Those who wish to provide comment must identify their name and address. The Board will accept comments on specific agenda items.

(b) Comments on Drainage Issues- The Board will address verbal drainage complaints after they have been reviewed by Drainage Department staff.

(2) Written Comments

(a) The public will be offered the opportunity to present written comments at any time. The Board Secretary will provide a form of suitable nature to receive and document drainage complaints and other comments.

(b) The Board will receive comments through the City Web site. The Board Secretary will compile them, forward drainage related complaints to Drainage Department staff while forwarding other issues to the Board prior to the Board meeting.

G. **Ordinances Enforcement - HELD IN RESERVE AS OUTLINE**

i. Plan Review

ii. Construction Oversight

iii. Point of Contact

iv. General Approach

v. Procedure for Action

**3. Coordination with City Common Council and Mayor**

A. The Board will provide an update to the Common Council and Mayor's Office at least annually on the state of the City's Stormwater Program.

i. The Annual update will be transmitted to the Common Council by the first business day of July each year.

ii. The Annual update will be transmitted in written form and summarized verbally by the Board Chairman if afforded the opportunity by the Common Council.

iii. The Annual update will report the number of:

(1) Non-drainage complaints and comments received.

(2) Drainage complaints and comments received.

(3) Drainage complaints addressed with maintenance or capital projects.

(4) Maintenance projects completed (repair, replacement and preventative) using City staff.

(5) Maintenance projects completed (repair, replacement and preventative) using contracted staff.

(6) Capital improvement projects completed using City staff.

(7) Capital improvement projects completed using contracted staff.

iv. The Annual update will report a financial summary including:

(1) revenue collected,

(2) accounts receivable,

(3) accounts payable,

(4) projected next annual budget,

(5) suitability of user fee rate, and

(6) results of the 3rd party financial reviews or audits

B. **The Board will provide an update to the Common Council and Mayor's Office at least quarterly on the state of the City's Stormwater Program.**

i. The Quarterly update will be transmitted to the Common Council by the first business day of January, April and October each year.

ii. The Quarterly update will be transmitted in written form to the Common Council.

iii. The Quarterly Board will report the number of:

(1) Non-drainage complaints and comments received.

(2) Drainage complaints and comments received.

(3) Drainage complaints addressed with maintenance or capital projects.

(4) Maintenance projects completed (repair, replacement and preventative) using City staff.

(5) Maintenance projects completed (repair, replacement and preventative) using contracted staff.

(6) Capital improvement projects completed using City staff.

(7) Capital improvement projects completed using contracted staff.

C. **Any requests to modify the stormwater user fee base rate shall be submitted to the Common Council with an explanation of why the request should be granted.**

**4. City and Contracted Staff Coordination - HELD IN RESERVE AS OUTLINE**

A. **Meeting Participation**

B. **Other Coordination Activities**

C. **Drainage Department Staff**

D. **Planning and Zoning**

E. **Soil and Water Conservation District (SWCD) Coordination**

**5. Financial Administration**

A. **Budget Development Process**

i. The Board will develop and administer a 1-year and 5-year budget.

ii. The Board will start operate on a fiscal year of January 1 through December 31.

iii. The Board will make its detailed budget available to the public by not later than its first meeting in December and receive comments from the public on the Budget in at least one regular Board meeting.

B. **Periodic Rate Analysis**

i. The Board through its annual Budget development process will consider the effectiveness and viability of the stormwater user fee rate structure. Any potential or recommended changes in the rate structure will be communicated the Common Council and Mayor through the Annual Board Report.

ii. The Board will at least every three years evaluate the fairness and equitability of the stormwater user fee billing policies and administration.

C. **Independent Annual Reviews and Tri-Annual Audits**

i. The Board will have an independent audit of the financial system every three years. The review will include an in-depth review of budget administration processes, capacity and related standard audit procedures.

ii. The Board will have an independent review of the financial system annually. The review will include a general assessment of budget administration processes and capacity.

iii. The results of Independent Reviews and Audits will be transmitted in full detail within 30-days of receipt to the City Controller, Mayor and Common Council.

D. **Costs Oversight**

i. The Board shall review and approve any costs at each regular Board meeting.

ii. The Board will receive and review monthly reports from the Board Treasurer. Monthly reports will include overall balance on hand, and accounts payable.

E. **Revenue (User Fee) Oversight**

i. The Board will receive and review monthly reports from the City Utilities Billing Director.

ii. Monthly reports will include accounts receivable, delinquent accounts, user fee credit requests, user fee appeals requests and related matters.

iii. The Board will conduct annual billing system maintenance to include:

(1) Updating the land use inventory with any new developments.

(2) Updating the aerial photography inventory.

(3) Noting any parcels that have been divided.

**6. Process for Receiving and Addressing Complaints**

A. **Receipt**

i. The Board's preferred method of receiving public comments is the City's Stormwater Web site at www.newalbanystormwater.org.

ii. For documentation purposes, public comments received by the Board verbally at Board meetings will be summarized and entered into the City stormwater web site complaint management system by the board Secretary.

B. **Logging & Documentation**

i. Comments, concerns and complaints received by Board members or Drainage Department staff will be summarized and entered into the City stormwater web site complaint management system.

ii. The Board will review at least monthly a summary of comments, concerns and complaints received at the City Stormwater web site.

C. **Timelines for Appeals**

i. Appeals regarding stormwater user fees, enforcement or technical issues will be brought before the Board.

ii. User Fee appeals will be received by the City Utilities Billing Director and presented to the Board monthly.

iii. Technical Appeals will be received through the plan review and construction inspection process. **- HELD IN RESERVE AS OUTLINE**

iv. Enforcement Appeals will be received through the process. **- HELD IN RESERVE AS OUTLINE**

D. **Project Prioritization and Back log Management**

i. The number of complaints and time of listing will be considered in the project prioritization process. See policy **Section 1.D.iii**.

**7. IDEM Coordination and Compliance (Adopted by Board 11/3/06)**

A. **Reporting -** MS4 Phase II Permit (IDEM – "Rule 13")

i. The Board will put measures in place to comply with annual program progress and compliance demonstration reporting requirements.

ii. The Board will put measures in place to comply with monthly construction site inspection and enforcement reporting requirements.

iii. Currently, the Mayor is the certifying agent for SWQMP elements to IDEM. Future certifications or other information requested by IDEM will indicate that the Stormwater Board Chairman as the certifying authority.

B. **Other Coordination Activities**

i. In the event of a formal or informal visit by the IDEM, the Board Chairman (or as delegated to the Vice-Chair) and City (or contracted) staff with working knowledge of the SWQMP implementation details will meet with IDEM staff.

ii. All correspondence with IDEM on behalf of the City will be duplicated to or transmitted with Mayor and Board Chairman.

**8. Coordination with Other Agencies - HELD IN RESERVE AS OUTLINE**

A. **Correspondence with IDEM on behalf of the City will be duplicated to or transmitted with Mayor and Board Chairman.**

**9. Process for Appeals - HELD IN RESERVE AS OUTLINE**

A. **User Fee Credits and Adjustments**

i. Receipt

ii. Logging

iii. Timelines for Appeals

B. **Technical Approval (Development)**

i. Receipt

ii. Logging

iii. Timelines for Appeals

iv. Costs

C. **Field Enforcement**

i. Receipt

ii. Logging

iii. Timelines for Appeals

iv. Costs

**10. Process for Bid Solicitation, Project Completion and Payment**

A. **The process for bid solicitation for projects shall be consistent with the applicable Indiana Code sections.**

i. Contracts for engineering, architectural, or accounting services shall be governed by IC 36-1-12-3.5.

ii. For projects with a cost of at least seventy-five thousand dollars ($75,000) the process for bid solicitation shall be governed by IC 36-1-12-4.

iii. In accordance with IC 36-1-12-4.5, a bond or a certified check shall be filed with each bid by a bidder in the amount determined and specified by the board in the notice of the letting. The amount of the bond or certified check may not be set at more than ten percent (10%) of the contract price. The bond or certified check shall be made payable to the political subdivision or agency. All checks of unsuccessful bidders shall be returned to them by the board upon selection of successful bidders. Checks of successful bidders shall be held until delivery of the performance bond, as provided in IC 36-1-12-14(e).

iv. Whenever a project is estimated to cost at least twenty-five thousand dollars ($25,000) and less than seventy-five thousand dollars ($75,000), the board must accept quotes pursuant to IC 36-1-12-4.7.

v. If a public work project is estimated to cost less than twenty-five thousand dollars ($25,000) and a contract is to be awarded, the board may proceed under IC 36-1-12-5 or IC 36-1-12-4.

vi. The board shall follow IC 36-1-12-6 when awarding contracts, providing notice to proceed. Furthermore the remedies in IC 36-1-12-6 shall govern when the board fails to issue notice, award, and execute contracts pursuant to the provisions in IC 36-1-12-6. If the successful bidder rejects the award or withdraws the bid notice must be given pursuant to IC 36-1-12-6.

vii. Public work performed or contracted for on a public building with a cost of more than one hundred thousand dollars ($100,000) may be undertaken by the board in accordance with the plans and specifications approved by and architect or engineer pursuant to IC 25-4 or IC 25-31.

viii. Pursuant to 36-1-12-8, the board may award a public work contract for road, street, or bridge work subject to the open price provisions of IC 26-1-2-305. The contract may provide that prices for construction materials are subject to price of materials adjustment. When price adjustments are part of the contract, the method of price adjustments shall be specified in the contract. However, this section does not authorize the expenditure of money above the total amount of money appropriated by the political subdivision or agency for road, street, or bridge contracts.

ix. In accordance with IC 36-1-12-9, the board, upon a declaration of emergency, may contract for a public work project without advertising for bids if bids or quotes are invited from at least two (2) persons known to deal in the public work required to be done. The minutes of the board must show the declaration of emergency and the names of the persons invited to bid or provide quotes.

An **emergency is defined by IC 36-1-2-4.5** as a situation that could not reasonably be foreseen and that threatens the public health, welfare, or safety and requires immediate action.

x. Pursuant to IC 36-1-12-10, the board must obtain approval from the state department of health, the division of fire and building safety and other state agencies designated by statute for all plans and specifications for public buildings.

B. **Completion of Projects and Payments**

i. For a project costing at least one hundred thousand dollars ($100,000) that involves a public building, within (60) days after the completion of a public work project the board must file in the division of fire and building safety a complete set of final record drawings for the public work project. This is in accordance with IC 36-1-12-11.

ii. When a project is to be performed, the board shall follow the payment processes detailed in IC 36-1-12-12.

iii. Pursuant to IC 36-1-12-13, a contract for public work must contain a provision for the payment of subcontractors, laborers, material suppliers, and those performing services. The board shall withhold money from the contract price in a sufficient amount to pay the subcontractors, laborers, material suppliers, and those furnishing services.

iv. Pursuant to IC 36-1-12-15, the board must conform to the wage scale provisions of IC 5-16-7 and the antidiscrimination provisions of IC 5-16-6. The board may consider a violation of IC 5-16-6 a material breach of the contract as provided in IC 22-9-1-10.

v. A contract for public work by the board is void if it is not let in accordance with the provisions in IC 36-1-12.

vi. The board shall adhere to IC 36-1-12-17 which governs the contract requirements, payment of claims, final payment and interest for late payment for a contract for street or road work.

vii. The board shall adhere to the requirements of 36-1-12-18 when specifications are changed or altered and for change orders.

viii. The cost of a public work project includes the cost of materials, labor, equipment rental, and all other expenses incidental to the performance of the project. The cost of a single public work project may not be divided into two (2) or more projects for the purpose of avoiding the requirement to solicit bids. A bidder or quoter or a person who is a party to a public work contract who knowingly violates this section commits a Class A infraction and may not be a party to or benefit from any contract under this chapter for two (2) years from the date of the conviction. Any board member or officer of a political subdivision or agency who knowingly violates this section commits a Class A infraction. See IC 36-1-12

ix. For a public works project that may require creation of a trench of at least five (5) feet in depth. IOSHA regulations 29 C.F.R. 1926, Subpart P, for trench safety systems shall be incorporated into the contract documents for a public works project. The contract documents for a public works project shall provide that the cost for trench safety systems shall be paid for as a separate pay item or in the pay item of the principal work with which the safety systems are associated.

x. A person who submits a bid for a public works contract under this chapter that involves the installation of plumbing must submit evidence that the person is a licensed plumbing contractor under IC 25-28.5-1. If a public works contract under this chapter is awarded to a person who does not meet the requirements of subsection (a), the contract is void.

**11. Credits Policy (Adopted by Board 11/17/06; Modified by Board 10/23/08)**

A. **Background and Purpose**

i. The adoption of the Stormwater User Fee Ordinance (No. G-05-52) authorized the establishment of a stormwater management fee to support the City's efforts to address the new EPA stormwater requirements, operation and maintenance of the stormwater drainage system and flooding and drainage issues.

ii. In accordance with the Stormwater User Fee Ordinance, Section 7, the intent of the Credits Policy is to recognize the property owners' efforts to reduce stormwater impacts and therefore, decrease the City's level of service for certain properties.

iii. BMPs must meet the requirements set forth in this policy and go above and beyond the minimum requirements set forth in the 1992 New Albany Stormwater Master Plan in order to be considered for credits toward user fee.

B. **Administration**

i. The credits policy shall be **effective January 1, 2007**. It shall be administrated by the City Engineer's office in the Drainage Department. It has been included in Appendix A.

ii. Maximum credit received will not exceed 40% of the stormwater user fee.

iii. City staff shall review applications within 10 normal business days of submittal.

iv. The City of New Albany's management standards are provided in the New Albany BMP Manual.

v. Applications should be submitted to the:

Tim Marinaro
City Engineer
38 West Tenth Street
New Albany, IN 47150
Phone: (812) 948-5320

(1) Applications shall contain:

(a) Vicinity map illustrating site drainage features.

(b) Hydrologic and hydraulic calculations performed.

(c) Construction details.

(d) Maintenance.

(e) Credit estimation calculation.

(f) Applicable area for credit determination.

(g) Credit application form.

ii. The credit management facility shall be constructed and inspected by the City Engineer for compliance in accordance with the approved plans, specifications, and design calculations. Credit will become effective when the structure has been completed and is operating properly.

iii. An easement, right of way or land purchase agreement restricting the use of the property for anything but the intended management facility shall be provided. A copy of the recording instrument shall be submitted (ie, plat).

iv. Provide regular maintenance for the facility in accordance with the maintenance management plan.

B. **Annual Credit Renewal**

i. Annual credit renewal will be administered by the City Engineer.

ii. Credit shall be renewed annually by way of an Annual Management and Maintenance Report on each facility. Inspections may be performed by City staff to confirm the operation and maintenance of the applied management practice.

iii. Annual Report Requirements

(1) Stormwater user fee account number.

(2) Applicant statement certifying that the conditions under which the credit was originally issued have substantially remained the same.

(3) Applicant statement certifying that if structural management practices are receiving credit, they are being inspected and maintained within appropriate standards for the management practice.

(4) Summary of regular inspection results.

(5) Summary of maintenance activities.

iv. Facility/management practice/activity is maintained as described in the approved application, or if not otherwise described, then within the parameters established by the New Albany Stormwater Best Management Practices (BMP) Manual.

D. **Types of Credit**

The available credit associated with each Best Management Practice is included in the "Stormwater User Fee Non-Residential Credit Application."

i. Education **–** The goal is to facilitate and promote awareness, appreciation, knowledge, and stewardship of water resources through the development of dissemination of classroom-ready teaching aids.

ii. Water Quality Treatment Practices – The goal of this credit is to recognize efforts that New Albany area developers have committed to by successfully installing and utilizing water quality treatment management practices that meet or exceed the goals set forth in the application document.

iii. Detention/Retention – The goal of this credit is to recognize the efforts that New Albany area developers have committed to by building detention/retention management practices that conform to City standards.

iv. Industrial National Pollution Discharge Elimination Permit (NPDES) – The goal of this credit is to recognize the stormwater management and water quality improvement efforts that New Albany area industries have implemented under the Industrial NPDES Permit Program.

v. Stream Buffer – This credit recognizes efforts by those nonresidential land owners that have constructed or otherwise protected stream resources with buffers and/or filter strips.

vi. Filter Strip – This credit recognizes efforts by those nonresidential land owners that have constructed or otherwise protected stream resources with filter strips.

vii. Swales – The goal of this credit is to recognize the efforts of New Albany area nonresidential landowners that have built drainage control swales.

viii. Pervious Surfaces – This credit recognizes the efforts of New Albany area nonresidential landowners that use pervious asphalt or concrete in lieu of conventional impervious surfaces.

# Appendix A

# City of New Albany
# Stormwater User Fee Credit Policy and
# Application Procedure
# 2009

## Part A: Getting Started

**Step A-1** Obtain a credit application form from:

Tim Marinaro
City Engineer
38 West Tenth Street
New Albany, IN 47150
Phone: (812) 948-5320

**Step A-2** If you are not familiar with the City of New Albany's management standards it is suggested that you obtain a copy of the New Albany BMP Manual. The New Albany BMP Manual is located at http://www.newalbanystormwater.org/develop.htm

**Note:**

- The maximum credit to be received will not exceed 40% of the stormwater user fee.
- Length of review by City staff will be **about 2 weeks or 10 normal business days**.

## Part B: Assemble Data

**Step B-1** Vicinity map that illustrates site drainage features

_____ Adjoining lakes, streams, or other major drainage ways
_____ Existing and proposed contours
_____ Impervious delineation and labels (buildings, driveways, etc.)
_____ Drainage area map, including off-site areas draining through the site
_____ Size and location of all stormwater structures
_____ Other permits (i.e. IDEM, Indiana DNR, etc.)

**Step B-2** Perform hydrologic and hydraulic calculations

_____ Hydrologic calculations for undeveloped and developed land uses
_____ Hydraulic calculations stage-discharge relationships of controls

**Step B-3** Construction details

_____ As-built drawings
_____ Construction drawing and details of proposed controls

**Step B-4** Maintenance

_____ Maintenance Management Plan
_____ Maintenance schedule of all operations that affect the efficiency of the structural control including mowing, sediment removal, cleaning, planting, monitoring, watering, and channel restoration

**Part C: Credit Estimation Calculation**

**Step C-1** Calculate the estimated impervious area of property

- Obtain a "user fee" from the user billing statement
- Divide user fee by $3.17/ERU to determine ERU's
- Multiply ERU's by 2500 sq.ft. to determine the approximate amount of impervious area on site

**Step C-2** Determine area available for credit on site

- Determine the percentage of property area benefited by the management practice and BMP
- Multiply fraction of property benefited by total impervious area (IA) to obtain modified impervious area (MIA) for amended charge

| Percentage of Property Benefited | Total Impervious Area (IA) | Modified Impervious Area (MIA) | Amended User Fee |
|---|---|---|---|
| | | | |

**Part D: Complete the New Albany Stormwater Application Form**

Complete and submit data for consideration of application to:

Tim Marinaro
City Engineer
38 West Tenth Street
New Albany, IN 47150
Phone: (812) 948-5320

**Final Steps Necessary to Obtain Credit**

1. Provide an easement, right-of-way, or land purchase agreement that ensures the property owners may use the property for anything but the intended management facility in perpetuity. A right-of-entry to the City of New Albany must be included. Submit copy of recording instrument. (i.e. plat)

2. Construct the credit management facility in accordance with the approved plans, specifications, and design calculations and obtain an inspection of the credit management facility by the City Engineer or his/her representative. Credit will become effective when the structure has been completed and is operating properly.

3. Provide regular maintenance for the facility in accordance with the maintenance management plan.

**To Maintain Credit**

1. Submit an annual management and maintenance report on each facility. At the discretion of the City of New Albany's staff, inspections may be performed in order to confirm the operation and maintenance of the applied management practice. (See Annual Reporting Requirements)

2. Maintain facility/management practice/activity, as described in the approved application; or, if not otherwise described, than within the parameters established by the New Albany Stormwater Best Management Practices Manual.

# Additional Requirements

## Education Credit

The goal of the Education Credit is to facilitate and promote awareness, appreciation, knowledge, and stewardship of water resources through the development and dissemination of classroom-ready teaching aids. It is beneficial to educate all citizens of the City of New Albany on the importance of Water Quality and how it relates to the community. The City of New Albany will allow the maximum annual credit of 25% to those schools, grades K-12 and post-secondary institutions, public and private, located within the City of New Albany, which can demonstrate that it has successfully implemented a curriculum to educate the students on the benefits of clean water. Eligible hands-on activities for schools could include things like sampling water quality at nearby lakes or streams, or raising native plants used in water quality applications near the school.

### Minimum Design Criteria for Education Practices

1. The education practice must be available to 100% of the student population per school.

2. The participating school shall provide a curriculum to the City Engineer that will cover watershed issues in Southern Indiana.

3. Elements that will aid instructing students including special projects, field trips, and guest speakers (visitors) to the classroom who provide benefit with instruction and an open question and answer discussion stressing the importance of improved water quality throughout the community.

4. Other elements approved by the City Engineer.

### Procedures for the Education Credit Application

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following information for the facility under application:

    a. Provide roster of students, including grade, school, and teacher, who attended watershed workshop, or field trip.
    b. Provide curriculum discussed over the course of the school year. List any topics discussed, guest speakers, places visited.

### Annual Credit Renewal

To maintain the credit, the institution must submit an annual report including the number of students educated and the curriculum.

## Water Quality Treatment Practices Credit

The goal of this credit is to recognize efforts that New Albany area developers have committed to by successfully installing and utilizing water quality treatment management practices that meet or exceed the goals set forth in this document. Examples of water quality treatment practices include, but do not exclude, HD separators, pocket wetlands, etc.

### Minimum Design Criteria for Water Quality Treatment Practice

1. The finished management practice must be sized to accommodate City of New Albany design storm requirements.

2. The outlet structure must reduce flow and perform safely without danger to downstream structures.

### Procedures for the Water Quality Treatment Management Credit Application

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following information for the facility under application:

    a. Vicinity map and watershed map;
    b. Description of site drainage features and drainage plan;
    c. Hydrologic, hydraulic and credit calculations;
    d. Construction details;
    e. Maintenance Information; and
    f. Any other documentation that supports the management practice.

3. Submit completed application form and support documents to the City of New Albany.

### Long-term Maintenance

For the credit to be renewed annually, the *Annual Management Practice Maintenance Certification* must be submitted annually. This practice must be maintained to a level described in the original credit application approval or, if not otherwise described, than within the parameters established by the New Albany *Stormwater Best Management Practices Manual*. It will be automatically renewed annually unless there is an issue with the *Annual Management Practice Maintenance Certification* or an issue is identified by the City during routine inspections, and it is not resolved in a time frame acceptable to the City.

## Detention/Retention Credit

The goal of this credit is to recognize the efforts that New Albany area developers have committed to by building detention/retention management practices that conform to City standards. Property owners with detention/retention management practices that improve stormwater management and water quality can apply for up to a 25% reduction in their stormwater service fee, depending on the level of detention or retention provided. If the stormwater BMP is effective for 100% of the site, then the property owner can receive 100% of the available credit. The amount of this credit is based pro-rata on the effectiveness of the BMP including, but not limited to, treating the storm events specified in the City of New Albany Stormwater User Fee Non-Residential Credit Request form. This is provided that the management practices are: built according to City requirements; constructed and functioning properly prior to application; regularly maintained in accordance with the basin's *Long-term Operation and Maintenance Agreement*; and documented with appropriate support information.

Should property owners that do not meet the new minimum requirements make improvements which exceed the new requirements, appropriate credit will be applied in accordance with this section.

### Minimum Design Criteria for the Detention/Retention Management Practice

1. The finished management practice must be sized to accommodate City of New Albany design storm requirements.

2. The outlet structure must reduce flow and perform safely without danger to downstream structures.

### Procedures for the Detention/Retention Credit Application

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following information for the facility under application:

    a. Vicinity map and watershed map;
    b. Description of site drainage features and drainage plan;
    c. Hydrologic, hydraulic and credit calculations;
    d. Construction details;
    e. Maintenance Information; and
    f. Any other documentation that supports the management practice.

3. Submit completed application form and support documents to the City of New Albany.

### Long-term Maintenance

For the credit to be renewed annually, the *Annual Management Practice Maintenance Certification* must be submitted annually. This practice must be maintained to a level described in the original credit application approval or if not otherwise described than within the parameters established by the New Albany *Stormwater Best Management Practices Manual*. It will be automatically renewed annually unless there is an issue with the *Annual Management Practice Maintenance Certification* or an issue is identified by the City during routine inspections, and it is not resolved in a time frame acceptable to the City.

## Industrial National Pollution Discharge Elimination Permit (NPDES) Credit

The goal of this credit is to recognize the stormwater management and water quality improvement efforts that New Albany area industries have implemented under the Industrial NPDES Permit Program. New Albany area industries that have an appropriate NPDES Stormwater Permit can apply for up to a 12% reduction in their stormwater service fee. This is provided that: their permit has definable stormwater management and water quality improvement practices; they have implemented all of the proposed management practices; regularly maintain those practices; exceed monitoring goals annually; and submit appropriate support documentation.

### Procedures for Industrial NPDES Credit Application

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following documents for the facility under application:

    a. Notice of Intent (NOI) to comply with the General Permit or Individual permit;
    b. Certificate of Coverage (COC);
    c. Stormwater Pollution Prevention Plan (if applicable); and
    d. Provide documentation supporting that most recent Notice of Violation (NOV) was 5 years or more prior to date of application (if applicable).

3. Submit completed application form and support documents to the City of New Albany.

## Stream Buffer Credit

This credit recognizes efforts by those nonresidential land owners that have constructed or otherwise protected stream resources with buffers and/or filter strips. If the management practices meet City requirements, then a reduction up to 20% in their stormwater service fee may be possible. This is provided that: the management practice is properly constructed and functions appropriately; the practice is regularly maintained; and appropriate support information is submitted.

### Minimum Criteria for the Stream Buffer Management Practice

1. Stream Buffer is a minimum 100 feet in length and drains more than 25 acres.

2. Buffer/strip only receives shallow, dispersed flow

3. Credit will be adjusted according to the width of the stream buffer.

    a. A buffer 25 feet in average width will receive a 5% credit.
    b. A buffer more than 50 feet in average width will receive a 10% credit.
    c. A buffer more than 100 feet in average width will receive a 20% credit.

### Procedures for Stream Buffer Credit Application

1. Complete a "Stormwater User Fee Credit Application Form."

2. Attach copies of the following information for the facility under application:

    a. Vicinity map;
    b. Description of site drainage features;
    c. Credit calculations;
    d. Construction details (if appropriate);
    e. Maintenance Information; and
    f. Any other documentation that supports the management practice.

3. Submit completed application form and support documents to the City of New Albany.

### Long-term Maintenance

For the credit to be renewed annually, the *Annual Management Practice Maintenance Certification* must be submitted annually. This practice must be maintained to a level described in the original credit application approval or if not otherwise described than within the parameters established by the New Albany *Stormwater Best Management Practices Manual*. It will be automatically renewed annually unless there is an issue with the *Annual Management Practice Maintenance Certification* or an issue is identified by the City during routine inspections, and it is not resolved in a time frame acceptable to the City.

## Filter Strip Credit

This credit recognizes efforts by those nonresidential land owners that have constructed or otherwise protected stream resources with filter strips. If the management practice meets City requirements then land owners may apply and receive up to a 7% reduction in their stormwater service fee. This is provided that: the management practice is properly constructed and functions appropriately; the practice is regularly maintained; and appropriate support information is submitted.

### Minimum Criteria for the Filter Strip Management Practice

1. Grass filter strip
   - Located as close as possible to runoff source
   - Minimize compaction of underlying soil

2. The filter strip management practice accepts at least 50% of the parking area.

### Procedures for Filter Strip Credit Application

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following information for the facility under application:

   a. Vicinity map;
   b. Description of site drainage features;
   c. Credit calculations;
   d. Construction details (if appropriate);
   e. Maintenance Information; and
   f. Any other documentation that supports the management practice.

3. Submit completed application form and support documents to the City of New Albany.

### Long-term Maintenance

For the credit to be renewed annually, the *Annual Management Practice Maintenance Certification* must be submitted annually. This practice must be maintained to a level described in the original credit application approval or if not otherwise described than within the parameters established by the New Albany *Stormwater Best Management Practices Manual*. It will be automatically renewed annually unless there is an issue with the *Annual Management Practice Maintenance Certification* or an issue is identified by the City during routine inspections, and it is not resolved in a time frame acceptable to the City.

## Swales Credit

The goal of this credit is to recognize the efforts of New Albany area nonresidential landowners that have built drainage control swales. Nonresidential property owners that construct and maintain swales for stormwater management purposes and water quality management can apply for a maximum 15% reduction in their stormwater service fee. This is provided that the management practice is: built according to City requirements; constructed and functioning properly prior to application; regularly maintained; and documented with appropriate support information.

### Minimum Criteria for the Swale Management Practice

1. Must be sized to accommodate New Albany design storm requirements

2. Cannot be used in areas with high water tables

3. Underlying soils must have adequate infiltration capacity

4. Must have a minimum length of 150 ft.

5. Accept a minimum of 50% of the impervious area drained.

6. Channel retention time of 10 minutes

### Procedures for Swale Credit Application

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following information for the facility under application:

    a. Vicinity map or Plat that illustrates property location;
    b. Description of site drainage features;
    c. Credit calculations;
    d. Construction details;
    e. Maintenance Information; and
    f. Any other documentation that supports the management practice.

3. Submit completed application form and support documents to the City of New Albany.

### Long-term Maintenance

For the credit to be renewed annually, the *Annual Management Practice Maintenance Certification* must be submitted annually. This practice must be maintained to a level described in the original credit application approval or if not otherwise described than within the parameters established by the New Albany *Stormwater Best Management Practices Manual*. It will be automatically renewed annually unless there is an issue with the *Annual Management Practice Maintenance Certification* or an issue is identified during the City by routine inspections, and it is not resolved in a time frame acceptable to the City.

**Pervious Surface Credit**

The goal of this credit is to recognize the efforts of New Albany area nonresidential landowners that have provided pervious areas to intercept or interrupt runoff from impervious areas. Land owners with pervious surfaces (i.e. porous asphalt or concrete) equal to or greater than 10% of the impervious area of their property can receive a 10% reduction in stormwater user fees. Those who have pervious surfaces equal to or greater than 25% of the impervious area of their property can receive up to a 25% reduction in stormwater user fees.

**Minimum Criteria for the Pervious Surface Management Practice**

1. Porous or permeable asphalt or concrete in lieu of conventional asphalt or concrete.

**Procedures for Pervious Surface**

1. Complete a "Stormwater User Fee Credit Application Form".

2. Attach copies of the following information for the facility under application:

    a. Vicinity map or Plat that illustrates property location;
    b. Description of site drainage features;
    c. Credit calculations;
    d. Construction details;
    e. Maintenance Information; and
    f. Any other documentation that supports the management practice.

3. Submit completed application form and support documents to the City of New Albany.

## Annual Reporting Requirements

Annual reporting is required by all credit recipients to maintain the service fee reduction. A form that may be accompanied by letter or report that describes the status, operation and maintenance of each management practice is to be submitted to the City of New Albany, Drainage Department no later than two weeks (14 days) following the anniversary date of the original credit award. Failure to submit the annual report will result in cancellation of the credit. In addition, the City reserves the right to periodically inspect the credited management practice to assure City requirements are being followed.

The annual report will generally require the following information:

- Stormwater User Fee Account Number;
- Applicant statement certifying that the conditions under which the credit was originally issued have substantially remained the same;
- Applicant statement certifying that if structural management practices are receiving credit, they are being inspected and maintained within appropriate standards for the management practice;
- Summary of regular inspection results; and
- Summary of maintenance activities.

Submit the completed "*Annual Management Practice Maintenance Certification*" form along with any accompanying letters or reports to:

Tim Marinaro
City Engineer
38 West Tenth Street
New Albany, IN 47150
Phone: (812) 948-5320

# Forms

- **Stormwater User Fee Application**

- **Stormwater User Fee – Non-residential Credit Request**

- **Stormwater Credit Renewal - Annual Management Practice Maintenance Certification**

# City of New Albany Stormwater User Fee Application

**SECTION A-CONTACT INFORMATION**

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: (___) _____ Fax: (___) _____

Email: _____

Account Number: _____

**SECTION B-SITE INFORMATION**

Name: _____

Stormwater Billing Account No: _____

Location: _____

_____

Impervious Area: _____ ERU's _____

**SECTION C-PROFESSIONAL OF RECORD**

Name: _____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: (___) _____ Fax: (___) _____

Email: _____

Certification:

_____ _____

Name Title – LS or PE #

_____ _____

Signature Date

## ENGINEER SEAL

## SECTION D-DATA REQUIRED FOR SUBMISSION

| Type of Data | Submitted | | Accepted | |
|---|---|---|---|---|
| | Date | Initials | Date | Initials |
| **All Submittals** | | | | |
| 1. Mapping | | | | |
| 2. Design Calculations* | | | | |
| 3. Construction Drawings* | | | | |
| 4. Maintenance Agreement and Schedule* | | | | |
| 5. User Fee Calculation | | | | |
| 6. Credit Calculation | | | | |
| 7. Application Form | | | | |
| **Education** | | | | |
| 1. Curriculum | | | | |
| 2. Student Roster | | | | |
| **Water Quality Treatment Practices** | | | | |
| 1. Documentation Demonstrating Sized to Accommodate New Albany Design Storm Requirements | | | | |
| 2. Outlet Structure Must Reduce Flow and Perform Safely Without Danger to Downstream Structures | | | | |
| **Detention/Retention** | | | | |
| 1. Documentation Demonstrating Sized to Accommodate New Albany Design Storm Requirements | | | | |
| 2. Outlet Structure Must Reduce Flow and Perform Safely Without Danger to Downstream Structures | | | | |
| **Industrial NPDES** | | | | |
| 1. Permit has definable stormwater management and water quality improvement practices | | | | |
| 2. Implementation of all of the proposed management practices | | | | |
| 3. Regularly maintain management practices | | | | |
| 4. Exceed monitoring goals annually | | | | |
| 5. Submit appropriate documentation, including:<br>• Notice of Intent (NOI) to comply with the General Permit or Individual permit;<br>• Certificate of Coverage (COC);<br>• Stormwater Pollution Prevention Plan (if applicable); and<br>• Provide documentation supporting that most recent Notice of Violation (NOV) was 5 years or more prior to date of application (if applicable). | | | | |

| | | | | |
|---|---|---|---|---|
| **Stream Buffer** | | | | |
| 1. Minimum 100 feet in length and drains more than 25 acres | | | | |
| 2. Buffer only receives shallow dispersed water | | | | |
| **Filter Strip** | | | | |
| 1. Grass filter strip that is located as close as possible to runoff source and minimizes compaction of soil | | | | |
| 2. Practice must accept at least 50% of parking area | | | | |
| **Swales** | | | | |
| 1. Sized to accommodate New Albany design storm requirements | | | | |
| 2. Cannot be used in areas with high water tables | | | | |
| 3. Underlying soils must have adequate infiltration capacity | | | | |
| 4. Must have minimum length of 150 feet | | | | |
| 5. Accept a minimum of 50% of impervious area drained | | | | |
| 6. Channel retention time of 10 minutes | | | | |
| **Pervious Surface** | | | | |
| 1. Use of porous of permeable asphalt or concrete in lieu of conventional asphalt or concrete | | | | |

* Not required for Submittal for Education Credit

**City of New Albany**
**Stormwater User Fee**
**Non-Residential Credit Request**

☐ Request for Credit
☐ Request for Plans Review
(Future Credit Application)

Check all categories requested for consideration

| Best Management Practice | Available Credit | Requested Credit | Credit Received |
|---|---|---|---|
| **Education**<br>(K-12 and post-secondary for 100% student population)<br>☐ Watershed Issues in Curriculum<br>☐ Special projects, trips, etc. | 15%<br>10% | | |
| **Water Quality Treatment Practices****<br>(HD separators, pocket wetlands, etc.)<br>☐ >50% up to 75%<br>☐ 75% up to 95%<br>☐ 95% or greater | 10%<br>20%<br>30% | | |
| **Detention/Retention****<br>☐ Based on the pro-rata effectiveness of the BMP up to 25% reduction of stormwater fee | 25% | | |
| **Industrial Permits**<br>☐ Violation within past 5 years<br>☐ No limits exceeded in past 5 years<br>☐ No limits exceeded in past 15 years<br>☐ Exceed monitoring frequency requirement goals annually | 0%<br>5%<br>10%<br>2% | | |
| **Stream Buffers****<br>(>100-feet long waterway draining > 25-acres)<br>☐ > 25-feet avg. width<br>☐ > 50-feet avg. width<br>☐ > 100-feet avg. width | 5%<br>10%<br>20% | | |
| **Filter Strips****<br>☐ > 50% of PA drained<br>☐ > 90% of PA drained | 4%<br>7% | | |
| **Swales** (>150-feet) **<br>☐ > 50% IA drained<br>☐ > 90% IA drained | 7%<br>15% | | |
| **Pervious Surfaces**<br>☐ 10% or greater of impervious area pervious area<br>☐ 25% or greater pervious area | 10%<br>25% | | |
| **TOTAL*** | 40% (max) | | |

*The maximum annual credit to be received will not exceed 40% of the stormwater bill.
** Requires ongoing maintenance to ensure credit is renewed.
DCIA = Directly Connected Impervious Area
IA = Impervious Area
PA = Parking Area

# City of New Albany Stormwater Credit
# Annual Management Practice Maintenance Renewal

**Applicant:**

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: (___) _____ Fax: (___) _____

Email: _____

Account Number: _____

**Site / Facility Information:**

Name: _____

Location: _____

Type of Management Practice: _____

Inpsections Performed (w/ dates): _____

_____

_____

Maintenance Performed (w/ dates): _____

_____

**CERTIFICATION:**

I hereby request consideration for Maintenance Acceptance. I certify that I have authority to make such a request and authorization for this property. I further certify that the above information is true and correct to the best of my knowledge and belief. I certify that the above stated management practice has been maintained to the prescribed criteria in accordance with the approved application and/or City of New Albany's Best Management Practices Manual and agree to do so. I hereby release the City of New Albany from any maintenance responsibility whatsoever on the above identified management practice located on my property. I agree to provide corrected information should there be any change in the information provided herein.

_____ _____

Name Affiliation & Title

_____ _____

Signature Date

# Appendix 2.8

# CHAPTER 7: TECHNICAL CRITERIA

## INTRODUCTION

This chapter contains the criteria necessary for the design of storm water drainage facilities and the control of soil erosion and sedimentation in the City of New Albany. Storm water drainage facilities include systems of storm water storage and storm water transport. Soil erosion and sedimentation controls include those related to construction activities and those related to increased runoff due to development. The criteria included here, used in conjunction with the Storm Water Master Plan, will assist individuals in preparing and submitting the drainage plans necessary for all proposed development projects.

## STORM WATER DRAINAGE FACILITIES

The parameters and procedures contained herein apply to the design of drainage facilities in both major and minor drainage systems. Minor drainage systems are those which are contained within the limits of the area to be developed and do not transport storm water under a thoroughfare having a usage classification of a collector street or higher. Major drainage systems are defined as those transporting drainage off site and/or under a thoroughfare having a usage classification of a collector street or higher. The following sections outline procedures and guidelines for designing various aspects of drainage facilities.

### Hydrology

To design facilities for the transportation and storage of storm water runoff, the volumes and rates of runoff to be considered must first be determined. The procedures for calculating these quantities of water runoff will be determined based upon the size of the project area and the location of its discharge point. To determine peak rates of runoff the selected method of calculation shall be based on the following criteria:

If the total land area of the project is 50 acres or less and if the runoff leaving the site does not flow directly into a blue-line stream or a major drainage channel the Rational Method is recommended.

When the total land area of the project is greater than 50 acres, or the runoff leaving the site flows directly into a blue-line stream or major channel the Soil Conservation Service Methods are recommended.

For other rates and volumes of storm water discharge the SCS Methods are recommended. The Rational and SCS Methods are discussed in subsequent paragraphs.

#### *Design Storm:*

The 10-year return interval storm shall be used for the planning and design of drainage facilities in the City of New Albany.

The 100-year rainfall event shall be used as the check storm.

The duration of the design storm and check storm shall be equivalent to the time of concentration for the project areas that utilize the Rational Method . A 24 hour duration shall be used for the design and check storms for those projects requiring the use of SCS Methods.

The 10-year return interval storm will generally be used for the design of facilities to manage post-development storm water runoff for both the minor and major drainage systems. However there may be instances where more stringent requirements will be placed on the capacity of the major drainage systems. Design criteria in such cases shall be provided by the city.

Pre-development 100-year flood elevations, as indicated by current Flood Insurance Study elevations or, in the case of areas not covered by a FEMA Flood Insurance Study, as indicated by analysis provided by the development engineer, shall not be increased under post-development conditions. Analysis demonstrating compliance shall be provided by the development engineer.

***Rainfall:***

Rainfall intensity and duration shall be determined from the Rainfall Intensity-Duration Curves located in Appendix A-1. These curves are based on rainfall data and patterns for Louisville, Kentucky.

***Land Characteristics Maps:***

Work maps prepared during this study showing the SCS Hydrologic Soil Groups and maps depicting the existing and proposed land use for major watersheds in the City of New Albany are available from the New Albany Plan Commission. Contact the Commission staff for any review of these maps.

***Site Runoff Determination:***

The following are the recommended methods for the calculation of runoff quantities from the project area. These methods should be used to estimate the pre-and post-construction runoff. In those instances when the applicability of the prescribed procedures are in question the city should be contacted prior to design.

Rational Method

The Rational Method is the recommended procedure for estimating the peak runoff rate from the project site where the total land area is 50 acres or less; and the runoff leaving the site does not flow directly into a blue-line stream or major drainage channel.

This method functions under the basic assumptions that the peak rate of runoff can be determined from the rainfall intensity averaged over a time period equal to the time of concentration and that the rainfall occurs uniformly over the entire watershed.

The Rational formula is:

$Q = I\ A\ C$,
where
Q = peak runoff rate (cfs)
I = rainfall intensity (iph)
A = drainage area of the upstream watershed (acres)
C = runoff coefficient

The rainfall intensity factor I, may be determined from the Rainfall Intensity-Duration Curves, for the appropriate design storm. As previously discussed the design storm duration shall be equal to the time of concentration, Tc. Tc is the time required for runoff to travel from the most hydraulically remote point of the project watershed to the point of interest. The overland portion of this travel time may be determined from the overland flow and velocity chart in Appendix A-2. Any pipe or channel flow time should be calculated with the Manning equation.

A is the area of the project watershed upstream of the point of interest.

C is a dimensionless coefficient reflective of the percentage of rainfall that results in runoff. This coefficient is a cumulative method of taking into account parameters such as infiltration, interception, surface detention and antecedent conditions. To determine the appropriate coefficient value the land use, hydrologic soil group, slope range and storm return interval must be obtained. With these parameters the accompanying Runoff Coefficient table in Appendix A-3 may be utilized and a coefficient determined. For those instances when the project area is not homogenous a composite C value must be calculated. This composite or weighted C value can be determined from the following equation:

$$\frac{C_1A_1 + C_2A_2 + C_3A_3 + \ldots\ldots}{A_T}$$

where
$C_i$ = drainage coefficient representative of a specific area of the project watershed

$A_i$ = corresponding area of project watershed

$A_T$ = total project watershed area

With the various parameters determined the peak runoff rate, Q may be calculated. This peak rate may then be used in sizing the transport components of the drainage system.

Soil Conservation Service Methods

The SCS Methods are the recommended means for estimating runoff quantities from project areas where the total land area is 50 acres or greater, and/or the runoff leaving the site flows directly into a blue-line stream or major channel. When these criteria are met

the city should first be consulted to determine if there is an existing hydrologic model encompassing the project area. If a model does exist it will be necessary for site calculations to be performed by the development engineer to correlate with the modelling.

The SCS Method recommended for the calculation of runoff quantities can be found in the SCS Technical Release Number 55 entitled Urban Hydrology for Small Watersheds, 2nd Ed., June 1986. This publication outlines the procedures for determining storm runoff volumes, peak rate of discharge, hydrographs and storage volumes required for floodwater reservoirs. Example worksheets from this document are located in Appendix A-4 through A-11.

Site specific information necessary for the utilization of the TR-55 method include the area of the watershed upstream from the point of interest, the amount of rainfall, the time of concentration, and the runoff curve number.

The rainfall parameter is the total amount of rainfall occurring over a prescribed period of time for a given return interval storm.

The time of concentration Tc, is the time required for runoff to travel from the most hydraulically remote point of the project watershed to the point of interest. Due to the generally increased complexity of larger watersheds the calculation of Tc is more involved for this method than that required for the Rational Method.

The curve number CN, is similar to the runoff coefficient of the Rational Method in that it represents the runoff potential of the area. It takes into account soils, plant cover, amount of impervious area, interception and surface storage. Curve numbers for the various soil groups and land uses specific to the City of New Albany accompany this chapter.

Utilization of SCS method TR-55 will give a uniformity to drainage design throughout the city and make the resulting design information compatible with the existing hydrologic models.

## Storm Water Storage

The design criteria for storm water storage or detention is set forth here with the intention of maintaining the pre-development runoff characteristics of a project area as land development occurs. In some cases this objective can be extended to improving the downstream pre-development conditions.

***Storm Water Detention Basins:***

The principal means of storm water storage is through the use of detention basins. The following design criteria and guidelines for detention basins will apply:

- Designs shall be based on runoff hydrographs computed by the methods discussed in this chapter or alternative methods previously approved by the City of New Albany.

- The minimum basin volume will be determined from the difference in runoff volume between the pre- and post-construction 100-year, 1-hour storm discharge.

- An emergency spillway shall be provided which will safely pass the 100-year, 24-hour design storm with 1 foot of freeboard.

- Basins shall have a maximum embankment slope of 3:1, unless design calculations warrant consideration otherwise.

- Basins are to remain essentially void of water during dry weather.

- Minimum drainage course slopes shall be 0.5 percent for paved channels and 2.0 percent for grass channels.

- Where basins are to be within 300 feet of residential and/or recreation areas precautions may be required such as protective fencing and grading to prevent steep drop-offs.

- Maintenance access to the basin shall be provided.

- The outlet structure shall be of a multi-stage design to discharge water at the 2-, 10-, and 100-year pre-development rates.

- Storage, discharge, and routing calculations for the design discharges must be submitted to the city for review.

Detention basins are not the exclusive means of temporarily storing storm water. Alternative storage facilities will be reviewed by the city on a case by case basis.

Storm Water Transport Systems

Storm water transport systems consist of structures that channelize storm water and direct it downstream. These structures include culverts, storm sewers and inlets, and drainage channels. Guidelines and criteria for these systems follow.

*Culverts:*

The following are guidelines and criteria for the design of culverts:

- Culverts shall be designed in accordance with methods such as those outlined in the U.S. Department of Transportation's publication, "Hydraulic Charts for the Selection of Highway Culverts". Designs must consider both inlet and outlet control of flow.

- The 10-year post-development storm runoff rate shall be used for culvert sizing. The 100-year discharge shall be used as a check. These rates should be calculated by the appropriate methods previously discussed.

- Allowable culvert headwater depths shall be determined as a function of the headwater to height of culvert ratio (HW/D). For culverts up to 36 inches in diameter or their equivalents, a HW/D of 1.0 to 1.2 should be used. For culverts 36 inches in diameter and larger or their equivalents a HW/D of 1.0 shall be used in their design.

- Elevations of the water surface resulting from the 100-year check discharge must be reviewed to insure that they cause no flooding of existing or proposed buildings and that they do not exceed the crown elevation of any thoroughfares having a usage classification of collector street or higher.

- The minimum size for culverts shall be 10 inches under driveways and 15 inches elsewhere.

- Culvert materials may consist of corrugated metal or concrete for those placed under driveways and secondary roads. All other culverts shall be constructed from concrete.

- Pipe slopes shall be steep enough to maintain a minimum velocity of 3 feet per second at the design flow.

- Outlet velocities should be determined for all culverts. If the erosive velocity of the downstream channel is exceeded, protective channel lining or some other means of energy dissipation must be employed.

***Storm Sewers:***

A storm sewer is a culvert or series of culverts that drain two or more surface inlets and/or manholes in a drainage system. The following are guidelines and criteria to be considered in storm sewer design.

Storm Sewer Conduits

- Mannings equation is the recommended method for determining the conduit sizes required in the storm sewer system. It is assumed that the flow capacity of a structure is that capacity occurring when the depth of flow is 0.8 times the structure height. The hydraulic grade line shall be at least 1.0 foot below the ground surface or building drain elevations.

- The 10-year post-development storm runoff rate shall be used for conduit sizing. The 100-year discharge shall be used as a check. These rates should be calculated by the appropriate methods previously discussed.

- The allowable conduit material for storm sewers will be concrete unless otherwise approved by the city.

- The minimum conduit dimension for storm sewers will be 15 inches.

- Conduit slopes shall be steep enough to maintain a minimum velocity of 3 feet per second at the design flow.

- Access to the sewer system through either inlets or manholes shall be spaced at no greater intervals than 400 feet. Access structures shall be provided at all breaks in horizontal or vertical alignments.

Inlets

Inlets provide a means for collecting and draining runoff into the conduit system. Although inlets usually occur as part of a storm sewer system they may be located so as to function independently. The following criteria and guidelines shall be used in the design of inlets.

- Inlet design and placement should be in accordance with methods such as those outlined in the U.S. Department of Transportation's publication, "Drainage of Highway Pavements".

- The 10-year post-development storm runoff rate shall be used for inlet design. The 100-year discharge shall be used as a check. These rates should be calculated by the appropriate methods previously discussed.

- The allowable drainage flow spread on city streets shall be 6 feet, or 8 feet if a gutter exists, for cul de sacs, local streets and collector streets. For minor and major arterials the spread allowed shall be 4 feet, or 6 feet if a gutter exists.

***Channels:***

Channels are those conduits in which water flows with a free surface such as in streams, ditches, flumes and partially full pipes. The recommended guidelines and criteria for the design of storm water channels having either grass, riprap or concrete linings follow. Refer to the SOIL EROSION AND SEDIMENT CONTROL, Conveyance Elements section for additional information.

Grass Lined Channels

- Grass lined channels shall be designed in accordance with methods such as those outlined in the U.S. Department of Agriculture, Soil Conservation Service's publication, "Engineering Field Manual for Conservation Practices".

- The 10-year post-development storm runoff rate shall be used for sizing the channel. The 100-year post-development discharge will be used to check the major system capacity. These flow rates should be calculated by the appropriate methods previously discussed. The 100-year discharge surface elevations shall be reviewed to ensure that no structural flood damage occurs.

- Design discharge velocities may not exceed 6 feet per second for grassed waterways.

- o Minimum channel slope is 1 percent for the minor drainage system.

- o A concrete low flow channel is required if the channel slope is less than 2 percent. The low flow channel should be designed for the base flow or the 2-year frequency storm, whichever is greater.

- o With channel slopes of 2 percent or greater the channel shall be sodded.

- o The maximum side slopes for grass lined channels is 4:1 with 3:1 being preferable.

Riprap Lined Channels

- o Riprap lined channels shall be designed in accordance with methods such as those outlined in the U.S. Department of Agriculture, Soil Conservation Service's publication, "Engineering Field Manual for Conservation Practices".

- o The 10-year post-development storm runoff rate shall be used for sizing the channel. The 100-year post-development discharge will be used to check the major system capacity. These flow rates should be calculated by the appropriate methods previously discussed. The 100-year discharge surface elevations shall be reviewed to ensure that no structural flood damage occurs.

- o Stone used for riprap should be graded with a minimum specific gravity of 2.5.

- o Maximum velocities for various stone sizes are presented below.

MAXIMUM PERMISSIBLE VELOCITY FOR VARIOUS STONE SIZES

| Velocity (ft/sec) | Stone Diameter (inches) |
|---|---|
| 4 | 2.5 |
| 6 | 5 |
| 8 | 9 |
| 10 | 14 |
| 12 | 20 |
| 14 | 28 |
| 16 | 37 |

- o The thickness of the riprap layer shall be 1.5 times the diameter of the maximum stone used with a minimum thickness of 6 inches.

- o Minimum channel slope is 1 percent for the minor drainage system.

- o Maximum side slopes for riprap lined channels shall be 1.5:1.

Concrete Lined Channels

- Procedures for the design of concrete lined channels should be similar to those found in "Open Channel Hydraulics" by V.T. Chow.

- The 10-year post-development storm runoff rate shall be used for sizing the channel. The 100-year post-development discharge will be used to check the major system capacity. These flow rates should be calculated by the appropriate methods previously discussed. The 100-year discharge surface elevations shall be reviewed to ensure that no structural flood damage occurs.

- Channels with slopes of less than 1 percent shall be concrete paved.

- Maximum side slopes shall typically be 2:1. Steeper side slopes will be considered when accompanied with the appropriate structural design information.

## SOIL EROSION AND SEDIMENT CONTROL

### Policy Mandate

Policy c. of Objective A-2 (Goal A) of New Albany - Fringe Area Comprehensive Plan Year 2000 advocates requirements for preventative measures which adequately minimize environmental degradation such as construction-related erosion. Implicit in this policy objective is the desire to adequately minimize other types of runoff-related surface erosion, as well as any corresponding sedimentation.

As New Albany continues to develop, the opportunities for erosions/sedimentation damage will compound, and they will tend to fall into two categories:

- construction-related (i.e., disturbed soil)

- post-development (i.e., increased runoff velocities)

Whereas the problems posed by the former can be addressed through essentially temporary design measures, those presented by the latter require the design of relatively permanent improvements.

### Construction-Related Criteria

*Overview:*

Sound construction practices should seek to:

- minimize overall land disturbance
- minimize the interim exposure time period between initial disturbance and construction completion
- confine eroded sediment to the immediate construction site
- collect and detain eroded sediment in an appropriate location immediately downstream of construction site(s)

Whereas the first two of these objectives have in practice been unavoidably defined and pursued in varying project-specific manners, the last two have over time been operationalized through practices gradually tending toward uniformity. Such uniformity has enabled the development of generally accepted technical design criteria.

***Site-Confinement Criteria:***

Check Dams

Check dams (small temporary dams) shall be constructed across temporary swales or drainage ditches for which protective linings are not feasible. They shall be spaced at intervals which are sufficiently small to prevent the development of erosional storm water flow velocities. For an example, see Appendix A-12.

Straw Bale Barriers

Such barriers shall be constructed as continuous, anchored, and entrenched rows which completely isolate the portion of the site from which erosional storm water velocities (either overland sheet flow or channel concentrated flow) and transported sediment originate. They shall be situated and implanted according to the following criteria:

- Maximum Drainage Area - 0.25 acre per 100 feet of barrier
- Maximum Slope Length Behind Barrier - 100 ft.
- Maximum Slope Behind Barrier - 2:1
- Minimum Anchorage - 2 stakes per bale

A depiction of a typical installation can be found in Appendix A-13.

Silt Fences

Using a synthetic fabric which is keyed into the soil surface, a fence(s) which intersects all possible overland runoff flow paths existing on all erodible disturbed surfaces shall be erected at the perimeter of the construction site. (For a depiction of a standard installation, see Appendix A-14.) Such a silt fence shall serve as a filtering medium for overland (sheet) runoff as it leaves the site. The following criteria shall be used in designing a silt fence arrangement for a particular site:

- Maximum Drainage Area - 0.25 acre per 100 foot of fence
- Maximum Slope Length - 100 feet
- Maximum Slope Gradient - 2:1
- Minimum Height - 15 inches
- Maximum Height - 36 inches
- Maximum Post Spacing - 10 feet

Stabilized Construction Entrances

In order to minimize the amount of erodible material transported from the construction site via the tires of exiting vehicles, a stabilized stone pads(s) shall be constructed at the

traffic point(s) encountered by such vehicles immediately prior to entrance onto paved areas (e.g., public roads) located outside of the site. Examples are depicted in Appendix A-15. The following criteria shall be used in designing such an entrance:

- o Minimum Entrance Dimensions
  - Thickness - 6 inches
  - Width - Entire entrance area
  - Length - 50 feet
- o Material - ASTM size 1 stone or larger
- o Washdown Area Requirements
  - Washdown facilities required as directed by the City
  - Washdown area must be established with crushed gravel
  - Washdown area must drain into a sediment trap or basin

***Collection and Detention Criteria:***

Sedimentation Basins

Impoundments which collect and detain all sediment-laden surface runoff shall be constructed if engineering analysis indicates that site-confinement measures will not adequately remove sediment from runoff leaving the construction site. Such a structure(s), which may consist of either excavation(s) or embankment(s) at the outlet point(s) through which all site runoff must pass, shall be designed to provide sufficient detention time for all inflowing runoff to enable the adequate retention of sediment.

The design of such temporary structures shall conform with all state and federal regulations and guidelines pertaining to dam safety. It shall also adequately address the procedure by which the sedimentation basin area is safely reclaimed once construction is completed.

In the absence of conflict with the above-mentioned state and federal criteria (in which case the state and federal criteria will take precedence), the following general criteria shall apply to the design of sedimentation basins:

- o Minimum Drainage Area - 5 acres
- o Maximum Drainage Area - 150 acres
- o Minimum Capacity - 67 cubic yards per acre of drainage area, measured to the elevation of the principal outlet
- o Basin Shape - the effective flow length should be at least twice the effective flow width
- o Outlet Requirements
  - Discharge Capacity - 10-year storm
  - Minimum Diameter - 8 inches
  - Anti-Vortex/Trash Rack Required
- o Embankment Requirements
  - Maximum Upstream Slope - 3:1
  - Maximum Downstream Slope - 2:1
  - Width/Height Relationship:

| Dam Height (Ft) | Top Width (Ft) |
|---|---|
| <10 | 8 |
| 11-14 | 9 |
| 14-19 | 10 |
| 20-25 | 12 |

- o Emergency spillway shall be designed for the 100-year post-development discharge.

A depiction of a sample sedimentation basin can be found in Appendix A-16.

Storm Drain Inlet Protection

If engineering analysis indicates that site-confinement measures will not adequately remove sediment from construction site runoff before it reaches storm drain inlets, protective sediment filters and/or excavated sediment basins shall be constructed in the immediate vicinity of the inlet. Examples are depicted in Appendix A-17 through A-20.

Such protective measures will not be considered adequate for any inlet receiving drainage from disturbed areas in excess of 1 acre. Protective filter media shall consist of sod, gravel, straw bales, and/or burlap.

## Post-Development (Permanent Improvements) Criteria

***Overview:***

The sound design of permanent land improvements should seek to:

- o minimize overall land disturbance
- o emphasize the protective vegetative cover of unpaved surfaces
- o collect and combine upstream runoff so as to direct it exclusively toward other conveyance elements that are situated downstream (e.g., stream channels, culverts)
- o protect conveyance elements from erosional effects
- o protect conveyance elements from sedimentation

Whereas the first of these objectives has been unavoidably defined and pursued in varying project-specific manners, the last four have over time been operationalized through practices gradually tending toward uniformity. Such uniformity has enabled the development of generally accepted technical design criteria.

***Protective Vegetative Cover:***

Surface Slopes Not Steeper than 2H:IV

Grass shall be adequately applied unless significant erosional damage will ensue during the growth period, in which case sodding shall be used. If other reasonable considerations (e.g., difficulty of maintenance) dictate the use of vegetative cover other than grass, a number of ground plants that is sufficient to cover the surface (through

growth over a subsequent time period that is too short for serious erosion to occur) shall be planted.

Surface Slopes Steeper than 2H:IV

Ground plants shall be used in the previously-stated manner.

***Conveyance Elements:***

General

The objective of any system of storm water conveyance elements is to confine storm water runoff to locations which are capable of withstanding anticipated flood levels, flow velocities, and/or sedimentation without appreciable damage. Given their usual incorporation of erodible materials, surface conveyance elements (e.g., stream channels), unlike subsurface elements (e.g., storm sewers), are susceptible to erosion. However, both surface and subsurface elements are susceptible to sedimentation.

Erosion Protection

Channel Lining

Appendix A-21 outlines permissible design velocities for earth and grass-lined channels. (Also see STORM WATER DRAINAGE FACILITIES, CHANNELS.) In general, if design velocities exceed those acceptable for earth channels, grass linings shall be considered, and if design velocities are still too high, a riprap (layer of stone particles) lining shall be selected and its particles sized in accordance with the following table:

| Flow Velocity (Ft/Sec) | Stone Diameter In |
|---|---|
| 4 | 2.5 |
| 6 | 5.0 |
| 8 | 9.0 |
| 10 | 14.0 |
| 12 | 20.0 |
| 14 | 28.0 |
| 16 | 37.0 |

The following design guidelines shall also be followed:

- Minimum Thickness - 1.5 x the maximum stone diameter but not less than 6 inches
- Minimum Stone Specific Gravity - 2.5
- Applicable Filter Blanket Material (required between riprap and soil)
  - Sand
  - Gravel

- Plastic Filter Cloth
- o Maximum Bank Slope - 1.5:1

Additional design guidelines can be found in STORM WATER DRAINAGE FACILITIES, CHANNELS, and these shall be consulted as well.

Energy Dissipation

By constricting cross-sectional flow areas, increasing channel invert slopes, or decreasing channel roughness coefficient values, drainage improvements can artificially increase channel flow velocities in stream reaches that are immediately downstream. Therefore, appropriate energy dissipation devices shall be included in any drainage improvement design which creates design flow velocities which are capable of eroding the immediate downstream area. Design guidelines for dissipation devices which accompany pipe and paved channel outlets are presented in Appendices A-22 and A-23, respectively.

Sedimentation Prevention

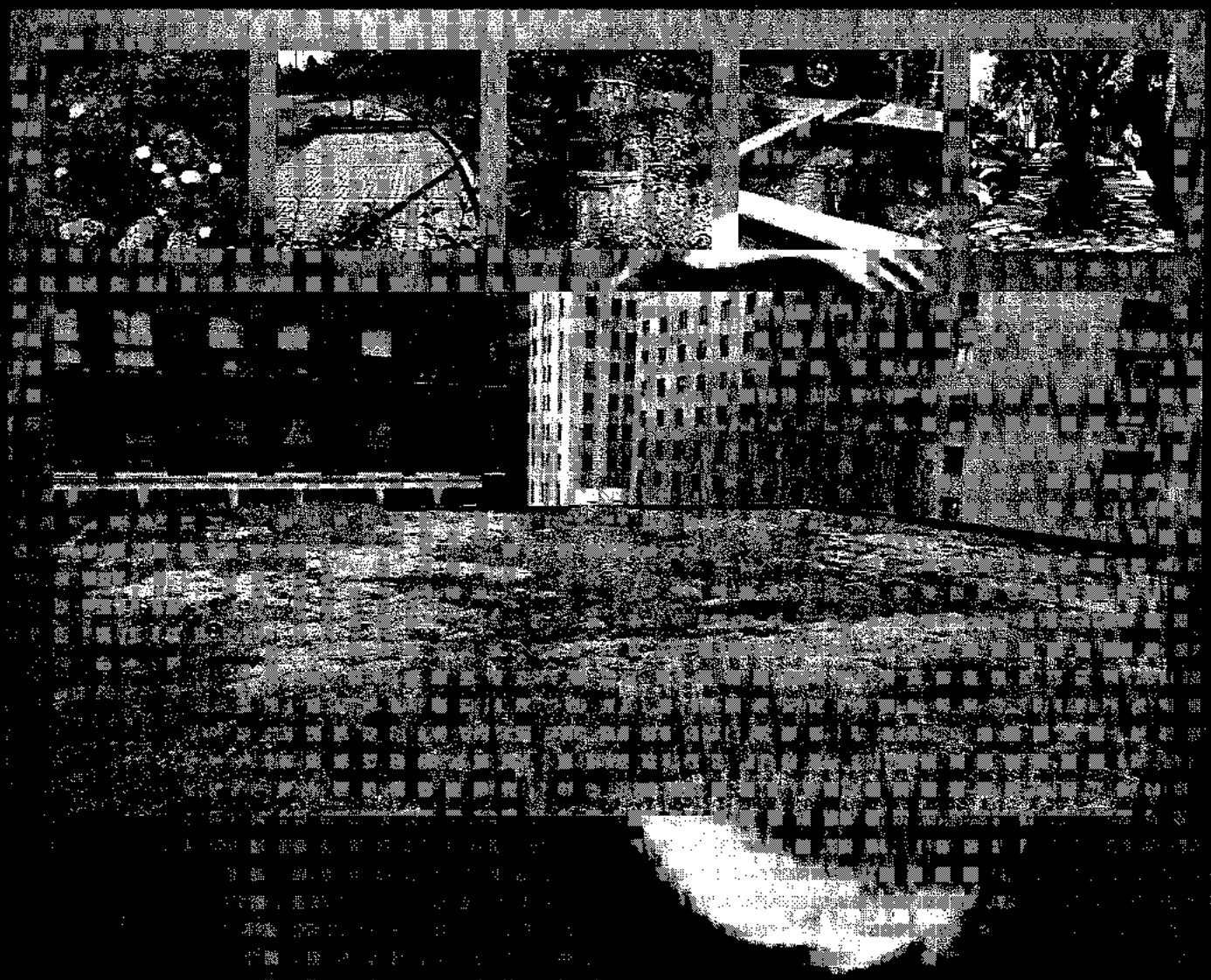
Storm Sewer Scour

Given their relatively non-erodible nature, subsurface storm sewer pipes can be designed so that design flows generate scour velocities which are sufficient to flush sediment. The Storm Water Transport Systems section (storm sewer and culverts subsections) stipulates a minimum design discharge velocity of 3 ft./sec.

Sedimentation Basins

If a new permanent land use is undertaken which generates a significant increase in the sediment load of runoff leaving the site, a relatively permanent sedimentation basin(s) shall be constructed according to the design criteria of the above CONSTRUCTION-RELATED CRITERIA, Collection and Detention Criteria, Sedimentation Basins section. Care must be taken to assess the effect of such a structure upon downstream receiving streams, for if the basin succeeds in reducing sediment load to a level which is significantly less than pre-development levels, degradation (progressive lowering of channel bed) of portions of downstream channels may occur.

# Appendix 2.9



Managing Wet Weather
with Green Infrastructure

# Water Quality Scorecard

Incorporating Green Infrastructure Practices
at the Municipal, Neighborhood, and Site Scales

# Managing Wet Weather with Green Infrastructure

## Municipal Handbook

## Water Quality Scorecard

The Municipal Handbook is a series of documents
to help local officials implement green infrastructure in their communities.

**August 2009**

EPA- 833-B-09-004

**Front Cover Photos**
Top: rain garden; permeable pavers; rain barrel; planter; tree boxes.
Large photo: green roof on Friends Center in Philadelphia, Pennsylvania

U.S. ENVIRONMENTAL PROTECTION AGENCY

# WATER QUALITY SCORECARD

## INCORPORATING GREEN INFRASTRUCTURE PRACTICES AT THE MUNICIPAL, NEIGHBORHOOD, AND SITE SCALES

### TABLE OF CONTENTS

# Executive Summary

Many communities across the United States face the challenge of balancing water quality protection with the desire to accommodate new growth and development. These cities and counties are finding that a review of local ordinances beyond just stormwater regulations is necessary to remove barriers and ensure coordination across all development codes for better stormwater management and watershed protection. Local policies, such as landscaping and parking requirements or street design criteria, should complement strong stormwater standards and make it easier for developers to meet multiple requirements simultaneously.

EPA's Water Quality Scorecard was developed to help local governments identify opportunities to remove barriers, and revise and create codes, ordinances, and incentives for better water quality protection. It guides municipal staff through a review of relevant local codes and ordinances, across multiple municipal departments and at the three scales within the jurisdiction of a local government (municipality, neighborhood, and site),[1] to ensure that these codes work together to protect water quality goals. The two main goals of this tool are to: (1) help communities protect water quality by identifying ways to reduce the amount of stormwater flows in a community and (2) educate stakeholders on the wide range of policies and regulations that have water quality implications.

The scorecard is for municipalities of various sizes in rural, suburban, and urban settings, including those that have combined sewers, municipal separate storm sewers, and those with limited or no existing stormwater infrastructure. It can help municipal staff, stormwater managers, planners, and other stakeholders to understand better where a municipality's[2] land development regulations and other ordinances may present barriers or opportunities to implementing a comprehensive water quality protection approach. The scorecard provides policy options, resources, and case studies to help communities develop a comprehensive water quality program.

# Background

Growth and development expand communities' opportunities by bringing in new residents, businesses, and investments. Growth can give a community the resources to revitalize a downtown, refurbish a main street, build new schools, and develop vibrant places to live, work, shop, and play. The environmental impacts of development, however, can make it more difficult for communities to protect their natural resources. The U.S. Census Bureau projects that the U.S. population will reach 400 million people by about 2040, which will add continued development pressure on local communities and the environment. Many communities are asking where and how they can accommodate this growth while maintaining and improving their water resources.

Land development directly affects watershed functions. When development occurs in previously undeveloped areas, the resulting alterations to the land can dramatically change the transportation and

[1] While the watershed scale is the best scale at which to look regionally at water quality protection strategies, it can be difficult to align policies, incentives, and regulations across political boundaries. For purposes of implementation, the largest scale the scorecard uses is the municipality.

[2] The term "municipality" as used by the International City/County Management Association (ICMA) refers to local government at both the city and county levels.

storage of water. Residential and commercial development create impervious surfaces and compacted soils that filter less water, which increases surface runoff and decreases groundwater infiltration. These changes can increase the volume and velocity of runoff, the frequency and severity of flooding, and peak storm flows.

Many communities are already struggling with degraded water bodies and failing infrastructure. For example, *EPA's National Water Quality Inventory: 1996 Report to Congress* indicated that 36 percent of total river miles assessed were impaired.[3] In EPA's 2004 Report to Congress, that percentage increased to 44 percent.[4] Further, a report by the National Academy of Sciences found urban stormwater is estimated to be the primary source of impairment for 13 percent of assessed rivers, 18 percent of lakes, and 32 percent of estuaries—significant numbers given that urban areas cover only 3 percent of the land mass of the United States.[5]

Urban runoff also affects existing wastewater and drinking water systems. EPA estimates that between 23,000 and 75,000 sanitary sewer overflows occur each year in the United States, releasing between 3 and 10 billion gallons of sewage annually.[6] Many of these overflow problems stem from poor stormwater management. Many municipalities—both large and small—must address the impact of existing impervious areas, such as parking lots, buildings, and streets and roads, that have limited or no stormwater management while at the same time trying to find effective and appropriate solutions for new development.

These water quality impairments exist, in part, because historically stormwater management—and indeed stormwater regulation—has focused primarily at the site level. The reasoning was that if one managed stormwater correctly at the site, then the protection of the community's water bodies occurred. However, as the findings of EPA's National Water Quality Inventory demonstrated, this strategy has not been as effective for two main reasons.

First, the site-level approach does not take into account the amount of off-site impervious surfaces. During the development boom from 1995-2005, rain-absorbing landscapes, such as forests, wetlands, and meadows, were transformed into large areas of houses, roads, office buildings, and retail centers. This development created vast areas of impervious cover, which generated significant increases in stormwater runoff. However, the amount of development in the watershed is not simply the sum of the sites within it. Rather, total impervious area in a watershed is the sum of sites developed plus the impervious surface of associated infrastructure supporting those sites, such as roads and parking lots.

Second, federal stormwater regulations focus on reducing pollutants in the runoff—the sediments from roads, fertilizers from lawns, etc.—and not on the amount of stormwater coming from a site. Nevertheless, the increased volume of runoff coming into a municipality's water bodies scours streams, dumps sediments, and pushes existing infrastructure past its capacity limits. Failure to consider the cumulative impact—this loss of natural land, increased imperviousness, and resulting stormwater runoff volumes— on regional water quality and watershed health has led communities to seek stormwater solutions that look beyond site-level approaches.

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[3] U.S. EPA National Water Quality Inventory: 1996 Report to Congress: http://www.epa.gov/305b/96report/index.html

[4] U.S. EPA National Water Quality Inventory: 2004 Report to Congress: http://www.epa.gov/owow/305b/2004report/

[5] *Urban Stormwater Management in the United States*, National Research Council of the National Academy of Sciences, 2008: http://dels.nas.edu/dels/rpt_briefs/stormwater_discharge_final.pdf

[6] U.S. EPA National Water Quality Inventory: 2004 Report to Congress: http://www.epa.gov/owow/305b/2004report/

Communities are recognizing the importance of managing water quality impacts of development at a variety of scales, including the municipal, the neighborhood, and site levels. A range of planning and development strategies at the municipal and neighborhood scales are necessary to address stormwater management comprehensively and systematically. At the same time that stormwater management is moving beyond the site level, it is also evolving beyond hardscaped, engineered solutions, such as basins and curb-and-gutter conveyance, to an approach that manages stormwater through natural processes.

A green infrastructure approach provides a solution to thinking at all 3 scales as well as how to change the specific types of practices used on the site.. Green infrastructure is a comprehensive approach to water quality protection defined by a range of natural and built systems that can occur at the regional, community, and site scales. At the larger regional or watershed scale, green infrastructure is the interconnected network of preserved or restored natural lands and waters that provide essential environmental functions. Large-scale green infrastructure may include habitat corridors and water resource protection. At the community and neighborhood scale, green infrastructure incorporates planning and design approaches such as compact, mixed-use development, parking reductions strategies and urban forestry that reduces impervious surfaces and creates walkable, attractive communities. At the site scale, green infrastructure mimics natural systems by absorbing stormwater back into the ground (infiltration), using trees and other natural vegetation to convert it to water vapor (evapotranspiration), and using rain barrels or cisterns to capture and reuse stormwater. These natural processes manage stormwater runoff in a way that maintains or restores the site's natural hydrology.

At the municipal scale, decisions about where and how our towns, cities, and regions grow are the first, and perhaps most important, development decisions related to water quality. Preserving and restoring natural landscape features (such as forests, floodplains, and wetlands) are critical components of green infrastructure. By choosing not to develop on and thereby protecting these ecologically sensitive areas, communities can improve water quality while providing wildlife habitat and opportunities for outdoor recreation. In addition, using land more efficiently reduces and better manages stormwater runoff by reducing total impervious areas. Perhaps the single most effective strategy for efficient land use is redevelopment of already degraded sites, such as abandoned shopping centers or underused parking lots, rather than paving greenfield sites.

At the intermediate or neighborhood scale, green infrastructure includes planning and design approaches such as compact, mixed-use development, narrowing streets and roads, parking reduction strategies, and urban forestry that reduce impervious surfaces and better integrate the natural and the built environment.

At the site scale, green infrastructure practices include rain gardens, porous pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting for non-potable uses such as toilet flushing and landscape irrigation. These processes represent a new approach to stormwater management that is not only sustainable and environmentally friendly, but cost-effective as well.

Municipalities are realizing that green infrastructure can be a solution to the many and increasing water-related challenges facing municipalities, including flood control, combined sewer overflows, Clean Water Act requirements, and basic asset management of publicly owned treatment systems. Communities need new solutions and strategies to ensure that they can continue to grow while maintaining and improving their water resources. This Water Quality Scorecard seeks to provide the policy tools, resources, and case studies to both accommodate growth and protect water resources.

# The Water Quality Scorecard

EPA worked with numerous water quality experts, local government staff, developers, urban designers, and others working on land use and water quality issues to develop this Water Quality Scorecard. The purpose of the scorecard is to address water quality protection across multiple scales (municipality, neighborhood, and site) and across multiple municipal departments. This scorecard can help municipal staff, stormwater managers, planners, and other stakeholders to understand better where a municipality's land development regulations and other ordinances may present barriers or opportunities to implementing a comprehensive green infrastructure approach. The tool's two main goals are to: (1) help communities protect water quality by identifying ways to reduce the amount of stormwater flows in a community and (2) educate stakeholders on the wide range of policies and regulations that have water quality implications.

Communities throughout the U.S. are implementing stormwater regulations that require or encourage the use of green infrastructure for managing stormwater on site. These cities and counties are finding that, to better manage stormwater and protect watersheds, green infrastructure policies require a review of many other local ordinances to remove barriers and ensure coordination across all development codes. Local policies, such as landscaping and parking requirements or street design criteria, should complement strong stormwater standards and make it easier for developers to meet multiple requirements simultaneously. At the same time, if these policies support water quality goals, they can independently reduce and better manage stormwater runoff.

## How to Use the Scorecard

This scorecard is a locally controlled self-assessment and guide for better incorporating green infrastructure practices at the municipal, neighborhood, and site scales. While one department or agency could complete the tool, the effectiveness of this tool will increase if an interagency process is established to review all local codes and policies that might affect water quality.

Completing the Water Quality Scorecard requires different documents, plans, codes, and guidance manuals. While the legal structure for stormwater management and land development regulation varies among municipalities, the following list contains the most common and relevant documents to complete this scorecard and describes how they can create impervious cover.

- *Zoning ordinances* specify the type and intensity of land uses allowed on a given parcel. A zoning ordinance can dictate single-use low-density zoning, which spreads development throughout the watershed, creating considerable excess impervious surface.

- *Subdivision codes* or ordinances specify development elements for a parcel: housing footprint minimums, distance from the house to the road, the width of the road, street configuration, open space requirements, and lot size—all of which can lead to excess impervious cover.

- *Street standards or road design guidelines* dictate the width of the road, turning radius, street connectivity, and intersection design requirements. Often in new subdivisions, roads tend to be too wide, which creates excess impervious cover.

- *Parking requirements* generally set the minimum, not the maximum, number of parking spaces required for retail and office parking. Setting minimums leads to parking lots designed for peak

demand periods, such as the day after Thanksgiving, which can create acres of unused pavement during the rest of the year.

- *Setbacks* define the distance between a building and the right-of-way or lot line and can spread development out by leading to longer driveways and larger lots. Establishing maximum setback lines for residential and retail development will bring buildings closer to the street, reducing impervious cover associated with long driveways, walkways, and parking lots.

- *Height limitations* limit the number of floors in a building. Limiting height can spread development out if square footage is unmet by vertical density.

- *Open space or natural resource plans* detail land parcels that are or will be set aside for recreation, habitat corridors, or preservation. These plans help communities prioritize their conservation, parks, and recreation goals.

- *Comprehensive plans* may be required by state law, and many cities, towns, and counties prepare comprehensive plans to support zoning codes. Most comprehensive plans include elements addressing land use, open space, natural resource protection, transportation, economic development, and housing, all of which are important to watershed protection. Increasingly, local governments are defining existing green infrastructure and outlining opportunities to add new green infrastructure throughout the community.

An initial step in using this tool is to convene appropriate staff to review various sections of the tool and coordinate to both identify opportunities for change and address the potential inconsistencies between policies. The approaches described in this scorecard may be under the control of a number of different local government agencies, including:

- Parks and Recreation
- Public Works
- Planning
- Environmental Protection
- Utilities
- Transportation

The scorecard's review of land use and development policies provides guidance for implementing a range of regulatory and non-regulatory approaches, including land use planning elements, land acquisition efforts, and capital investment policies that can help various municipal agencies integrate green infrastructure into their programs. Internal agency policies and practices, such as maintenance protocols or plan review processes, may be potential barriers as well.

Each policy or approach is described in the context of its potential for providing water quality benefits, although most of the policies have many additional benefits for community livability, human health, air quality, energy use, wildlife habitat, and more. This tool does not provide model ordinance language. It emphasizes best practices and helps municipalities understand the incremental steps for changing specific policies and internal agency practices. The scorecard divides the tools and policies into four categories:

1. Adopt plans
2. Remove barriers
3. Adopt incentives

4. Enact regulations

These four categories provide greater structure to the compiled tools by organizing the policies or approaches as incremental changes and updates. These categories may help municipal staff prioritize which tools to work on based on local factors like resources, time, and political support. For example, an appropriate first step in the process of updating local regulations may be to remove a barrier rather than enacting a new regulation. Most policy options avoid specific performance guidance so that the tool is useful to a range of municipalities in different contexts. However, the case studies and resources provide locally appropriate performance measures where possible.

To highlight the diverse nature of green infrastructure approaches, as well as the fact that oversight over these policies resides in various municipal agencies, the scorecard has five sections:

1. Protect Natural Resources (Including Trees) and Open Space
2. Promote Efficient, Compact Development Patterns and Infill
3. Design Complete, Smart Streets that Reduce Overall Imperviousness
4. Encourage Efficient Provision of Parking
5. Adopt Green Infrastructure Stormwater Management Provisions

The five sections organize green infrastructure approaches based on drivers of impervious cover at the municipal, neighborhood, and site scales. Yet all three scales may be in any single section. For example, the parking section will have questions that address the municipal, neighborhood and site level considerations.

The scorecard describes alternative policy or ordinance information that, when implemented, would support a comprehensive green infrastructure approach, and will allow the municipality to determine where, in the broad spectrum of policy implementation, their policies fall.

## A Note about the Point System

The tool includes a point system to make it easier to evaluate and improve local programs. The municipality can decide whether to use the point system at all. If the point system is used, municipalities can set locally appropriate thresholds and goals.

Governments could choose to use the point system in many different ways, including:

- State governments could require municipalities to complete the Water Quality Scorecard and establish measures for improvement over different permit cycles. For example, a municipality might have to improve its score by some number of points before the next permit cycle.

- Local governments could determine a score based on existing programs and policies and then set goals from this baseline. Local targets may include incremental yearly improvements or achieving additional points in a particular section, such as "Encourage Efficient Parking Supply" or "Protect Natural Resources and Open Space."

- Stakeholders such as watershed groups or environmental organizations could complete the scorecard and then provide feedback and information assistance to the local government about sections within the scorecard that received few points and might be an area for improvement.

- The total score or scores in certain sections could educate elected officials, decision makers, and others about the importance of these issues and the role of local policies in addressing them.

- A lack of points in one section may alert a municipality that a certain area, such as parking, lacks local ordinances that support green infrastructure and may be ripe for improvement.

- Variation in the number of points achieved across the five sections may help a municipality to better assess local sources of impervious cover and potential for the introduction of green infrastructure.

Because the scorecard is for use by a range of community types and sizes in locations throughout the U.S., please note that no single municipality will be able to receive every point. Some questions and points may only be available to urban municipalities while others may only be available to those in a suburban or rural setting.

## Tips for Building Relationships Between Stormwater Managers, Land Use Planners, and Other Local Officials

Effective stormwater management requires coordination and collaboration across many different municipal departments and processes. Below are some ideas for incorporating stormwater management in traditional planning processes and programs.

- Include both land use planners and stormwater managers in pre-concept and/or pre-application meetings for potential development projects.

- Use local government sites (e.g., schools, regional parks, office buildings, public works yards) as demonstration projects for innovative land use strategies and stormwater management. Form a team that includes land use planners, stormwater managers, parks and school officials, etc. to work out the details.

- Include stormwater managers in the comprehensive plan process to incorporate overall watershed and stormwater goals.

- Make sure that both land use planners and stormwater managers are involved in utility and transportation master planning.

- Allow stormwater managers to be involved in economic development planning, especially for enterprise zones, Main Street projects, and other projects that involve infill and redevelopment. Encourage stormwater managers to develop efficient watershed-based solutions for these plans.

- Develop cross training and joint activities that allow land use planners, stormwater managers, and transportation, utility, and capital projects planners to explore the improved integration of various land use and stormwater processes.

- Hold staff trainings with speakers that are knowledgeable about smart growth and stormwater management. Alternately, encourage land use planners, stormwater managers, and other local officials to attend trainings on this topic as a team.

## TABLE 1: WATER QUALITY SCORECARD QUICK REFERENCE GUIDE

| INCORPORATING GREEN INFRASTRUCTURE PRACTICES AT THE MUNICIPAL, NEIGHBORHOOD, AND SITE SCALES SUMMARY | | |
|---|---|---|
| | **Policy Question** | **Goal** |
| | **PROTECT NATURAL RESOURCES (INCLUDING TREES) AND OPEN SPACE** | |
| **1A.** | **Natural Resource Protection** | |
| | Are development policies, regulations, and incentives in place to protect natural resource areas and critical habitat? | Protect natural resource areas (e.g., forests, prairies) and critical habitat (e.g., conservation corridors, buffer zones, wildlife preserves) from future development. |
| | Are no-development buffer zones and other protective tools in place around wetlands, riparian areas, and floodplains to improve/protect water quality? | Protect critical areas such as wetlands, floodplains, lakes, rivers, and estuaries with a mandatory no-development buffer. |
| | Does the community have protection measures for source water protection areas through land use controls and stewardship activities? | Protect source water areas from current or potential sources of contamination. |
| **1B.** | **Open Space Protection** | |
| | Does the jurisdiction have adequate open space in both developed and greenfield areas of the community? | Create open networks throughout a community that serve a dual function of providing recreational areas and assisting in management of stormwater runoff. |
| **1C.** | **Tree Preservation** | |
| | Does the local government have a comprehensive public urban forestry program? | Protect and maintain trees on public property and rights-of-way and plant additional trees to enhance the urban tree canopy. |
| | Has the community taken steps to protect trees on private property? | Preserve trees on private property and require replacement when trees are removed or damaged during development. |
| | Do local codes encourage or require street trees as part of road and public right-of-way capital improvement projects? | Leverage existing capital funds to plant more street trees and add multiple benefits to the public right-of-way. |
| | **PROMOTE EFFICIENT, COMPACT DEVELOPMENT PATTERNS AND INFILL** | |
| **2A.** | **Infill and Redevelopment** | |
| | Are policy incentives in place to direct development to previously developed areas? | Municipalities implement a range of policies and tools to direct development to specific areas. |
| **2B.** | **Development in Areas with Existing Infrastructure** | |
| | Is the jurisdiction directing growth to areas with existing infrastructure, such as sewer, water, and roads? | Adopt policies, incentives, and regulations to direct new development to areas that have infrastructure, such as water and sewer. |
| **2C.** | **Mixed-Use Development** | |
| | Are mixed-use and transit-oriented developments allowed or encouraged? | Revise codes and ordinances to allow for the "by right" building of mixed-use and transit-oriented developments. |
| | **DESIGN COMPLETE, SMART STREETS THAT REDUCE OVERALL IMPERVIOUSNESS** | |
| **3A.** | **Street Design** | |
| | Do local street design standards and engineering practices encourage streets to be no wider than is necessary to move traffic effectively? Do policies allow narrow | Appropriate street widths allow narrower lanes for certain street types, thereby reducing overall imperviousness. |

| | | |
|---|---|---|
| | neighborhood streets designed to slow traffic and create safer conditions for pedestrians and bicyclists? | |
| | Are shared driveways, reduced driveway widths, two-track driveways, and rear garages and alleys encouraged for all single-family developments? | Encourage alternative forms and decreased dimensions of residential driveways and parking areas. |
| **3B.** | **Green Infrastructure Elements and Street Design** | |
| | Are major street projects required to integrate green infrastructure practices as a standard part of construction, maintenance, and improvement plans? | Formally integrate green infrastructure into standard roadway construction and retrofit practice. |
| | Do regulations and policies promote use of pervious materials for all paving areas, including alleys, streets, sidewalks, crosswalks, driveways, and parking lots? | Build and retrofit these surfaces with pervious materials to reduce stormwater runoff and its negative impacts. |
| | **ENCOURAGE EFFICIENT PROVISION OF PARKING** | |
| **4A.** | **Reduced Parking Requirements** | |
| | Does your local government provide flexibility regarding alternative parking requirements (e.g., shared parking, off-site parking) and discourage over-parking of developments? Do parking requirements vary by zone to reflect places where more trips are on foot or by transit? | Match parking requirements to the level of demand and allow flexible arrangements to meet parking standards. |
| **4B.** | **Transportation Demand Management Alternatives** | |
| | Does the municipality allow developers to use alternative measures such as transportation demand management or in-lieu payments to reduce required parking? | Provide flexibility to reduce parking in exchange for specific actions that reduce parking demands on site. |
| **4C.** | **Minimizing Stormwater From Parking Lots** | |
| | Are there requirements for landscaping designed to minimize stormwater in parking lots? | Require substantial landscaping to help reduce runoff. |
| | **ADOPT GREEN INFRASTRUCTURE STORMWATER MANAGEMENT PROVISIONS** | |
| **5A.** | **Green Infrastructure Practices** | |
| | Are green infrastructure practices encouraged as legal and preferred for managing stormwater runoff? | Make all types of green infrastructure allowed and legal and remove all impediments to using green infrastructure (including for stormwater requirements), such as limits on infiltration in rights-of-way, permit challenges for green roofs, safety issues with permeable pavements, restrictions on the use of cisterns and rain barrels, and other such unnecessary barriers. |
| | Do stormwater management plan reviews take place early in the development review process? | Incorporate stormwater plan comments and review into the early stages of development review/site plan review and approval, preferably at pre-application meetings with developers. |
| | Do local building and plumbing codes allow harvested rainwater use for exterior uses such as irrigation and non-potable interior uses such as toilet flushing? | Ensure that the municipality allows and encourages stormwater reuse for non-potable uses. |
| | Are provisions available to meet stormwater requirements in other ways, such as off-site | Allow off-site management of runoff while still holding developers responsible for meeting stormwater |

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| | management within the same sewershed or "payment in lieu" of programs, to the extent that on-site alternatives are not technically feasible? | management goals. |
| **5B.** | **Maintenance/Enforcement** | |
| | Does your stormwater ordinance include monitoring, tracking, and maintenance requirements for stormwater management practices? | Incorporate monitoring, tracking, and maintenance requirements for stormwater management practices into your municipal stormwater ordinance. |

## Getting Started

Below are suggested steps to help complete the Water Quality Scorecard:

**Step 1**. Review the scorecard to identify which agencies, departments, or personnel will be required to complete each section.

**Step 2.** Convene appropriate staff to review various sections of the tool, and work together to ensure that updates and changes to codes, policies, and internal processes align well with other agency changes.

**Step 3**. Collect existing ordinances and policies that will be necessary references to complete the scorecard.

**Step 4**. Coordinate between appropriate agencies or departments to complete the scorecard.

Please indicate by your signature that you have reviewed the tool with all co-signees of this document (name, department, and date):

_____

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**Step 5**: Identify sections of the scorecard and/or specific policy questions that should be prioritized for immediate revision or update.

**Step 6**: Identify short-, medium-, and long-term goals and strategies for revising local policies to better support green infrastructure.

# Section 1: Protect Natural Resources (Including Trees) and Open Space

| 1.A—Natural Resource Protection | Tools and Policies | Points Available | Points Received or N/A | Notes and Local References |
|---|---|---|---|---|
| **(1) Sensitive Natural Lands/Critical Area Protection**<br><br>**Question:** Are development policies, regulations, and incentives in place to protect natural resource areas and critical habitat?<br><br>**Goal:** Protect natural resource areas (e.g., forests, prairies) and critical habitat (e.g., conservation corridors, buffer zones, wildlife preserves) from future development.<br><br>**Why:** Protection of significant tracts of critical lands and wildlife habitat will aid in protecting and improving water quality by increasing infiltration and groundwater recharge, preventing erosion and contamination of ground water and surface water resources, and protecting sources of drinking water. | **Adopt Plans/Educate:**<br><br>• Identify and map critical natural resource areas (e.g., steep slopes, wildlife habitat, forests, drinking water source areas). | 1 | ✓ | 156.056 D Open space + steep slopes |
| | • The local comprehensive plan contains a natural resource protection element with goals calling for preservation of identified critical natural resource areas. | 1 | — | |
| | • Identify key natural resource areas for protection in jurisdiction's parks and open space plan. | 1 | ✓ | |
| | • Assist landowners in identifying sensitive natural areas and laying out developments to avoid such areas. | 1 | ✓ | |
| | • Local plans establish and enforce areas which are available for development and which lands are a priority for preservation. | 1 | ✓ | 156.056 |
| | **Remove Barriers:**<br><br>• Protection of sensitive natural areas and wildlife habitat qualifies for credit towards local open space dedication and set-aside requirements. | 1 | ✓ | |
| | **Adopt Incentives:**<br><br>• Provide financial support to or collaborate with land trusts to acquire critical natural areas. | 1 | ✓ | |

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| | • Establish a dedicated source of funding for open space acquisition and management (e.g., bond proceeds, sales tax). | 2 | Ø | |
| | • Adopt a transferable developments rights program to provide an incentive for landowners to preserve sensitive natural lands and wildlife habitat. | 1 | Ø | |
| | • Land use regulations provide for the creation of cluster and conservation subdivision on the periphery of urban growth areas to encourage preservation of intact blocks of sensitive natural areas. | 1 | 1 | 156.037 F |
| | **Enact Regulations:**<br>• Adopt regulations to protect steep slope, hillsides, and other sensitive natural lands (e.g., by limiting development on slopes > 30% or requiring larger lot sizes in sensitive areas). | 2 | 2 | 156.056 D 1a2 |
| | • Adopt wildlife habitat protection regulations aimed at preserving large contiguous blocks of habitat areas. | 2 | Ø | |
| | • Create agriculture/natural resource zoning districts (e.g., minimum lot size of 80 acres and larger) to preserve agricultural areas and forests. | 2 | Ø | |
| **(2) Protection Of Water Bodies/Aquifers**<br><br>**a. Question:** Are no-development buffer zones and other protective tools in place around wetlands, riparian areas, and floodplains that improve/protect water quality? | **Adopt Plans/Educate:**<br>• Identify and map critical water resource areas. | 1 | 1 | 56.95 D 2 |
| | • The local comprehensive plan contains a water quality protection element with goals calling for protection of identified water bodies and other water resource areas such as wetlands. | 1 | — | |

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| **Goal:** Protect critical areas such as wetlands, floodplains, lakes, rivers, and estuaries with a mandatory no-development buffer.<br><br>**Why:** The use of these practices will reduce pollutant loads and hydrologic alterations to water bodies. | • Identify key critical water resource areas for protection in jurisdiction's parks and open space plan.<br><br>• Cooperate in developing regional approaches to watershed protection and stormwater management. | 1<br><br>1 | Ø<br><br>1 | 56.67 |
| | **Remove Barriers:**<br><br>• Wetlands and other water bodies and buffer areas qualify for credit against local open space dedication/set-aside regulations. | 1 | Ø | |
| | **Adopt Incentives:**<br><br>• Protected water bodies and buffer areas qualify for twice the credit (or more) against open space requirements set by the municipality.<br><br>• Restoration of degraded riparian/wetland areas qualifies for additional open space credit within the local municipal system.<br><br>• Transfer of density from protected riparian areas/buffers to upland portions of development sites. | 1<br><br>1<br><br>1 | Ø<br><br>Ø<br><br>Ø | |
| | **Enact Regulations:**<br><br>• Riparian and wetland buffer areas required by local land use regulations<br>--Buffer is at least 50 feet (as measured from the top of bank) = 1 point<br>--Buffer is at least 100 feet (as measured from the top of bank) = 2 points<br>--Buffer is greater than 100 feet (as measured from the top of bank) = 3 points<br><br>• Critical water resource areas cannot be counted in | 1 to 3 points<br><br>1 | 1<br>Ø<br>xxx<br><br>Ø | buffer is 50 ft<br>56.84 B |

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| | calculating allowable density on a site (e.g., on a 200-acre site with 50 acres of wetlands, only 150 acres can be used to calculate density under zone district regulations, and only those 150 acres may be developed). | | | 15(.056 D |
| | • Development in floodplains is prohibited or must demonstrate no adverse impacts upstream and downstream (See resources below for details on "no adverse impact" approach to floodplain management). | 2 | 2 | 156.080 |
| | • Stormwater quality and quantity performance standards exist for development sites (e.g., restrictions on sedimentation levels, pre/post development flows). | 1 | 1 | 56.21 |
| | • Local regulations require restoration of degraded riparian/wetland areas on a development site. | 1 | Ø ? | 404/401 ? |
| | • Compensation for damage to riparian/wetland areas must be on a minimum 2:1 basis on- or off-site. | 1 | Ø ? | 404/401 ? |
| | • Performance standards exist and are well enforced for stormwater discharges to wetlands that protect the hydrologic regimes and limit pollutant loads. | 1 | | |
| **b. Question:** Does the community have protection measures for source water protection areas through land use controls and stewardship activities?<br><br>**Goal:** Protect source water areas from current or potential sources of contamination.<br><br>**Why:** These practices will help | **Adopt Plans/Educate:**<br>• Local land use plans identify aquifer recharge/source water areas and recommend protective measures. | 1 | Ø | |
| | • Require that all stormwater inlets carry a notice regarding discharge to receiving waters. | 1 | Ø | |
| | • Map and publish wellhead and aquifer recharge areas to alert developers to potential restrictions. | 1 | Ø | |

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| safeguard community health, reduce the risk of water supply contamination, and potentially reduce water treatment costs. | **Adopt Incentives:**<br>• Identification of drinking water source protection and aquifer recharge areas with a dedicated funding source in place to purchase and protect such areas.<br>• Protection of critical water source areas qualifies for additional credit towards local open space requirements. | 1<br>1 | Ø<br>Ø | |
| | **Enact Regulations:**<br>• Adopt well-head protection regulations/zones to prevent incompatible development and uses.<br>• Adopt aquifer protection regulations/zones to prevent incompatible development and uses. | 1<br>2 | Ø<br>6 | |
| **1.B– Open Space Protection** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |
| **(1) Question:** Does the jurisdiction have adequate open space in both developed and greenfield areas of the community?<br><br>**Goal:** Create open space networks throughout a community that serve a dual function of providing recreational areas and assisting in the management of stormwater runoff.<br><br>**Why:** In addition to providing open space throughout a community as an amenity, such a network can provide large areas that contribute little to stormwater loads and can | **Adopt Plans/Educate:**<br>• Adopt a community-wide open space and parks plan.<br>• The local comprehensive plan contains an open space/parks element that recognizes the role of open space in sustainable stormwater management. | 1<br>1 | –<br>– | |
| | **Remove Barriers:**<br>• Green infrastructure practices count towards local open space set aside requirements up to 50% of total.<br>• Allow and encourage retrofits of abandoned or underutilized public lands to serve as permanent or temporary open space and green infrastructure sites. | 1<br>1 | Ø<br>6 | |

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| provide large areas for the infiltration and purification of stormwater. | **Create Incentives:**<br>• Additional open space credits are eligible for green stormwater management facilities improved/designed for public recreational purposes.<br>• Provide credit against open space impact fees for green roofs. | 1<br>1 | Ø<br>Ø | |
| | **Enact Regulations:**<br>• Adopt neighborhood policies and ordinances that work to create neighborhood—not development site—open space amenities that are within ¼ to ½ mile walking distance from every residence.<br>• Adopt an open space impact fee to purchase passive open space that can assist in stormwater management.<br>• Adopt open space dedication and/or set aside requirements based on the demand generated by the development. As a baseline, use the average open space requirements adopted by the National Recreation and Park Assn. (e.g., 10 acres of community and neighborhood parks for every 1,000 persons in a development or fraction thereof). | 1<br>1<br>1 | Ø ?<br>Ø<br>Ø | |
| **1.C–Tree Protection** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |
| **(1) Question:** Does the local government have a comprehensive public urban forestry program?<br><br>**Goal:** Protect and maintain trees on public property and rights-of-way | **Adopt Plans/Educate:**<br>• Survey and inventory existing trees on public lands and street rights-of-way. Document the characteristics and location of street trees and urban tree canopy to inform public tree planting, adoption, and maintenance | 1 | 0 | |

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| and plant additional trees to enhance the urban tree canopy.<br><br>**Why:** Mature trees provide multiple community benefits, reduce overall stormwater runoff, and improve stormwater quality. | programs.<br><br>• Select tree species based on known performance for managing stormwater runoff. Publish list and make widely available for homeowners/others that plant street trees.<br><br>• Conduct education and outreach about tree protection, proper maintenance, and replanting opportunities through printed materials, workshops, events, and signage.<br><br>• Adopt a policy to protect existing trees on local government development sites (e.g., municipal parking lots, municipal buildings).<br><br>• Maintain an active tree maintenance program for public trees, including pest control, pruning, watering, and similar measures. | 1<br><br>1<br><br>1<br><br>1 | Ø<br><br>Ø<br><br>1<br><br>Ø | 100.07 |
| | **Remove Barriers:**<br><br>• Acknowledge trees as part of community infrastructure and develop a coordinated design for locating public utilities to provide enough space for mature tree canopy and root development. | 1 | Ø | |
| | **Adopt Incentives:**<br><br>• Provide free or reduced-price trees to homeowners to be used as street trees. | 1 | Ø | |
| | **Enact Regulations:**<br><br>• Require any public trees removed or damaged during construction associated with private development to be replaced on- or off-site with an equivalent amount of tree caliper (e.g., remove a 24-inch diameter tree/replace with 6 four-inch diameter trees). | 1 | Ø | |

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| | • Adopt construction protection rules for all public trees (e.g., fencing, no storage of hazardous materials, avoid cutting into root zones). | 1 | ✓ | 100.07 |
| **(2) Question**: Has the community taken steps to protect trees on private property?<br><br>**Goal**: Preserve trees on private property and require replacement when trees are removed or damaged during development.<br><br>**Why**: Mature trees provide multiple environmental, economic, and community benefits, including improved water and air quality, reduced heat island effects, lowered energy costs, and improved community aesthetics. | **Adopt Plans/Educate:**<br>• Community plans specifically include tree preservation and replacement as community goals.<br>• Conduct educational sessions for builders and developers regarding appropriate tree protection techniques and/or publish a technical tree protection manual.<br>• Follow maintenance and inspection timelines and meet canopy goals and milestones by ensuring old trees survive, replacing dead or diseased trees, and planting new trees. | 1<br>1<br>1 | ✓<br>✓<br>✓ | |
| | **Remove Barriers:**<br>• Set up maintenance and inspection agreements for private properties meeting stormwater requirements or receiving stormwater fee credit for trees.<br>• Set up long-term maintenance and inspection schedules for trees on public lands. | 1<br>1 | ✓<br>✓ | |
| | **Adopt Incentives:**<br>• Support local non-profits that plant trees and provide educational services.<br>• Provide financial incentives for tree purchases and planting.<br>• A tree fund has been established to receive in-lieu payments when trees must be removed from a development site to accommodate permitted projects. | 1<br>1<br>1 | ✓<br>✓<br>1 WOB | 100.13 |

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| | • Trees of a specified minimum size count towards a percentage of stormwater management requirements (e.g., partial credit given for each mature tree exceeding a specified height or canopy size).<br><br>• Trees over a specified minimum size (e.g., 3-inch caliper) protected during development are credited towards landscaping requirements.<br>-- meeting the established landscape requirement = 1 point<br>--exceeding the established landscape requirement = 2 points | 1<br><br>1 to 2 points | Ø<br><br>Ø | |
| | **Enact Regulations:**<br><br>• Require permits before removing trees on proposed development or redevelopment sites. Provide fines and/or stop-work authority for permit violations.<br><br>• Set minimum tree preservation standards for new development sites.<br><br>• Require site plans or stormwater plans to include tree preservation.<br><br>• Require/allow tree replacement off-site for infill sites. | 1<br><br>1<br><br>1<br><br>1 | Ø<br><br>Ø<br><br>1 ?<br><br>Ø | 156.024 |
| **(3) Question:** Are street trees encouraged or required as part of road and public right-of-way capital improvement projects?<br><br>**Goal**: Leverage existing capital funds to plant more street trees and add multiple benefits to the public right-of-way.<br><br>**Why**: Street trees can help manage | **Adopt Plans/Educate:**<br><br>• Local comprehensive and transportation plans support the planting of street trees by all private and public development projects.<br><br>• Capital improvement plans include tree planning as part of project budgets.<br><br>**Adopt Incentives:** | 1<br><br>1 | Ø<br><br>– | |

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| and reduce stormwater runoff while providing multiple public and environmental benefits. | • Offer incentives, such as reduced setbacks or increased building densities, in exchange for additional tree preservation beyond ordinance requirements. | 1 | Ø | |
| | **Enact Regulations:**<br>• All private and public developments are required to plant street trees in accordance with size, spacing, and other local government requirements. | 1 | Ø | |
| | • New street designs and redesigns of existing streets take into account space for tree development and require necessary surface area and volume of soil dependent on type of tree species selected (this includes lateral root growth as well as direct downward growth to accommodate mature tree canopy and roots without adversely affecting other utilities). | 1 | Ø | |
| | • Street specifications require permeable paving for sidewalks and other surfaces to reduce stormwater runoff and allow street trees to benefit from the available water. | 1 | Ø | |
| **Total score for PROTECT NATURAL RESOURCE AREAS AND OPEN SPACE:** | | 80 | 13 | |

**This section has been reviewed and scored by** _____
**(Insert Department name and signee)**

## RESOURCES

- Planner's Guide to Wetland Buffers for Local Governments, Environmental Law Institute: http://www.elistore.org/reports_detail.asp?ID=11272

- Mertes, James D. and James R. Hall. *Park, Recreation, Open Space and Greenway Guidelines*. National Recreation and Park Association, 1996.
- Center for Watershed Protection guidance on aquatic buffers: http://www.cwp.org/Resource_Library/Restoration_and_Watershed_Stewardship/perviousarea.htm
- "Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances," Carl Vinson Institute of Government, The University of Georgia: http://www.rivercenter.uga.edu/publications/pdf/riparian_buffer_guidebook.pdf
- No Adverse Impact Floodplain Management, Association of State Floodplain Managers: http://www.floods.org/index.asp?menuID=349&firstlevelmenuID=187&siteID=1
- Riparian Toolbox: Model Regulations and Legal Issues, Long Island Sound Study: http://www.longislandsoundstudy.net/riparian/legal.htm
- Model Ordinances to Protect Local Resources: Aquatic Buffers, U.S. EPA: http://www.epa.gov/owow/nps/ordinance/osm1.htm
- Duerksen, Christopher and Cara Snyder. *Nature-Friendly Communities: Habitat Protection and Land Use Planning*. Island Press, 2005.
- City Trees: Sustainability Guidelines and Best Practices: http://www.treetrust.org/pdf/community-forestry-city-trees-bonestroo.pdf
- Guide to Setting Urban Tree Canopy Goals, American Forests: http://www.americanforests.org/resources/urbanforests/treedeficit.php
- Urban Forestry Manual, Center for Watershed Protection: http://www.cwp.org/forestry/part3forestrymanual.pdf (pg. 69))
- Duerksen, Christopher and Suzanne Richman, "Tree Conservation Ordinances." *American Planning Association*. 1993: Planning Advisory Service Report No. 446.
- Duerksen, Christopher , Mowery, M. and McGlyn M. "Tree Preservation." *Zoning Practice*. July 2006: American Planning Association, Volume 23 Number 7.
- "Trees for green streets: An illustrated guide," Portland Metro: http://www.metro-region.org/index.cfm/go/by.web/id=26337
- Tree Preservation Information Guide, Portland, Oregon: http://www.sustainableportland.org/shared/cfm/image.cfm?id=72545
- Storm Water Pollution Prevention Plan (SWPPP) Guide, U.S. EPA: http://cfpub.epa.gov/npdes/stormwater/swppp.cfm
- Center for Urban Forest Research, U.S. Forest Service: http://www.fs.fed.us/psw/programs/cufr/
- Urban Forest Policy and Management, U.S. Forest Service: http://www.fs.fed.us/psw/programs/cufr/research/studies.php?TopicID=1
- Plants for Stormwater Design Volume II, Great River Greening: http://www.greatrivergreening.org/_downloads/PSD%20II%20Sample.PDF

### CASE STUDIES

- Alachua County, Florida's land conservation and acquisition program, *Alachua County Forever*, has conserved over 17,000 acres of environmentally sensitive land: http://www.alachuacounty.us/government/depts/epd/land/filesforms.aspx
- Baltimore County, Maryland's Master Plan 2010 designates land management areas that include agricultural preservation areas and resource preservation areas: http://www.baltimorecountymd.gov/Agencies/planning/masterplanning/smartgrowth.html
- King County, Washington's Greenprint Project is an open space and resource conservation strategy that focuses on land acquisition, restoration projects, regulatory changes and protection within the urban growth boundary: http://dnr.metrokc.gov/wlr/greenprint/about.htm
- The Pennsylvania Horticultural Society's *Philadelphia Green* program revitalizes and maintains abandoned land and public spaces by partnering with government, businesses and the community: http://www.pennsylvaniahorticulturalsociety.org/phlgreen/about.html
- Chicago, Illinois's Open Space Impact Fee Ordinance charges a fee associated with residential development building permits and spends the funds on acquisition of neighborhood open space in the same area where development occurs:

http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?blockName=Buildings%2FContent&deptMainCategoryOID=-536901233&entityName=Buildings&topChannelName=Dept&contentOID=536988877&contenTypeName=COC_EDITORIAL

- Lenexa, Kansas's Watershed Management Plan, includes erosion and sediment control, stream buffers, subwatershed protection and improvement, and design standards for the city's uniform development code: https://www.ci.lenexa.ks.us/Planning/compplan/Overview/
- The Maryland Cooperative Extension Service provides a fact sheet on how to design, plant and maintain a riparian forest buffer: http://www.riparianbuffers.umd.edu/fact/FS725.html
- Vermont's Department of Environmental Conservation offers grants to conservation organizations to purchase or receive donated river corridor easements on private property within priority stretches of river: http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_RiverCorridorEasementGuide.pdf
- The U.S. Department of Agriculture's Natural Resources Conservation Service provides guidance on riparian buffers through the Ohio Lake Erie Buffer Program: http://www.oh.nrcs.usda.gov/programs/Lake_Erie_Buffer/riparian.html
- Davidson, North Carolina requires a public park within a five minute walk of all housing units, providing multifunctional neighborhood open space: http://www.ci.davidson.nc.us/index.aspx?NID=576
- San Jose, California gives post-construction stormwater treatment credit for new and existing trees in close proximity to impervious areas: http://www.sanjoseca.gov/planning/stormwater/Policy_6-29_Memo_Revisions.pdf
- Portland, Oregon gives a stormwater fee discount for trees over 15 feet tall: http://www.portlandonline.com/bes/index.cfm?c=43444&#types
- Portland, Oregon also gives a tree credit for meeting local stormwater requirements: http://www.portlandonline.com/shared/cfm/image.cfm?id=93075
- Portland, Oregon Parks and Recreation and Bureau of Development Services regulate tree cutting on private property and public property: http://www.portlandonline.com/parks/index.cfm?c=39712
- New York City requires street tree planting for a range of developments and zoning increases: http://www.nyc.gov/html/dcp/html/street_tree_planting/index.shtml
- Charlottesville, North Carolina has set goals for achieving a 40% minimum urban tree canopy: http://www.charlottesville.org/Index.aspx?page=1745 (Chapter 8, pgs. 184-187)

# Section 2: Promote Efficient, Compact Development Patterns and Infill

| 2.A—Support Infill and Redevelopment | Tools and Policies | Points Available | Points Received or N/A | Notes and Local References |
|---|---|---|---|---|
| **(1) Question**: Are policy incentives in place to direct development to previously developed areas?<br><br>**Goal:** Municipalities implement a range of policies and tools to direct development to specific areas.<br><br>**Why**: Municipalities can realize a significant reduction in regional runoff if they take advantage of underused properties, such as infill, brownfield, or greyfield sites. Redeveloping already degraded sites such as abandoned shopping centers or underutilized parking lots rather than paving greenfield sites for new development can dramatically reduce total impervious area while allowing communities to experience the benefits and opportunities associated with growth. | **Adopt Plans/Educate:**<br><br>• Local plans identify potential brownfield and greyfield sites, and support their redevelopment.<br><br>• Capital improvement plans include infrastructure improvements (water, sewer, road, sidewalk, etc. upgrades) for identified brownfield and greyfield sites.<br><br>• Educate lending and financial institutions about benefits and local priorities of directing development to existing areas.<br><br>• Conduct outreach to the community to ensure support for local forms and patterns of development. | 1<br><br>1<br><br>1<br><br>1 | Ø<br><br>Ø ?<br><br>Ø<br><br>Ø | |
| | **Remove Barriers:**<br><br>• Establish a brownfields program to remove uncertainty regarding cleanup and liability issues. | 1 | Ø | |
| | **Adopt Incentives:**<br><br>• Provide incentives such as density bonuses and | 1 | Ø | |

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| N/A | accelerated permitting for brownfield and greyfield sites.<br>• Adopt funding mechanisms for remediating/redeveloping brownfield and greyfield sites.<br>• Streamlined permitting procedures facilitate infill and brownfield redevelopment plan review.<br>• Establish tax increment financing (TIF) districts to encourage redevelopment. | 1<br>1<br>1 | Ø<br>Ø<br>Ø | |
| | **Enact Regulations:**<br>• In local codes, ordinances, and policies, the municipality differentiates between greenfield and infill development. | 1 | Ø | |
| **2.B—Direct Development To Existing Infrastructure** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |
| **(1) Question:** Does the municipality direct growth to areas with existing infrastructure, such as sewer, water, and roads?<br><br>**Goal:** Adopt policies, incentives, and regulations to direct new development to areas that have infrastructure, such as water and sewer.<br><br>However, in situations where development is in areas with no sewer infrastructure, permitting alternative treatment options that can allow for higher density development or clustering of houses will reduce the overall water quality impact. | **Adopt Plans/Educate:**<br>• Local plans recommend/establish urban growth areas and urban growth boundaries. Development is encouraged within urban growth boundaries and discouraged outside of them.<br>• Analyze which areas within the jurisdiction are appropriate for higher density development based on existing infrastructure capacity, cost of providing new services, and access.<br>• Capital improvement plans for public infrastructure (roads, water, sewer, etc.) target funding inside urban growth boundary.<br>• Local sewer/water authority capital improvement plans follow development policies established in local comprehensive plans and target areas with existing | 1<br>2<br>2<br>1 | 1<br>2<br>Ø<br>Ø ? | 156.035 A<br>156.037 |

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| **Why:** Sewer and water authorities can play a major role in directing a region's growth by determining when and where new infrastructure investment will occur. Well-drafted facility planning areas can direct growth by providing sewer service in areas least likely to impact water resources. | development/infrastructure. | | | |
| | **Remove Barriers:**<br>• Development standards addressing landscaping, buffering, parking, and open space are tailored for infill areas to avoid creating unnecessary hurdles to development (e.g., imposing suburban parking requirements in high-density infill areas).<br>• Remove prohibitions on accessory dwelling units in infill areas to increase density of development.<br>• Off-site, regional water retention/detention encouraged/allowed to avoid costly on-site retention in densely developed infill areas and to provide benefit to priority retrofit sites, such as schools.<br>• Package plants and other wastewater treatment trains are encouraged for development in limited circumstance areas where growth is appropriate but sewers/treatment capacity does not exist.<br>• Technical information and analysis on the effectiveness of various treatment systems are readily available to developers. Local governments have determined which systems work best for their soil conditions and topography and have made this information available to the development community.<br>• Allow a wide variety of housing types and sizes within infill areas and reduced minimum lot sizes. | 2<br>2<br>2 in general<br>1<br>1<br>1 | Ø<br>Ø<br>2 * 56.67 B<br>Ø<br>Ø<br>Ø | |
| | **Adopt Incentives:**<br>• Increase development densities and allowable height in infill areas.<br>• Reduce impact fees for infill development based on less | 1<br>1 | Ø<br>Ø | |

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| | demand for new infrastructure.<br>• Create development incentives for green roofs (e.g., increased floor area ratio [FAR] bonus, additional building height).<br>• Include provision in stormwater management requirement that reduces on site management requirements for projects that decrease total imperviousness on previously developed sites. | 1<br>1 | Ø<br>Ø | |
| | **Enact Regulations:**<br>• Zoning and land development regulations implement urban service areas/urban growth boundary policies by restricting development in outlying areas.<br>• Adopt adequate public facility and concurrency ordinances that require adequate public infrastructure to be available when development comes on line (e.g., water, sewer, roads).<br>• Adopt large-lot/agricultural zoning (e.g., 1 unit/160 acres) on fringe of city to restrict inappropriate greenfield development.<br>• Enact transitional compatibility standards to ensure that new denser infill development is compatible with existing neighborhoods/adjacent development. | 1<br>1<br>1<br>1 | 6<br>Ø<br>1 ?<br>Ø | 156.020 B? |
| **2.C—Encourage Mixed-Use Developments** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |

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| **(1) Question:** Are mixed-use and transit-oriented developments allowed or encouraged?<br><br>**Goal:** Revise codes and ordinances to allow for the "by right" building of mixed-use and transit-oriented developments.<br><br>**Why:** Mixed-use developments allow for the co-locating of land uses, which decreases impervious surfaces associated with parking and decreases vehicle miles traveled—resulting in a reduction of hydrocarbons left on roadways and reduced air deposition.<br><br>Transit-oriented development (TOD) produces water quality benefits by reducing: (1) land consumption due to smaller site footprints; (2) parking spaces and the impervious cover associated with them; and (3) average vehicle miles traveled, which, in turn, reduces deposition of air pollution into water bodies. | **Adopt Plans/Educate:** | | | |
| | • Comprehensive plans identify appropriate areas for higher-density mixed-use developments (e.g., at transit stops) and recommend policies to encourage their development. | 1 | – | |
| | • Local capital improvement plans and funding are targeted to areas appropriate for mixed-use development. | 2 | Ø | |
| | **Remove Barriers:** | | | |
| | • Zoning ordinances can create by-right mixed-use and transit-oriented development districts or overlays through amendments. | 1 | Ø | |
| | • Initiate map amendments to designate mixed-use and transit-oriented development areas, eliminating the need for developers to secure zoning amendments. | 1 | Ø | |
| | **Adopt Incentives:** | | | |
| | • Parking requirements are reduced to reflect decreased automobile use. | 1 | Ø | |
| | • Credit given for adjacent on-street parking, which can count for local parking requirements. | 1 | Ø | |
| | • Shared parking and alternative parking arrangements encouraged. | 1 | 1 | 156.077 A |
| | • Mixed-use districts/areas feature increased densities and height. | 1 | Ø | |
| | • Accessory parking structures are not counted against maximum floor area ratio (FAR) on a site. | 1 | – | |

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| | **Enact Regulations:**<br>• Zoning code requires a minimum mix of uses and minimum density in designated mixed-use and transit-oriented development areas.<br>• Auto-oriented uses and drive-throughs are restricted or prohibited in mixed-use and transit-oriented development areas. | 1<br>1 | Ø<br>Ø | |
| **Total score for PROMOTE EFFICIENT, COMPACT DEVELOPMENT PATTERNS AND INFILL:** | | 45 | 7 | |

**This section has been reviewed and scored by** _____
**(Insert Department name and signee)**

**RESOURCES**

- "Protecting Water Resources with Higher-Density Development," U.S. EPA Development, Community and Environment Division: http://www.epa.gov/dced/water_density.htm
- "Infill Development: Completing the Community Fabric," Municipal Research and Services Center of Washington: http://www.mrsc.org/Subjects/Planning/infilldev.aspx
- Smart Growth Priority Funding Areas Act of 1997, Maryland Department of Planning: http://www.mdp.state.md.us/fundingact.htm
- Metro Regional Government Urban Growth Boundary, Portland Metro: http://www.metro-region.org/index.cfm/go/by.web/id/277
- Smart Growth Toolkit, Smart Growth Leadership Institute: http://www.smartgrowthtoolkit.net/main-content/the-smart-growth-implementation-tools.html
- "Water and Growth: Toward a Stronger Connection Between Water Supply and Land Use in Southeastern Pennsylvania," 10,000 Friends of Pennsylvania: http://10000friends.org/water-and-growth
- "Connecting Smart Growth and Brownfields Redevelopment," Center for Environmental Policy and Management, University of Louisville: http://cepm.louisville.edu/publications/PDF_docs/smart%20growth%20and%20brownfields%20for%20website.pdf
- "Strategies for Successful Infill Development," Northeast Midwest Institute: http://www.nemw.org/infillbook.htm
- "Smart Infill," Greenbelt Alliance: http://www.greenbelt.org/resources/reports/smartinfill/index.html
- Infill Incentives, Policy Link: http://www.ci.phoenix.az.us/BUSINESS/infilpgm.html

**CASE STUDIES**

- Wisconsin Department of Natural Resources is responsible for helping municipalities establish Sewer Service Area Planning to protect water quality and guide growth within public sewer systems: http://dnr.wi.gov/org/water/wm/GLWSP/SSAPlan/
- Dane County, Wisconsin's BUILD program offers incentives for infill development and removes barriers to redevelopment in order to preserve farmland and prevent greenfield development: http://www.countyofdane.com/plandev/Community/build/about.asp
- U.S. EPA and Land-of-Sky Regional Council in Asheville, North Carolina developed a report outlining market, policy and regulatory changes that can help overcome the barriers to infill and brownfield redevelopment: http://www.epa.gov/dced/pdf/losrc_brownfields.pdf
- The Oregon Transportation and Growth Management Program prepared a Model Infill Ordinance to clarify legal and policy-related questions about local infill incentives: http://www.dca.state.ga.us/intra_nonpub/Toolkit/ModelOrdinances/ModOrdInfl.pdf
- The City of Sacramento, California's Infill Strategies includes a Water Development Fee Waiver, Reduced Entitlement Fees and Sewer Facility Fee Reductions: http://www.cityofsacramento.org/planning/infill/
- Phoenix, Arizona's Infill Housing Program provides incentives to encourage single-family housing on vacant and underutilized land and offers high density development standards: http://www.ci.phoenix.az.us/BUSINESS/infilpgm.html
- Portland, Oregon's Infill Design website provides design strategies for integrating infill development into medium-density neighborhoods: http://www.portlandonline.com/bps/index.cfm?c=34024
- Portland, Oregon's Ecoroof Floor Area Ratio (FAR) Bonus allows developers to increase a building's footprint or floor area by adding an ecoroof: http://www.portlandonline.com/bes/index.cfm?a=236916&c=48725
- The Georgia Quality Growth Partnership's Infill Development Program outlines a comprehensive infill strategy that includes incentives, improvements to public facilities, streamlined regulations, and guidelines for the design, density and location of infill projects: http://www.georgiaqualitygrowth.com/ToolDetail.asp?GetTool=32
- Santa Cruz, California's Accessory Dwelling Unit Development Program encourages well-designed rental housing in the developed core of the City while being careful to discourage poorly-constructed illegal residential additions: http://www.ci.santa-cruz.ca.us/pl/hcd/ADU/adu.html
- Clark County, Washington's Infill Development Incentives include a waiver of all stormwater requirements for infill projects that create less than 5,000 square feet of new impervious surface: http://www.clark.wa.gov/commdev/documents/devservices/handouts/46-infill.pdf
- San Diego, California offers expedited permitting for eligible affordable/infill housing projects: http://www.sandiego.gov/development-services/industry/pdf/infobulletin/ib538.pdf

# Section 3: Design Complete, Smart Streets That Reduce Overall Imperviousness

| 3.A—Street Design | Tools and Policies | Points Available | Points Received or N/A | Notes and Local References |
|---|---|---|---|---|
| **(1) Question:** Do local street design standards and engineering practices encourage streets to be no wider than necessary to move traffic effectively?<br><br>Do street designs vary according to:<br><br>*street type* (arterial streets, collector streets, neighborhood streets) and<br><br>*urban context* (urban core, transit station area, suburban center, general suburban, rural)?<br><br>Do policies allow narrow neighborhood streets designed to slow traffic and create safer conditions for pedestrians and bicyclists?<br><br>**Goal**: Appropriate street widths allow narrower lanes for certain street types, thereby reducing overall imperviousness.<br><br>**Why:** The width of travel lanes, parking lanes and sidewalks should be tailored to the urban setting. Where appropriate, narrowing travel lane width to 10-11 feet, | **Adopt Plans/Educate:**<br><br>• Comprehensive plan/transportation plan emphasizes alternative modes of transportation (walking, biking, and transit) to reduce vehicle miles traveled and width and prominence of roads/streets. | 1 | — | |
| | • Comprehensive/transportation plan calls for distributing traffic across several parallel streets, reducing the need for high capacity streets with wide rights-of-way. | 1 | — | |
| | • Comprehensive/transportation planning process brings emergency response and other local government departments (e.g., public works, utilities) to the table early in the process to discuss street design. | 1 | — | |
| | • Adopt formal bicycle/pedestrian master plan. | 1 | Ø | |
| | • Create "safe routes to school" programs or other pedestrian/bike safety initiatives. | 1 | Ø | |
| | • Make consistent improvements to walking/biking conditions or develop a formal bicycle/pedestrian master plan. | 1 | Ø | |
| | **Remove Barriers:**<br><br>• Comprehensive plan endorses context-sensitive street design with narrower streets in appropriate locations. | 1 | Ø | |
| | • Improve pedestrian crossing at intersections to encourage walking. | 1 | Ø | |

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| rather than the standard 12-13 feet, can significantly reduce the total amount of impervious surfaces. Such streets can also substantially improve conditions for walking, biking, and using transit, which reduces automobile use and overall demand for parking spaces. | • Consolidate utilities in street right-of-way to improve sidewalk design and function. | 1 | | |
| | • Negotiate with state department of transportation or county transportation department to allow different design standards for regional roads passing through downtowns or other key areas. | 1 | | |
| | • Promote street standards for fire safety that include attributes of narrow streets (20 feet widths) while identifying factors relevant to local government departments involved with streets such as public works, engineering and utilities. | 2 | | |
| | • Take formal control of state or county roads within city boundaries to ensure power over design and operations. | 2 | | |
| | **Adopt Incentives:** | | | |
| | • Developments that provide comprehensive pedestrian/bicycle circulation systems allowed reducing number of vehicle parking spaces. (See parking section below for greater detail.) | 1 | | |
| | • Developments with approved comprehensive mobility/transportation plans allowed building narrower, less costly streets and alleys. | 1 | | |

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| | **Enact Regulations:** | | | |
| | • Revamp local government technical street specifications to allow context-sensitive, innovative street design with narrower travel lanes, without curb and gutter, etc., in appropriate circumstances (See Institute of Transportation Engineers Recommended Practice document below). | **2** | 9 | |
| | • Emergency response professionals and other local government departments involved with streets (e.g. public works, engineering, utilities) have endorsed or adopted design standards for narrower neighborhood streets. | **1** | 0 | |
| | • Development review process involves emergency response early on to reach consensus on appropriate project street design and access. | **1** | 0 | |
| | • Development review process requires submittal of project pedestrian/bicycle circulation plans with safe street routes and other pedestrian/bicycle-friendly features in addition to traffic circulation plans for larger developments. | **1** | 0 | |
| | • Apply formal connectivity index[7] or other measures to ensure adequate internal street and pedestrian/bicycle connections. | **2** | 0 | |
| | • Zoning/subdivision regulations require minimum number of connections between new project and surrounding developments and neighborhoods. | **2** | 0 | |

[7] Connectivity index refers to the directness of links and the density of connections in path or road network. A well-connected road or path network has many short links, numerous intersections, and minimal dead-ends (cul-de-sacs). As connectivity increases, travel distances decrease and route options increase, allowing more direct travel between destinations, and creating a more Accessible and Resilient system. Source: Online Travel Demand Management Encyclopedia, http://www.vtpi.org/tdm/tdm116.htm

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| | **Remove Barriers:**<br>• Allow developments that utilize shared driveways and rear-loaded garages to permit overnight parking in driveways and on-street.<br>• Development code prohibits homeowner covenants forbidding overnight parking in driveways, on-street overnight parking, and shared driveways. | 1<br>1 | Ø<br>Ø | |
| | **Adopt Incentives:**<br>• Allow developments with narrow driveways and rear-loaded garages to reduce number of parking spaces for guests.<br>• Zoning/subdivision regulations require minimum number of connections between new project and surrounding developments and neighborhoods. | 1<br>1 | Ø<br>Ø | |
| | **Enact Regulations:**<br>• Shared driveways are permitted or required for single-family residential developments.<br>• Minimum widths for single-family driveways reduced to 9 feet.<br>• Two-track driveways are allowed by technical street/subdivision specifications.<br>• Single-family residential developments encouraged/required to be designed with minimum percentage of alley-accessible, rear-loading garages.<br>–Alleys/garages encouraged = 1 points<br>–Alleys/garages required = 2 points | 1<br>1<br>1<br>**1 to 2 points** | Ø<br>Ø<br>Ø<br>Ø | |

| 3.B—Green Infrastructure Elements and Street Design | Tools and Policies | Points Available | Points Received or N/A | Notes and Local References |
|---|---|---|---|---|
| **(1) Question:** Are major street projects required to integrate green infrastructure practices as a standard part of construction, maintenance, and improvement plans?<br><br>**Goal:** Formally integrate green infrastructure into standard roadway construction and retrofit practice.<br><br>**Why:** Consistent projects to improve or repair streets provide opportunities to include green infrastructure retrofits as part of larger project budget, design, and construction. | **Adopt Plans/Educate:**<br>• Comprehensive/transportation plans promote green infrastructure practices in street design.<br>• Street project cost estimates include green infrastructure designs and assess cost savings from reduced hard infrastructure. | 1<br>1 | Ø<br>Ø | |
| | **Remove Barriers:**<br>• Technical street specifications allow/require integration of green infrastructure elements into street project construction.<br>• Allow street-side swales to replace conventional curb and gutter for managing stormwater and for separating sidewalks from street traffic in appropriate circumstances. | 1<br>1 | Ø<br>Ø | allow? |
| | **Adopt Incentives:**<br>• Undertake consistent effort to secure state and federal funds (e.g. transportation enhancements) to pay for green infrastructure elements.<br>• Streets with green infrastructure count towards stormwater requirements. | 1<br>1 | Ø<br>Ø | |
| | **Enact Regulations:**<br>• Adopt green infrastructure retrofit standards for major street projects. | 1 | Ø | |

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| | • Adopt technical specifications and design templates for green infrastructure in private and public rights-of-way.<br>• All local road projects required to allocate a minimum amount of the total project cost to green infrastructure elements. | 1<br>1 | | |
| (2) **Question:** Do regulations and policies promote use of pervious materials for all paving areas, including alleys, streets, sidewalks, crosswalks, driveways, and parking lots?<br><br>**Goal**: Build and retrofit these surfaces with pervious materials to reduce stormwater runoff and its negative impacts.<br><br>*Note:* While eliminating sidewalks or placing sidewalks on only one side of the road can reduce impervious cover, this strategy is typically most appropriate for rural areas. However, other effective strategies can achieve the same runoff reductions that will not limit residents' options for recreation and transportation.<br><br>**Why**: Streets, sidewalks, and other hard surfaces contribute a large portion to a municipality's total imperviousness. Making these impervious surfaces more permeable protects water quality, reduces flooding, and can recharge | **Adopt Plans/Educate:**<br>• Sponsor/approve pilot programs to determine appropriate pervious materials for different paving areas (e.g., permeable concrete for sidewalks, permeable pavers for driveways), as well as process for installation and maintenance.<br>• Pilot project results incorporated into standard practice for all new paved areas and retrofits of existing paved surfaces.<br>• Adopt policy to replace impervious materials with pervious materials where practical. | 1<br>1<br>1 | | |
| | **Remove Barriers:**<br>• Technical street specifications allow pervious paving materials in appropriate circumstances (e.g., not allowed over aquifer recharge areas). | 1 | | |
| | **Adopt Incentives:**<br>• Create formal program offering incentives (e.g., cost sharing, reduction in street widths/parking requirements, assistance with maintenance) to property owners who utilize pervious pavement elements. | 1 | | |

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| groundwater. | **Enact Regulations:**<br>• Adopt requirement that some percentage of parking lots, alleys, or roads in a development utilize pervious materials.<br>• Development approvals that allow/require use of pervious materials include requirements for continuing maintenance/cleaning of pervious surfaces. | 1<br>1 | Ø<br>Ø | |
| **Total score for DESIGN COMPLETE, SMART STREETS THAT REDUCE OVERALL IMPERVIOUSNESS:** | | 50 | 0 | |

**This section has been reviewed and scored by** _____
**(Insert Department name and signee)**

**RESOURCES**

- Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, Institute of Transportation Engineers: http://www.ite.org/css/ (Ch. 6, pages. 65-87)
- "Neighborhood Street Design Guidelines: An Oregon Guide for Reducing Street Widths," Oregon Department of Transportation and Department of Land Conservation and Development: http://www.oregon.gov/LCD/docs/publications/neighstreet.pdf
- University of California, Davis Sustainable Transportation Center Sustainable Streets Project: http://stc.ucdavis.edu/outreach/ssp.php
- New York High Performance Infrastructure Guidelines: http://www.designtrust.org/pubs/05_HPIG.pdf
- Stormwater Guidelines for Green, Dense Redevelopment: Stormwater Quality Solutions for the City of Emeryville: http://www.ci.emeryville.ca.us/planning/pdf/stormwater_guidelines.pdf
- "Sustainable Green Streets and Parking Lots Design Guidebook," San Mateo County, California Water Pollution Prevention Program: http://www.flowstobay.org/ms_sustainable_streets.php
- Green Streets: Innovative Solutions for Stormwater and Stream Crossings, Portland Metro: http://www.oregonmetro.gov/index.cfm/go/by.web/id=26335
- Green Highways Partnership between U.S. EPA, U.S. Federal Highway Administration and Maryland State Highway Administration: http://www.greenhighways.org/

- Protecting Water Quality with Smart Growth Strategies and Natural Stormwater Management in Sussex County, Delaware: http://www.epa.gov/smartgrowth/pdf/2009_0106_sussex_county.pdf
- Promoting Sustainable Transportation Through Site Design: An Institute of Transportation Engineers Proposed Recommended Practice: http://www.cite7.org/Technical_Projects/Final%20Proposed%20Recommended%20Practice%20RP-035.pdf
- Transportation is about *Places*, Project for Public Spaces: http://www.pps.org/transportation/

**CASE STUDIES**

- The Road Ecology Center at the University of California, Davis conducts research and develops policies to design transportation systems that minimize the impacts of roads on landscapes and communities: http://roadecology.ucdavis.edu/
- Houston, Texas's Urban Corridor Planning changes development regulations and infrastructure standards to support transit ridership and walkability in key corridors: http://www.houstontx.gov/planning/Urban/urban_cor.html
- San Francisco, California's Better Streets Plan created a common set of standards and guidelines for designing, building and maintaining more pedestrian friendly sidewalks, crosswalks and roadways, including extensive greening: http://www.sfbetterstreets.org
- Portland, Oregon's Green Streets Program includes design specifications for swales, planters and curb extensions, creative funding for projects that treat runoff from public rights-of-way, case studies, tours, and videos of public and private green street projects: http://www.portlandonline.com/BES/index.cfm?c=44407
- Seattle, Washington's Right-of-Way Improvements Manual outlines the requirements and permitting process for right-of-way improvements, as well as provides specific design criteria and model templates for submitting street design concepts: http://www.seattle.gov/transportation/rowmanual/
- Florida Department of Transportation developed Model Regulations and Plan Amendments for Multimodal Transportation Districts, including regulation changes related to traffic calming, parking, sidewalks and pedestrian and bicycle facilities, and incentives for developments located in multimodal transportation districts: http://www.dot.state.fl.us/planning/systems/sm/los/pdfs/MMTDregs.pdf
- New York Department of Transportation's Sustainable Streets Strategic Plan includes an initiative to retrofit underused roads into public plazas, streamlining design review for capital projects, and goals to connect tree pits for better surface drainage, among other stormwater management improvements ; http://www.nyc.gov/html/dot/html/about/stratplan.shtml
- Chicago, Illinois's Green Alley Program retrofits existing alleys with permeable pavement for better stormwater management, localized flood mitigation, heat reduction, material recycling, and energy conservation: http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/GreenAlleyHandbook.pdf
- North Carolina Department of Environment and Natural Resources offers guidance to developers on eliminating curbs and gutters, including siting and design considerations, maintenance concerns, effectiveness and cost considerations: http://www.p2pays.org/ref/41/40403.pdf
- New York City requires street trees for every 25 feet of street frontage of a zoning lot: http://www.nyc.gov/html/dcp/pdf/street_tree_planting/tree_adopted_cc_043008.pdf, page 8.
- Seattle Public Utilities' Natural Drainage System projects redesign residential streets to include vegetated drainage systems that use swales, wetlands, trees and other natural features to treat pollutants and minimize the speed and volume of road runoff: http://www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Natural_Drainage_Systems/

# Section 4: Encourage Efficient Parking

| 4.A—Reduced Parking Requirements | Tools and Policies | Points Available | Points Received or N/A | Notes and Local Resources |
|---|---|---|---|---|
| **(1) Question:** Does your local government provide flexibility regarding alternative parking requirements (e.g., shared parking, off-site parking) and discourage over-parking of developments?<br><br>Do parking requirements vary by zone to reflect places where more trips are on foot or by transit?<br><br>**Goal:** Match parking requirements to the level of demand and allow flexible arrangements to meet parking standards.<br><br>**Why:** Inflexible parking requirements that do not allow for alternative approaches, as well as standards that require too much parking for specific uses increase the amount of impervious surface in a development. Over-parking a development also encourages greater vehicle use and detracts from the overall pedestrian environment. | **Adopt Plans/Educate:** | | | |
| | • The comprehensive plan recognizes the advantages to reduced parking requirements generally and specifically for mixed-use and transit-oriented developments. | 1 | — | |
| | • The comprehensive plan recommends alternative, flexible approaches to meeting parking demands (e.g., shared parking, counting on-street spaces towards site parking requirements) | 1 | Ø | |
| | • Comprehensive/bicycle plans recommend provision of bicycle parking spaces/storage lockers and concomitant reduction in vehicle parking space requirements. | 1 | Ø | |
| | **Remove Barriers:** | | | |
| | • Allow flexibility in meeting parking space requirements through shared parking, off-site parking, and similar approaches. | 1 | Ø | |
| | • Permit businesses with different peak demand periods to share their required parking spaces. | 1 | / | 156.077 A |
| | **Adopt Incentives:** | | | |
| | • Permit reduction in vehicle parking spaces through the provision of a minimum number of bicycle parking spaces. | 1 | Ø | |
| | • Allow by-right reduction in required parking spaces | 1 | Ø | |

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| | (e.g., 25%) in mixed-use and transit-oriented developments and districts. | 1 | | |
| | • Permit developers to undertake parking studies to establish that specific developments (e.g., senior housing, affordable housing) require fewer parking spaces than typical projects. | 1 | Ø | |
| | • Create parking districts to finance/construct centralized parking lots/structures as shared parking facilities to reduce on-site parking. | 1 | Ø | |
| | **Enact Regulations:** | | | |
| | • Revise parking regulations to reduce minimums below standard ITE (Institute of Transportation Engineers) requirements based on analysis of local developments and actual parking demand/experience. | 2 | Ø | |
| | • Charge developers for every space beyond parking minimums to offset environmental impacts. | 1 | Ø | |
| | • Enact parking standards that allow credit for adjacent on-street parking. | 1 | Ø | |
| | • Create zones with reduced parking requirements (e.g., transit overlay districts, mixed-use activity centers, multi-modal districts). | 1 | Ø | |
| | • Waive all parking minimums in downtown and other locations that are pedestrian-oriented and/or have good transit access. | 1 | Ø | |
| | • Adopt parking standards that reduce requirements based on sliding scale tied to degree of walkability/transit access locations (20% reduction in areas well served by bus, 30% reduction in areas served by rail stations). | 1 | Ø | |
| | • Require shared parking agreements where appropriate complementary uses exist. | 1 | Ø | |

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| | • Adopt maximum parking caps (e.g., 125% above minimum) for multi-family and commercial developments. | 2 | Ø | |
| | • Reduce minimum parking space size based on analysis of average vehicle size in jurisdiction. | 1 | Ø | |
| **4.B—Transportation Demand Management Alternatives** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |
| **(1) Question:** Can developers use alternative measures such as transportation demand management or in-lieu payments to reduce required parking?<br><br>**Goal:** Provide flexibility to reduce parking in exchange for specific actions that reduce parking demands on site.<br><br>**Why:** Incentives such as transit passes, vanpool arrangements, flexible work schedules, market-priced facilities, and separate leasing for spaces in apartments and condominiums have quantifiable impacts on parking demand. Incorporating them into parking requirements creates the opportunity to meet demand with less impervious cover. | **Adopt Plans/Educate:**<br><br>• Comprehensive/transportation plans recognize transportation demand management as an approach to reducing vehicle miles traveled and parking requirements. | 1 | – | |
| | **Remove Barriers:**<br><br>• Rather than include parking spaces with an apartment lease, allow tenants to opt-out by treating parking as a separate optional lease agreement. | 1 | Ø | |
| | **Adopt Incentives:**<br><br>• Allow businesses that offer employee transit passes, provide vans for employee commuting, allow flexible working arrangements, or charge market rates for parking to 1) provide fewer parking spaces or 2) pay less into a parking district fund for required parking spaces. | 2 | Ø | |
| | • Allow developers to make in-lieu fee payments for parking. Fees utilized by local government/parking authority to provide off-site parking lots/structures. | 1 | Ø | |
| | • Provide mechanisms for car sharing in transit-oriented | 1 | Ø | |

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| | development. Where done, area parking requirements are reduced. | | | |
| | **Enact Regulations:**<br>• Create a parking district and allow/require businesses to support public garages rather than provide their own on-site parking.<br>• Require large developments to adopt transportation demand management techniques to lower vehicle use and parking demand. | 1<br>1 | Ø<br>Ø | |
| **4.C—Minimize Stormwater From Parking Lots** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |
| **(1) Question:** Are there requirements for landscaping designed to minimize stormwater in parking lots?<br><br>**Goal:** Require substantial landscaping to help reduce runoff.<br><br>**Why:** Parking lots generate a large amount of impervious cover. Requiring landscaping reduces the | **Adopt Plans/Educate:**<br>• Comprehensive plan calls for landscaping in parking lots to help reduce stormwater runoff. | 1 | Ø ? | MS4 BMPs |
| | **Remove Barriers:**<br>• Allow alternative or innovative landscaping solutions that provide stormwater management functions to count towards perimeter or other landscaping requirements. | | Ø ? | MS4 BMPs |

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| environmental impact of parking and can provide additional community benefits by providing shade and, if appropriately placed, creating natural barriers between pedestrians and cars. | **Adopt Incentives:**<br>• Parking lot landscaping and green roofs on parking structures credited towards meeting local stormwater management requirements.<br>• Give additional landscaping credit for preservation of large, mature trees within parking lots.<br>• Do not count parking structures with green roofs against the allowable floor area ratio of a site. | 1<br>1<br>1 | Ø<br>Ø<br>Ø | |
| | **Enact Regulations:**<br>• Adopt parking lot landscape regulations that require provision of trees, minimum percent of parking lot interior area to be landscaped (e.g., 10%), and minimum sized landscaping areas (e.g., minimum of 25 square feet for island planting areas).<br>• In parking lot landscaping regulations, specify the types and sizes of shrubs and trees most appropriate for controlling/reducing stormwater runoff.<br>• Adopt standards requiring a minimum area of the parking lot to drain into landscaped areas.<br>• Require the management of runoff from parking lots through green infrastructure practices, including trees, vegetated islands, swales, rain gardens, or other approaches.<br>• Enact specific alternative landscaping and parking regulations to support infill development (parking requirements, parking lot landscaping options that focus on perimeter landscaping to encourage smaller lots, etc.).<br>• Require parking structures to incorporate green roofs to | 1<br>1<br>1<br>1<br>2<br>1 | Ø<br>Ø<br>Ø<br>Ø<br>Ø<br>Ø | 1459? |

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| | reduce stormwater runoff.<br><br>• Reduce drive aisle widths in parking lots to decrease the amount of pervious surface. For multi-family developments, drive aisles can be shared. In commercial developments, typical drive aisles can be reduced 5–10%. | 1 | ϕ | |
| **Total score for ENCOURAGE EFFICIENT PROVISIONS OF PARKING:** | | **40** | | |

**This section has been reviewed and scored by** _____
**(Insert Department name and signee)**

## RESOURCES

- "Parking Spaces/Community Places: Finding the Balance through Smart Growth Solutions" (pg. 14, 18-19, 21), U.S. EPA Development, Community and Environment Division: http://www.epa.gov/piedpage/pdf/EPAParkingSpaces06.pdf
- "Shared Parking, Second Edition," Urban Land Institute: www.uli.org/bookstore/
- "Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices," Metropolitan Transportation Commission: http://www.mtc.ca.gov/planning/smart_growth/parking_study/April07/bestpractice_042307.pdf
- "Driving Urban Environments: Smart Growth Parking Best Practices," Maryland Governor's Office of Smart Growth: http://www.smartgrowth.state.md.us/pdf/Final%20Parking%20Paper.pdf
- "Design Principles for Parking Lots," Tennessee Valley Authority Economic Development: http://www.tvaed.com/sustainable/parking.htm
- Efficient Parking Strategies, Centralina Council of Governments and Catawba Regional Council of Governments: http://www.epa.gov/region4/airqualitytoolkit/9_CaseStudies/SEQL%20-%20Efficient%20Parking%20Strategies.pdf
- "Parking Management: Strategies, Evaluation and Planning," Victoria Transport Policy Institute: http://www.vtpi.org/park_man.pdf
- "Smart Growth Alternatives to Minimum Parking Requirements," *Proceedings from the 2nd Urban Street Symposium*, July 28-30, 2003: http://transtoolkit.mapc.org/Parking/Referenced_pdfs/Forinash_SmartGrowthParkingAlternatives.pdf
- "Flexible Parking Standards," Georgia Quality Growth Partnership: http://www.dca.state.ga.us/toolkit/ToolDetail.asp?GetTool=17
- "Multifunctional Landscaping: Putting Your Parking Lot Design Requirements to Work for Water Quality," University of Illinois Extension: http://urbanext.illinois.edu/lcr/LGIEN2002-0017.html
- "Low-Impact Parking Lot Design Reduces Runoff and Pollutant Loads," Journal of Water Resources Planning and Management, 2001: http://cedb.asce.org/cgi/WWWdisplay.cgi?0101775

- "Managing Stormwater for Urban Sustainability Using Trees and Structural Soils," Virginia Polytechnic Institute and State University: http://www.cnr.vt.edu/urbanforestry/stormwater/Resources/TreesAndStructuralSoilsManual.pdf

### Case Studies

- San Mateo County, California's "Sustainable Green Streets and Parking Lots Design Guidebook" provides policy guidance and design and construction details, including site layout strategies, green infrastructure design guidelines and case studies for both streets and parking lots: http://www.flowstobay.org/ms_sustainable_streets.php
- Minneapolis, Minnesota's zoning code includes regulations to support pedestrian-oriented off-street parking, including parking maximums, shared parking allowances, pedestrian-overlay districts with reduced parking requirements, replacing off-street parking spaces with bicycle racks, and more: http://www.ci.minneapolis.mn.us/lrtrezoning/tod-haiwatha-09.asp
- Boston Metropolitan Area Planning Council gives detailed guidance for reducing parking demand and developing parking requirements based on local factors such as access to transit, expected demographics, auto ownership rates and access to destinations and transit service: http://transtoolkit.mapc.org/Parking/Strategies/flexiblerequirements.htm
- San Diego, California's Community Parking District Program helps older commercial districts collect revenue and implement parking plans to construct public parking facilities, make public transit enhancements, and maximize off-street parking inventory: http://www.sandiego.gov/economic-development/business-assistance/small-business/pmd.shtml
- Placer County, California enacted an In-Lieu Parking Fee that allows developments within specific parking districts to pay a fee in lieu of complying with off-street parking standards. The collected fees are then used to construct new public parking spaces within the same parking district: http://www.placer.ca.gov/Departments/Works/TahPkngStudy/DraftParkingFeeOrdinance.aspx
- Minnesota's Urban Small Sites Best Management Practice Manual provides drawings, design guidelines and plant lists for impervious surface reduction in parking lot design: http://km.fao.org/uploads/media/Impervious_surface_reduction_parking_lot_desing.pdf
- The retrofit of Our Lady Gate of Heaven Parish parking lot in Chicago, Illinois included a large swale that absorbs 100,000 gallons of runoff per year, reducing flooding in the parking lot and in nearby streets and properties. This U.S. EPA-funded project continues to be monitored for performance data: http://www.cnt.org/natural-resources/demonstration-projects/olgh-case-study
- The Florida Aquarium Parking Lot and Queuing Garden in Tampa, Florida maximizes existing site vegetation for stormwater management and provides education to Aquarium visitors. This website includes construction cost information, lessons learned, monitoring results and maintenance protocols: http://www.sustainablesites.org/cases/show.php?id=16
- Several parking lot demonstration sites in Blacksburg, VA, Ithaca, NY and Davis, CA provide details about newly constructed parking lots and retrofitted lots that include trees, structural soils and pervious pavements for managing stormwater: http://www.cnr.vt.edu/urbanforestry/stormwater/DemonstrationSites.html

# Section 5: Adopt Green Infrastructure Stormwater Management Provisions

| 5.A—Green Infrastructure Practices | Tools and Policies | Points Available | Points Received or N/A | Notes and Local References |
|---|---|---|---|---|
| **(1) Question:** Are green infrastructure practices encouraged as legal and preferred for managing stormwater runoff?<br><br>**Goal:** Make all types of green infrastructure allowed and legal and remove all impediments to using green infrastructure (including for stormwater requirements), such as limits on infiltration in rights-of-way, permit challenges for green roofs, safety issues with permeable pavements, restrictions on the use of cisterns and rain barrels, and other such unnecessary barriers.<br><br>**Why:** Green infrastructure approaches are more effective and cost efficient than conventional stormwater management practices in many instances, and provide other substantial community benefits. | **Adopt Plans/Educate:**<br><br>• Inform the public, through education and outreach programs, that green infrastructure practices can manage stormwater runoff on their property.<br><br>• Create a green infrastructure workshop or training program for internal and external reviewers to ensure that the stakeholders who use this tool will have the ability to understand and use it effectively. | 1<br><br>1 | 1<br><br>Ø | MS4 MCM 1+2 |
| | **Remove Barriers:**<br><br>• Development and other codes encourage and allow property owners to adopt home-based green infrastructure practices, such as rain gardens, rain barrels, and other rainwater harvesting practices.<br><br>• Review and change, where necessary, building codes or other local regulations to ensure that all local government departments/agencies have coordinated with one another to ensure that green infrastructure implementation is legal, e.g. remove restrictions on downspout disconnection. | 1<br><br>1 | 1<br><br>Ø | MS4 MCM 1+2 |
| | **Adopt Incentives:**<br><br>• Green infrastructure practices credited towards required controls for stormwater runoff. | 1 | Ø | |

| | | | | |
|---|---|---|---|---|
| | • Establish a "Green Tape" expedited review program for applications that include green infrastructure practices.<br><br>• Reduce stormwater utility rates based on the use of green infrastructure practices. | 1 | ✗<br><br>✗ → none known; §56.07? | |
| | **Enact Regulations:**<br><br>• Zoning and subdivision regulations specifically permit green infrastructure facilities, including but not limited to: (1 point for each technique to a maximum of 4 points)<br>--Green roofs;<br>--Infiltration approaches, such as rain gardens, curb extensions, planter gardens, permeable and porous pavements, and other designs where the intent is to capture and manage stormwater using soils and plants;<br>--Water harvesting devices, such as rain barrels and cisterns;<br>--Downspout disconnection.<br><br>• Developers are required to meet stormwater requirements using green infrastructure practices where site conditions allow. Developers must provide documentation for sites that do not allow on-site infiltration, reuse, or evapotranspiration to meet locally determined performance stormwater management standards. | **1 to 4 points**<br><br>**1 to 2 points** | ✗<br><br>✗ | Suggested MS4 BMPs |
| **(2) Question:** Do stormwater management plan reviews take place early in the development review process?<br><br>**Goal:** Incorporate stormwater plan comments and review into the early stages of development review/site plan review and approval, preferably at pre-application | **Adopt Plans/Educate:**<br><br>• Encourage/require a pre-site plan meeting with developers to discuss stormwater management and green infrastructure approaches.<br>--Voluntary = 1 point<br>--Mandatory = 2 points<br><br>• Include landscape architects in design and review of stormwater management plans. | **1 to 2 points**<br><br>**1** | ✗<br><br>✗ | |

| | | | | |
|---|---|---|---|---|
| meetings with developers.<br><br>**Why:** Pre-site plan review is an effective tool for discussing with developers alternative approaches for meeting stormwater requirements. This will incorporate green infrastructure techniques into new projects at early design stages, well before construction begins. | **Adopt Incentives:**<br>• Provide accelerated review of projects where developer attended a pre-application meeting. | 1 | Ø | |
| | **Enact Regulations:**<br>• Preliminary stormwater plan review occurs contemporaneously with preliminary site plan review and before any development approvals.<br>• Development applications must include preliminary/conceptual stormwater management plans that incorporate green infrastructure elements and describe how stormwater management standards will be met. | 1<br>1 | Ø<br>Ø | |
| **(3) Question:** Do local building and plumbing codes allow harvested rainwater for exterior uses, such as irrigation, and non-potable interior uses, such as toilet flushing?<br><br>**Goal:** Ensure that the municipality allows and encourages stormwater reuse for non-potable uses.<br><br>**Why:** Stormwater reuse is important for dense, urban areas with limited spaces for vegetated green infrastructure practices. | **Adopt Plans/Educate:**<br>• Local government provides information brochures/manual for homeowners describing acceptable rainwater harvesting techniques. | 1 | Ø | ? Part of MCM 1+2? |
| | **Remove Barriers:**<br>• Local development, building, and plumbing codes updated to allow reuse of stormwater for non-potable purposes. | 1 | Ø | |
| | **Adopt Incentives:**<br>• Reduce stormwater management facility requirements for developments employing comprehensive rainwater harvesting.<br>• Reduce stormwater utility rates based on the use of → | 1<br>? | Ø<br>Ø | |

| | | | | |
|---|---|---|---|---|
| | harvest and reuse techniques. | | | |
| | **Enact Regulations:**<br>• Require developments to adopt rainwater harvesting techniques as element of stormwater management plans. | 1 | 9 | |
| (4) **Question:** Are provisions available to meet stormwater requirements in other ways, such as off-site management within the same sewershed or "payment in lieu" of programs, to the extent that on-site alternatives are not technically feasible?<br><br>**Goal**: Allow off-site management of runoff while still holding developers responsible for meeting stormwater management goals.<br><br>**Why:** In some cases, it is impracticable or infeasible to treat all or even some of the stormwater runoff on site. In such instances, alternative means should be provided through contribution to off-site mitigation projects or off-site stormwater management facilities (preferably green infrastructure facilities). | **Adopt Plans/Educate:**<br>• For infill and redevelopment areas, off-site green stormwater management plans should be developed in cooperation between local government and landowner/developers. Allowing off-site management of stormwater runoff requires sewershed designation within the local government to ensure that true mitigation is possible and realize the equal stormwater management and water quality benefits through off-site management.<br>• Retrofit projects that will utilize green infrastructure stormwater management techniques should be identified and prioritized within the sewershed. | 2<br><br>1 | part of MP?<br>Ø<br>Ø | |
| | **Remove Barriers:**<br>• Amend stormwater management regulations and development codes as necessary to allow off-site stormwater management, especially for infill and redevelopment areas. | 1 | Ø | part of MP? |
| | **Enact Regulations:**<br>• Establish system that allows/requires payment-in-lieu fees for off-site stormwater management facilities. Fees should be set sufficiently high as to cover the true cost of off-site management. Consider limitations on amount of | 1 | Ø | |

| | | | | |
|---|---|---|---|---|
| | off-site management allowed (more for infill areas, less for greenfield sites). | | | |
| **5.B—Maintenance/Enforcement** | **Tools and Policies** | **Points Available** | **Points Received or N/A** | **Notes and Local References** |
| **(1) Question:** Does your stormwater ordinance include monitoring, tracking, and maintenance requirements for stormwater management practices?<br><br>**Goal:** Incorporate monitoring, tracking, and maintenance requirements for stormwater management practices into your municipal stormwater ordinance.<br><br>**Why:** These measures will help ensure that the successful tracking and monitoring of green infrastructure practices and remain in proper working condition to provide the performance required by the stormwater ordinance. | **Adopt Plans/Educate**<br><br>• Develop a system to monitor and track stormwater management practices deployed at greenfield and redevelopment sites. Tracking of management practices should begin during the plan review and approval process with a database or geographic information system (GIS). The database should include both public and private projects.<br><br>• Provide model checklist for maintenance protocols for ease of inspection, tracking, and enforcement.<br><br>• Sponsor demonstration projects for green infrastructure management best practices. | 1<br><br>1<br><br>1 | 1<br><br>Ø<br><br>Ø | Part of SWGMP (?) |
| | **Remove Barriers:**<br><br>• Ensure that proper local agencies have authority to enforce maintenance requirements. | 1 | ) | Part of SWAMP (?) |
| | **Adopt Incentives:**<br><br>• Create self-inspection maintenance certification program that allows developers/landowners to train/retain private inspectors to certify compliance with stormwater management plans and long-term maintenance. | 1 | ) | QPI |

| | | | | |
|---|---|---|---|---|
| | **Enact Regulations:** | | | 56.68 F |
| | • Require long-term maintenance agreements that allow for public inspections of the management practices and account for transfer of responsibility in leases and/or deed transfers. | 1 | 1 | |
| | • Conduct inspections every 3 to 5 years, prioritizing properties that pose the highest risk to water quality, inspecting at least 20% of approved facilities annually. | 1 | Ø | |
| | • Develop a plan approval and post-construction verification process to ensure compliance with stormwater standards, including enforceable procedures for bringing noncompliant projects into compliance. | 1 | Ø | |
| | • Inspections of construction sites occur at for at least 25% of permitted projects to ensure proper installation of approved practices. | 1 | 1 | 56.29 B4, + C |
| | • Require conservation/green infrastructure bond/escrow in zoning/subdivision ordinances to ensure installation/maintenance of green infrastructure storm water management facilities. | 1 | Ø | |
| | **Total score for GREEN INFRASTRUCTURE STORMWATER MANAGEMENT PROVISIONS:** | 37 | 7 | |

**This section has been reviewed and scored by** _____
**(Insert Department name and signee)**

## RESOURCES

- Green Infrastructure Municipal Handbook, U.S. EPA Green Infrastructure website: http://cfpub.epa.gov/npdes/greeninfrastructure/munichandbook.cfm

# 3.0 Monitoring

Stantec tracked rain events during 2009 to identify significant rain events. Immediately following the rain events, Stantec performed field reconnaissance to identify high water marks and any maintenance concerns. The high water marks were surveyed to obtain their elevation and this elevation was used to help validate the models. Any observed maintenance concerns were communicated to City staff for immediate response.

## 3.1 RAIN EVENTS

A significant rain event was determined to be a rain event having a cumulative depth of at least two inches of rainfall during a 24-hour period. Such a rain event was targeted for field reconnaissance and high water mark determination. Several of these events occurred during the monitoring period. Two of these storms were chosen for further analysis due to the severity of flooding that occurred. These severe flooding events occurred on August 4, 2009 and September 20, 2009.

Rain gages from Louisville/Jefferson County Metropolitan Sewerage District (MSD) and the City of New Albany were utilized to track the rainfall within the area. Louisville MSD has real-time data on the internet, and the City of New Albany data was collected from the stations by City staff. Louisville MSD and New Albany gage stations collected total rainfall in 15-minute increments. Rainfall depths recorded by the Louisville MSD gages were compared to rain gage data collected at six New Albany gauging sites and used for model calibration as explained in **Section 4.5**. The rainfall amounts for the two significant events for each of the rain gages can be seen in **Table 3.1**.

Though the August 4$^{th}$ rain event was more intense in Louisville and along the river, most of New Albany received less rain than during the September 20$^{th}$ rain event. The August 4$^{th}$ rain event had an average rainfall depth of 4.75 inches, which corresponds to a return frequency between the 10-year and 25-year, 24-hour storm events. The September 20$^{th}$ rain event had an average depth of 4.0 inches which corresponds to a return frequency between the 2-year and 10-year, 24-hour events.

**Table 3.1. August 4th and September 20th Rainfall Depths.**

| Gage Number | Gage Location | 24-HR Rainfall Depth (In) | |
|---|---|---|---|
| | | August 4, 2009 | September 20, 2009 |
| 1 | Beargrass Creek PS^ | 6.04 | 3.84 |
| 2 | Ivy Tech^ | 1.80* | 2.55 |
| 3 | Mt. St. Francis^ | 0.12* | 4.77 |
| 4 | McLean Ave | 4.38 | 4.68 |
| 5 | Mt. Tabor Rd | 2.77 | 3.84 |
| 6 | East 8th St | 4.05 | 3.31 |
| 7 | Quail Chase | 2.22 | 4.58 |
| 8 | Prosser | 3.04 | 4.41 |
| 9 | West 10th St WWTP | 6.28 | 3.75 |
| ^ Louisville MSD rainfall gage station | | | |
| * Equipment malfunction | | | |

## 3.2 FIELD RECONAISSANCE

High water marks were collected based on visual observation of debris accumulation along the upstream or downstream banks of the culverts. The location of each high water mark was identified using a GPS (global positioning system), unit as well as a pin flag. Pictures were taken of high water marks as well. Field crews were sent out to perform field reconnaissance for both the August 4th and September 20th storms. The recorded GPS points were provided to Jacobi, Toombs, & Lanz (JTL) to use in locating the pin flags and providing an elevation for the high water marks. The surveyed high water mark locations and elevations can be found in **Appendix 3.1**.

In areas that excessive amounts of debris had accumulated in or near the stormwater conveyance infrastructure such that a blockage had occurred or was likely, information was immediately provided to the appropriate City staff.

# Appendix 3.1

# NEW ALBANY STREAM HIGH WATER SURVEY

FOR SEPTEMBER 20, 2009 RAINFALL EVENT

| LOCATION: | HIGH WATER ELEVATIONS: | NOTE |
|---|---|---|
| NEXT TO STRUCTURE 76 | 442.98 | |
| NEXT TO STRUCTURE 76 | 442.99 | |
| NEXT TO STRUCTURE 76 | 443.65 | |
| NEXT TO STRUCTURE 76 | 444.27 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 76 | 444.21 | |
| NEXT TO STRUCTURE 76 | 444.15 | |
| NEXT TO STRUCTURE 70 | 421.1 | |
| NEXT TO STRUCTURE 25 | 464.14 | NOT IN MODEL |
| NEXT TO STRUCTURE 113 | 459.54 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 109 | 450.93 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 4 | 445.5 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 10 | 443.76 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 53 | 447.45 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 98 | 420.84 | NOT IN MODEL |
| NEXT TO STRUCTURE 107 | 480.53 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 117 | 453.87 | NOT IN MODEL |
| NEXT TO STRUCTURE 127 | 436.58 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 7 | 462.89 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 81 | 486.29 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 26 | 428.05 | USED FOR CALIBRATION |
| NEAR STRUCTURE 26 BETWEEN STATE ST AND PEARL ST | 442.01 | |
| NEXT TO STRUCTURE 6 | 450.01 | NOT IN MODEL |
| NEXT TO STRUCTURE 112 | 470.71 | NOT IN MODEL |
| NEXT TO STRUCTURE 79 | 453.24 | NOT IN MODEL |
| NEXT TO STRUCTURE 30 | 458.11 | NOT IN MODEL |
| NEXT TO STRUCTURE 30 | 463.07 | NOT IN MODEL |
| NEXT TO STRUCTURE 24 | 493.48 | NOT IN MODEL |
| NEXT TO STRUCTURE 17 | 463.35 | NOT IN MODEL |
| NEXT TO STRUCTURE 29 | 464.59 | NOT IN MODEL |
| UPSTREAM FROM STRUCTURE 11 | 468.76 | NOT IN MODEL |
| DOWNSTREAM FROM STRUCTURE 19 | 468.61 | NOT IN MODEL |
| NEXT TO STRUCTURE 69 | 456.68 | NOT IN MODEL |
| CORYDON PK @ SILVER SLOPE DR | 440.54 | USED FOR CALIBRATION |
| NEXT TO STRUCTURE 95 | 434.16 | USED FOR CALIBRATION |
| MARKET STREET AT JAY STREET | 436.36 | NOT IN MODEL |
| EAST EIGHTH STREET @ RR TRACKS | 439.58 | NOT IN MODEL |
| ROANOKE AVE AND TWIN OAKS DR | 455.58 | NOT IN MODEL |
| GREEN VALLEY RD @ MOUNT TABOR RD | 503.08 | NOT IN MODEL |
| GREEN VALLEY RD @ CHERYL DR | 517.04 | NOT IN MODEL |
| NEXT TO STRUCTURE 120 | 474.17 | NOT IN MODEL |

# Appendix 3.2


Victor

**High Water Marks**
City of New Albany
September 2009

**High Water Marks**
City of New Albany
September 2009


Armstrong


Briarwood

**High Water Marks**
City of New Albany
September 2009


Castlewood and Ashwood


Brookwood


Meadowview

Dalebrook


Rainbow and Blackiston


Navajo


GRANT LINE ELEMENTARY
MARKET DAY
SEP 17 430-530

**High Water Marks**
City of New Albany
September 2009

I-265


Fire Department

Unruth

**High Water Marks**
City of New Albany
September 2009


Hickoryvale

**High Water Marks**
City of New Albany
September 2009

Canon

**High Water Marks**
City of New Albany
September 2009

Jolissaint


Grantline-21st Century Flooring

1438 Grantline

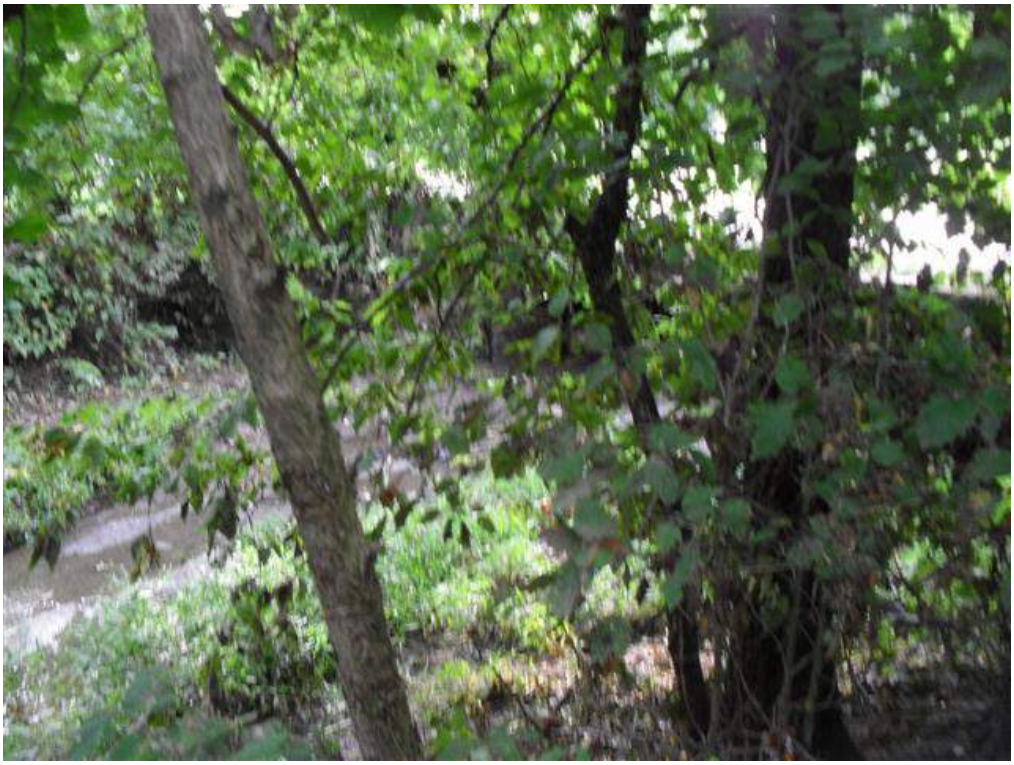

CSX

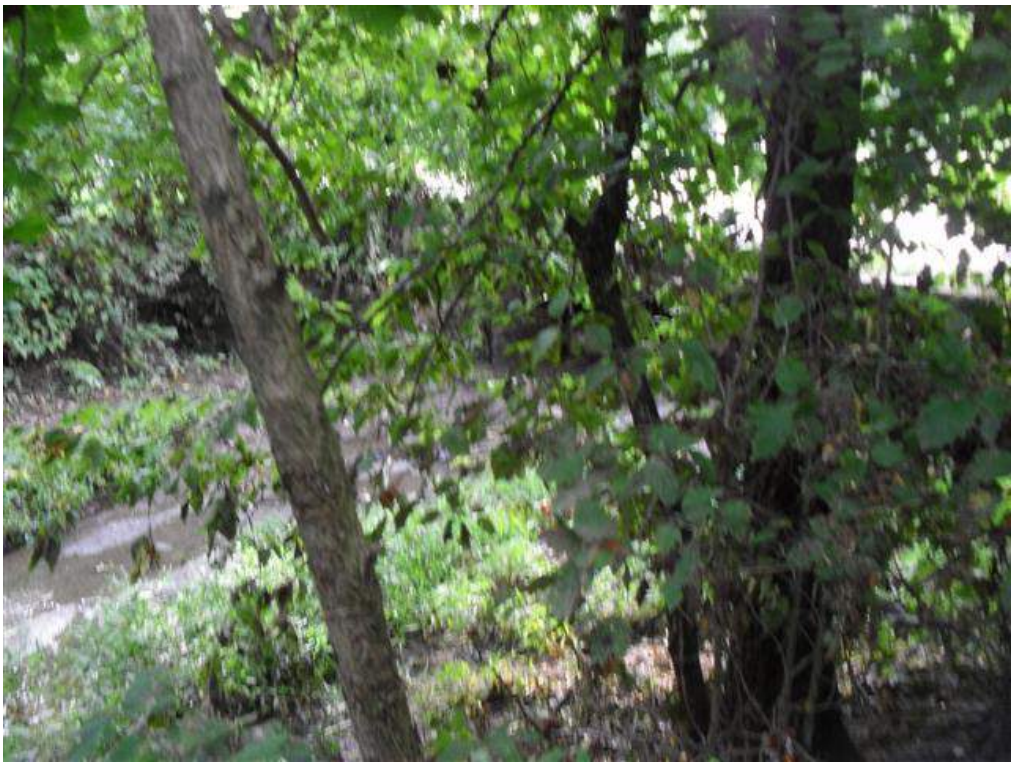

66460
INDIANA

Vance


STOP

Market and Jay





**High Water Marks**
City of New Albany
September 2009

# 4.0 Modeling

Two planning and modeling efforts were identified for the Stormwater Master Plan. Tier 1 planning is for drainage improvements that involve small structures with drainage areas of 50 acres or less. It is anticipated that construction of Tier 1 improvements will be completed by New Albany Stormwater Utility maintenance crews or maintenance contractors. The tool can also be used to quickly determine to size replacement or relief structures. The Tier 1 tool will be useful for planning reactive projects such as emergency repairs, routine pipe replacements and system repairs. The modeling effort to support Tier 1 planning is the development of a GIS (Geographic Information System)-based simplified drainage model that can be utilized by utility personnel to evaluate and plan Tier 1 improvements. The model is based on the Rational Method for predicting peak runoff rates using inputs developed from GIS data. Tier 2 planning is the evaluation of large scale drainage improvements based on the results SWMM models to evaluate current conditions, identify potential improvement alternatives and provide a basis for prioritizing drainage improvement projects that drain areas larger than 50 acres that will require engineering design and heavy construction.

This section of the report provides an overview of the Tier 1 Rational Method GIS Tool including concepts used to develop the tool and the methods that determine pipe capacity and runoff rates and a tutorial on the use of the tool. Next, the Tier 2 model development is described including a summary of literature and supporting data that was reviewed to develop the model and identify areas of concern, field reconnaissance and surveying work related to model development; development of design storms for use in the modeling and planning effort and; development of the Tier 2 SWMM model and its validation. This is followed by a summary of efforts to coordinate master planning results with the FEMA Map Modernization Program and its work in New Albany and Floyd County; criteria for analysis of drainage infrastructure and the development of alternatives for improvements; and an overview of improvement alternatives for the New Albany drainage system.

## 4.1 TIER 1- RATIONAL METHOD GIS TOOL

Tier 1, reactive projects, consists of stormwater infrastructure improvements such as emergency repairs and regular system maintenance or improvements. The intent of this tool is to provide the City of New Albany a method of analyzing pipes in small watersheds/ sewersheds with a drainage area under 50 acres. The tool will facilitate quick identification of infrastructure that is likely undersized and will evaluate alternate pipe sizes for replacement. The following describes the functionality and appearance of the tool for the City of New Albany. The goal of this tool is to assist the City with replacing the pipe with pipe that is appropriate sized based on the Rational Method.

### 4.1.1 The Rational Method GIS Tool Concept

The New Albany Stormwater Utility has mapped the stormwater drainage infrastructure throughout the city to comply with Rule 13 requirements. Separate storm sewers and culverts 12 inches in diameter and larger, catch basins, manholes, headwalls, open channels two (2) feet wide and larger, and stormwater outfalls have been mapped within the city limits. The location, size, pipe material, channel lining material and other data have been stored in the stormwater infrastructure GIS database. The GIS database also includes contour mapping, a digital terrain model (DTM), soils data, land use data, watershed boundaries, roads, aerial photography and other pertinent information.

The Rational Method uses the following equation to predict peak runoff rates:

$$q = CiA$$

Where $q$ is the peak runoff rate in cfs; $C$ is the runoff coefficient; $i$ is the rainfall intensity (in/hr) and $q = CiA$ is the drainage area in acres. The rational method assumes (Barfield, et al., 1981):

- Rainfall is uniform across the watershed;
- the peak rate of runoff can be reflected by the rainfall intensity averaged over a time period equal to the time of concentration ($t_c$) of the drainage area;
- runoff frequency is the same as the frequency of the rainfall used in the equation.

The runoff coefficient $C$ is a function of land use, surface cover, and land slope.

The tool determines the drainage area above the point of interest and average land slopes using contour mapping and the DTM. It then evaluates land use, soil cover, soil type, and land slope to determine the value of $C$ for the drainage area. The tool also uses this data to determine *t.* It then determines the value of $i$ based on depth-duration-frequency data for rainfall in New Albany and $t_c$ predicts the peak runoff rate for the drainage area using the Rational equation.

The capacity of the drainage infrastructure is determined using pipe shape, diameter, length, slope, materials and pipe conditions from the infrastructure database. Pipe capacity computations are based on Manning's equation using normal depths. **Table 4.1** shows pipe materials available for selection for input into the tool and the corresponding Manning's "n" value for each.

**Table 4.1. Available Pipe Materials and Manning's "n" Values for the Tier 1 Tool.**

| Pipe Type | Abbreviation | Manning's Roughness |
|---|---|---|
| Polyethylene Pipe (Plastic) | ADS | .02 |
| Brick Pipe | Brick | .015 |
| Corrugated Metal | CMP | .022 |
| Polyvinyl Chloride | PVC | .01 |
| Reinforced Concrete | RCP | .013 |
| Steel | STL | .012 |
| Vitrified Clay | VCP | .014 |
| Undetermined* | UNDET | .013 |
| *Reinforced Concrete Pipes (RCP) are the most common pipes found in New Albany; therefore undetermined pipes were considered to be RCP | | |

The tool then estimates the capacity of the existing pipe using this data as parameters in pipe capacity equations. Jacobi, Toombs, and Lanz, Inc. (JTL) collected survey data for pipe invert elevations and observation notes for specified pipes. Pipe slopes were derived using the invert data collected in the survey.

The following GIS applications were developed for the tool:

- to recover data from the map database for determining the size, time of concentration, and runoff coefficient for the area draining to a selected pipe in the drainage network;
- to determine rainfall intensity based on the time of concentration;
- to calculate runoff from the contributing area using the Rational Method;
- to recover pipe data from the infrastructure database;
- to determine conduit hydraulic parameters using pipe data; and
- to calculate pipe capacity based on Manning's Equation.

The pipe size analysis in the tool is based on storms with a 10-YR return period. The determination of design storms for analysis and design of drainage infrastructure in the City of New Albany is discussed in **Section 4.4** below.

### 4.1.2 Using the Tier 1 Tool – A Tutorial

The following example is used to illustrate the use of the Rational Method GIS Tool to evaluate the capacity of an existing storm sewer. The tool determines the area and characteristics of a watershed draining to a storm sewer segment, the extent and capacity of the pipe network upstream of the storm sewer segment and provides estimates of the capacity of the existing pipes relative to the runoff each receives.

The existing storm sewer network is shown in purple in **Figure 4.1**. Nodes in the network represent catch basins, manholes, outlets or other features that connect pipes in the network. Flow directions in each pipe segment are indicated by arrowheads. A pipe segment must be selected for analysis using the mouse and cursor. The selected pipe segment is highlighted in light blue in the screenshot.

Once a pipe is selected, the tool automatically traces pipes upstream. The traced pipe network is highlighted in red, as shown in **Figure 4.2**. The tool calculates flow rates for each pipe based on the peak runoff rate from the area draining to each pipe using the Rational Method. The capacity of each pipe in the network is computed based on the condition, material and geometry of the pipes.

A summary table of the pipe characteristics and flow data is available for each pipe in the network as shown in **Figure 4.2**. Definitions and descriptions of the parameters shown in the summary table are shown in **Table 4.2**.

The layout of the summary table may change as development of the tool continues. The analysis approach is not expected to change as the tool is tested and refined.

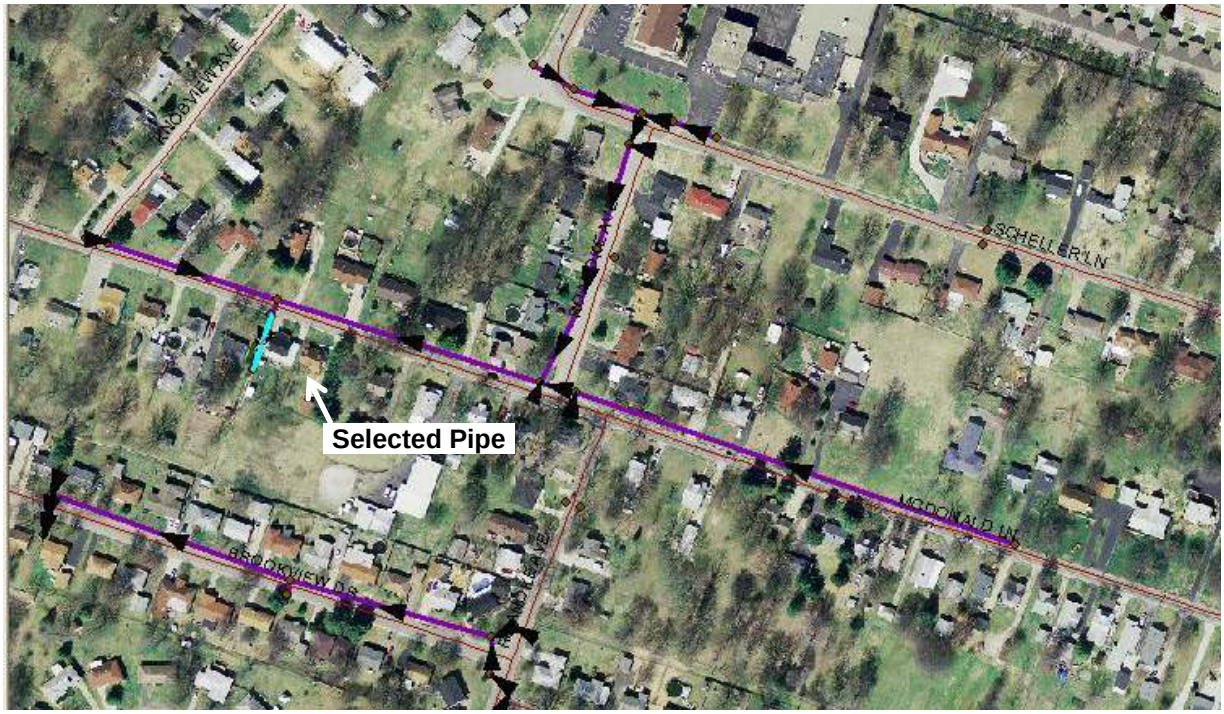



**Figure 4.1. New Albany Pipe Network Example.**

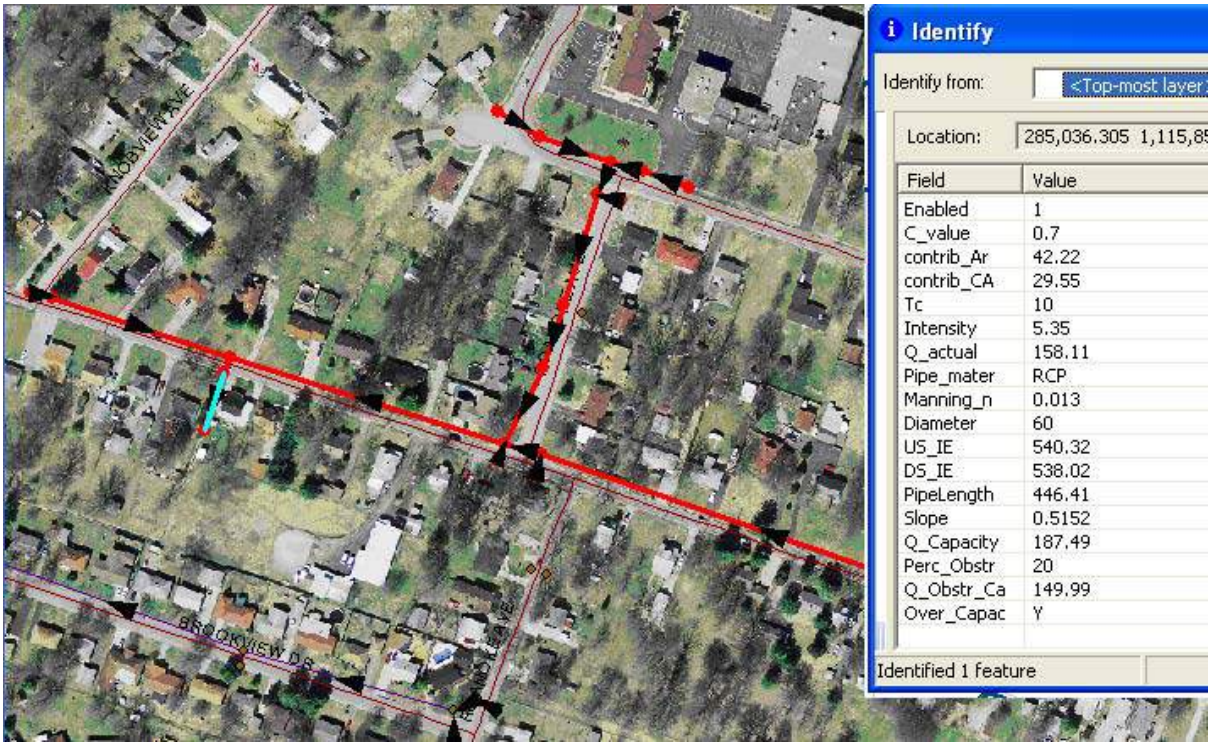



**Figure 4.2. Upstream Traced Pipe Network and Summary Table from the Tier 1 Tool.**

**Table 4.2. Definitions and Descriptions of Parameters Provided in Tier 1 Tool Summary Table.**

| Field | Definition | Description |
|---|---|---|
| C_value | Runoff Coefficient "C" for the Rational Method | Inputs and Results for the Rational Method to Determine the Runoff the Pipe Needs to Convey. |
| Contrib._Ar | Contributing drainage area to inlet nodes on the pipe (acres) | |
| Tc | Time of Concentration (minutes) | |
| Intensity | Rainfall intensity "i" for the Rational Method (in/hr) | |
| Q_actual | Peak Runoff Rate entering the Pipe Inlets (cfs) | |
| Pipe_mater | Pipe Material (RCP, CMP, HDPE, etc.) | Inputs and Results for the Analysis of Pipe Capacity Using Manning's Equation. |
| Manning_n | Manning's Roughness Coefficient | |
| Diameter | Pipe Diameter (in) | |
| US_IE | Upstream Invert Elevation (ft, NGVD) | |
| DS_IE | Downstream Invert Elevation (ft, NGVD) | |
| PipeLength | Pipe Length (ft) | |
| Slope | Pipe Slope (%) | |
| Q_Capacity | Flow Capacity of Open Pipe (cfs) | |
| Perc_Obstr | Percentage of Pipe that is Blocked (If Applicable) | |
| Q_Obstr_Ca | Flow Capacity of Pipe with Obstructions. (cfs) | |
| Over_Capac | Excess (+) or Deficit (-) Pipe Capacity<br>Compares Pipe Capacity to Peak Flow Rate based on Runoff from the Watershed (cfs). Negative Value indicates Pipe is Undersized. | Comparison of Pipe Capacity and Required Peak Runoff Rate |

## 4.2 LITERATURE REVIEW AND SUPPORTING DATA

Prior to the master plan model development, a review was performed to collect information of the existing stormwater system, known drainage problems, storm and high water mark data, photographic evidence of flooding, and available modeling data. This information is useful in focusing the planning and modeling effort on specific areas of concern that have experienced flooding and to validate model results. The following documents were reviewed for this study:

Field Reconnaissance data. These data were used in the delineation of areas of concern, identification of points of interest, to provide data for model inputs, and validation of model results.

Maintenance Request Call Records. Call records were used to delineate areas of concern and points of interest for the planning and modeling effort.

High Water Marks. Surveyed high water mark data of the August 4 and September 20, 2009 floods were provided by JTL. The high water mark survey data was transferred into an ArcMap shapefile to map their location and elevation. Photographs taken following the storms were reviewed to better understand the extent of flooding. High water mark maps and data were used to validate model results.

Known drainage issues within the City. The City provided information on known areas of concern and points of interest that have been identified by observations of City of New Albany and Stormwater Utility personnel. These areas and points of interest were not necessarily associated with service requests or high water mark surveys.

Federal Emergency Management Agency (FEMA) Map Modernization Program - Floyd County, Indiana. FEMA began the National Flood Insurance Program (NFIP) update of the effective Flood Insurance Map in Floyd County in 2009. The draft effective flood hazard boundary map and Flood Insurance Study (FIS) report have been reviewed and compared with this study. The FIS study includes detailed studies of the Ohio River; Middle Creek from SR 111 to the Southern Railway bridge above High Water Road; Vincennes Run from Middle Creek to Eagle Lane; Falling Run from the Ohio River to Jane Drive; Fall Run from its confluence with Falling Run to a point above Jolissant Avenue; and Silver Creek from the Ohio River to the county line. Unfortunately, the HEC-RAS models developed for the revised FIS will not be available until the study report and floodplain maps are finalized and released to the public.

## 4.3 FIELD RECONAISSANCE AND SURVEYING

It was anticipated that channel cross sections could be developed using existing topographic data and digital terrain models. However, it was found that this data was not adequate to represent culverts, stream and roadway geometry at critical locations. Field reconnaissance and survey activities were implemented to supplement existing topographic data for the modeling effort. Data acquisition for this effort was prioritized to meet the following needs:

- to obtain at least one open channel cross sectional profile for each reach in the model;
- to obtain geometry for as many pipes as practical, starting with pipes believed to be 24”-diameter and larger;
- to obtain dimensions for as many culverts as practical, starting with culverts at critical City road crossings;
- to obtain pipe invert elevations, starting with pipes believed to be 24”-diameter and larger;
- to determine culvert invert elevations for as many pipes as practical, starting with culverts under critical City roads

During these field activities, field notes were prepared that documented maintenance concerns and discussed watershed and conveyance system characteristics that were observed.

After the existing conditions models were developed and validated, potential infrastructure improvements were identified to address flooding concerns identified in maintenance request logs and through model results. To determine whether these proposed improvements were even worth considering, a field reconnaissance was performed on October 10, 2009 to check the feasibility of constructing the proposed improvements. Information collected included pipe and culvert sizes, availability of property, and any characteristics of the site that may affect its

constructability. Possible improvements were either verified or rejected based on field observations.

## 4.4 DESIGN STORM

Standard engineering methods were used to determine the discharge rates for flood events with return periods of 2- 10-, 25- and 100-years. These events have a 50-, 10-, 4- and 1-percent chance, respectively, of being equaled or exceeded during any given year. Storm events are also characterized by their duration and intensity patterns. According to the 1992 Master Plan, the design criteria for stormwater piping is to convey the SCS Type II 10-YR, 24-HR storm, without flooding. The Stormwater Board Policy further states that channel culverts should be designed to convey a 25-YR, 24-HR storm without flooding. Therefore, the 24-HR, SCS Type II storm with return periods of 10- and 25-years were selected as the project target storms.

The distribution of rainfall depth over the 24-HR storm duration using the NRCS (formerly SCS) Type II Distribution is illustrated in the dimensionless mass curve of **Figure 4.3**. Type II Storms begin with gentle rain and increase with intensity until it peaks near middle of the storm. Rainfall intensities then dissipate toward the end of the storm. This curve is used to distribute the rainfall depths for the 2-, 10-, 25-, and 100-YR storms over the 24-hour duration of each design storm. Rainfall depths for the design storms were determined for Floyd County, Indiana using the Storm Data module in the WinTR-55 program (NRCS, 2009). Rainfall depths for the design storms used in this study are given in **Table 4.3**.

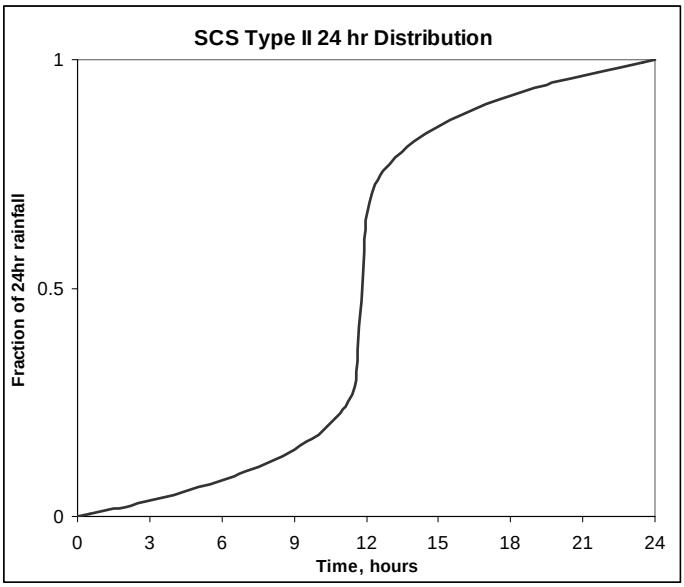



**Figure 4.3. Dimensionless Mass Curve for the NRCS (SCS) Type II 24-HR Rainfall Distribution.**
**Table 4.3. Rainfall Depth for 24-HR SCS Type II Design Storms.**

| Return Interval (years) | Depth (inches) |
|---|---|
| 2 | 3.2 |
| 10 | 4.5 |
| 25 | 5.2 |
| 100 | 6.2 |

In 2009, there were several uncharacteristic rain events that caused significant flooding within the City of New Albany. Most notably were the August 4, 2009 and the September 20, 2009 events. According to the Indiana State Climate Office, South Central Indiana experienced 20% more precipitation during 2009 than the local average for the spring and summer months. In 2008, the rainfall excess was greater with a 35% increase in precipitation over the local average for the spring and summer.

## 4.5 STORMWATER MANAGEMENT MODEL (SWMM)

The Stormwater Management Model (SWMM) was developed by EPA in 1971. It is a dynamic rainfall-runoff simulation model that can be used for either a single event or long-term simulation of runoff quantity and quality. It was developed to simulate runoff from primarily urban areas but has a wide range of applicability. The runoff component of the model simulates runoff from sub-basins in response to precipitation based on soil, land use, and topographic characteristics of the basins. The routing component of SWMM routes runoff from sub-basins through a system of conduits (conduits can be pipes, channels, storage/treatment facilities, pumps and/or flow regulators). SWMM computes the quantity and quality of runoff generated from each sub-basin, the flow rate, flow depth and quality of runoff in each conduit. The SWMM model has undergone several revisions since its inception (EPA, 2009). In addition, second party versions of SWMM have been developed. These typically use the computational engine developed by EPA with enhancements to modeling options, user interfaces and map generation.

SWMM models of the New Albany Watersheds were developed as the primary planning tool for Tier 2 projects. HEC-RAS and HEC-HMS were originally proposed as the basis of hydrologic and hydraulic models for larger stormwater systems in the city. However, after a review of the City's stormwater system and discussions with the City of New Albany, the decision was made to use XPSWMM because the City's drainage system includes a large pipe network. XPSWMM is a comprehensive software package used for modeling stormwater, sanitary and river systems. It can be used to simulate natural rainfall-runoff processes and flow in a large variety of stormwater conduits.

XPSWMM Version 10 was used to develop the Tier 2 models. Only the runoff quantity and flow routing capability of SWWM were used to develop the watershed models. Water quality is not a component of this planning effort. Opportunities for improving water quality should be considered in the design phase of drainage improvement projects.

### 4.5.1 SWMM Model Concepts

The SWMM model offers a variety of ways to simulate runoff and flow routing on watersheds. **Figure 4.4** illustrates the concepts used in SWMM to generate surface runoff (Rossman, 2009). The sub-basin surface is modeled as a reservoir. Depressional storage on the surface must be filled before surface runoff is generated. Once depressional storage is filled, surface runoff is the difference between precipitation (*P*) (rainfall or snowmelt) falling on the sub-basin, infiltration (*F*) into the soil profile and evaporation (*E*). During storm events, evaporation is assumed to be negligible. No runoff is generated from the soil surface until the ponding depth (d) is greater than the depth of depressional storage ($d_p$).

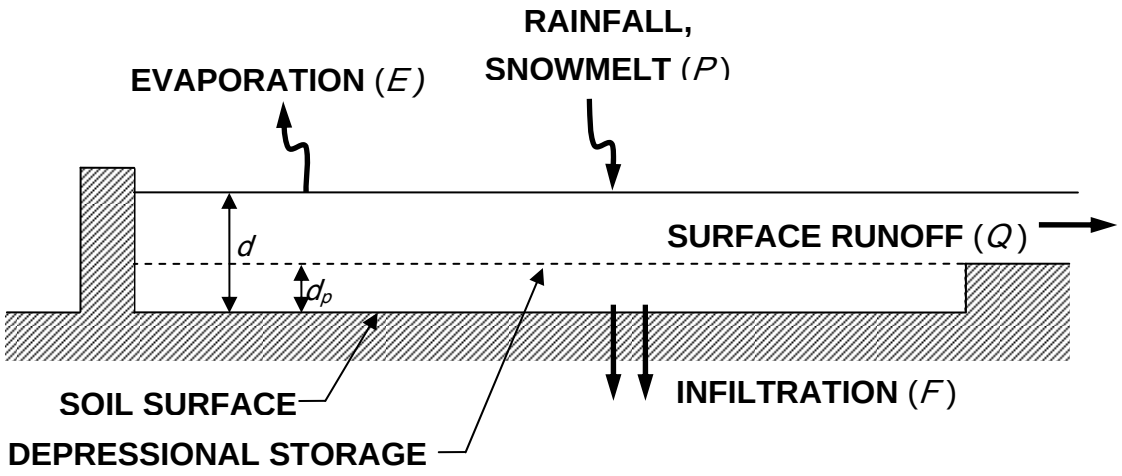



**Figure 4.4. Surface Runoff Concept in the SWMM Model (Adapted from Rossman, 2009).**

For each time step, SWMM computes runoff as follows:

$Q = 0$ ; if $d \le d_p$

$Q = P - F$ ; if $d > d_p$

Three options are available for estimating infiltration in the SWMM model: the Horton equation; Green-Ampt equation; and an estimate based on the NRCS Curve Number Method (Rossman, 2009).

The Horton equation is an empirical equation used to predict the rate (f) of infiltration:

$$f = f_c + (f_o - f_c)e^{-kt}$$

where $f_c$ is the final infiltration rate, $f_0$ is the initial infiltration rate and $k$ is the decay coefficient. In almost all cases, $f_o$, $f_c$ and $k$ are fitted parameters based on experimental observations. Local values may be available occasionally. There are no general tables or guidelines for determining the parameters for the Horton equation (Barfield, et.al., 1981).

The infiltration volume $(F)$ for a time step $(\Delta t)$ is calculated by:

$$F = f \cdot \Delta t$$

The Green-Ampt equation is a physically-based equation for infiltration based on measurable soil parameters (USDA, 1993):

$$f = K_a\left[1 + \frac{M \cdot S}{F}\right]$$

Here, $K_a$ is the hydraulic conductivity, $M$ is the fillable porosity and $S$ is the effective or average suction at the wetting front. $K_a$ represents the hydraulic conductivity just below saturation to account for entrapped air in the soil profile. All of these parameters can be derived from soil physical properties using unsaturated hydraulic conductivity and moisture characteristic curves for a soil. For practical purposes such as this study, $K_a$ is assumed equal to the saturated hydraulic conductivity when unsaturated conductivity data is not available. SWMM documentation refers to $K_a$ as the saturated conductivity for input into the model.

Runoff is routed through sub-basins assuming overland flow over pervious and impervious surfaces. Representative values of Manning's roughness coefficient (Manning's n) and characteristic flow lengths (to the sub-basin outlet node) for pervious and impervious areas are inputs for each subwatershed.

Sub-basins in the SWMM model are connected to nodes at ends of conduits. Nodes may represent a catch basin, culvert inlet, a channel inlet, manhole, storage basin, weirs, orifices, flow dividers, pump stations or other drainage structures. Conduits are pipes or open channels of various shapes. Runoff is routed from nodes through conduit networks using either steady-state, kinematic wave or dynamic wave routing (Rossman, 2009).

Steady-state routing is the simplest method of routing. The method assumes that flow is uniform and steady within each time step of the simulation. Using this method, hydrographs at the upstream node of a conduit is translated to the downstream node with no time delay or change in shape. Steady state routing can not evaluate channel storage, backwater effects, exit

and entrance losses, flow reversal or pressurized flow and can only be used for branched networks. Branched or dendritic networks are conduit networks where each node has only one outlet (with the exception of flow dividers) with no closed loops in the network. Steady-state routing is generally only appropriate for preliminary analysis using long-term continuous simulations.

Kinematic wave routing solves the continuity equation and a simplified form of the momentum equation. The simplified momentum equation requires the assumption of normal flow in each conduit (water surface slope is equal to the conduit slope). This method can not simulate backwater effects, account for entrance/exit losses, flow reversal or pressurized flow. It is also restricted to branched drainage networks. The method can maintain numerical stability with relatively large time steps on the order of five to fifteen (5-15) minutes.

Dynamic wave routing is a solution to the complete one-dimensional Saint Venant equations and produces the most theoretically complete results of the options available in SWMM. In this method, the continuity and momentum equations are solved for conduits with volume continuity solved at nodes. Using this method, pressurized flow in closed conduits flowing full, storage and back water effects and entrance/exit losses can be modeled. Much smaller time steps are required to maintain numerical stability. Time steps on the order of one minute or less are generally required (Rossman, 2009). SWMM automatically adjusts time step sizes to maintain numerical stability.

All of the routing methods use the Manning equation to model flow in conduits with the exception of circular pressurized force mains. Dynamic wave routing uses either the Hazen-Williams or Darcy-Weisbach equation for circular pressurized conduits (Rossman, 2009).

### 4.5.2 Modeling Approach

In an effort to maximize the efficiency of these initial master plan modeling efforts, it was determined that modeling efforts should be concentrated on areas in the city with the most severe and frequent stormwater drainage issues. A total of seventeen areas of concern were identified within the city limits based on concentrations and nature of maintenance request call log data obtained from both the New Albany Stormwater Utility and EMC for 2006-2009 and input from the City of New Albany. The request data was geo-referenced and entered into the GIS database to assist with identifying and mapping areas of concern.

SWMM models were developed for each area of concern. Pipes 24-inches in diameter and larger and open channels were modeled in each area of concern. Pipes 48-inches in diameter and larger and open channels were included in SWMM models outside the areas of concern.

### 4.5.3 Hydrologic Inputs for SWMM

Hydrologic inputs into the SWMM model are the watershed parameters that are necessary to simulate runoff from sub-basins within each watershed. The Green-Ampt infiltration option was used to model sub-basins in the SWMM models. Inputs necessary for the Green-Ampt

approach for simulating surface runoff are: sub-basin area; sub-basin width; average basin slope; percent impervious area; Manning's roughness (n) for impervious areas; Manning's n for pervious areas; depressional storage depth for impervious areas; depressional storage depth for pervious area; percent of impervious areas with zero depressional storage; and parameters for the Green-Ampt equation. Inputs for the Green-Ampt equation are saturated hydraulic conductivity ($K_a$); soil suction at the wetting front ($S$); and the moisture deficit (fillable porosity, $M$ ).

Percent impervious for the existing conditions SWMM models were determined from the 2008 land use GIS layer provided by the City of New Albany. Percent impervious values were assigned to each land use based on the percent impervious table from the 1992 Master Plan as shown in **Table 4.4** for existing conditions.

**Table 4.4. Percent Impervious Values for Land Use Classifications from 1992 Master Plan.**

| Land use Classification | Percent Impervious |
|---|---|
| Cultivated Crops | 0% |
| Deciduous Forest | 0% |
| Evergreen Forest | 0% |
| Grasslands | 0% |
| High-Intensity Development | 85% |
| Low-Intensity Development | 38% |
| Medium-Intensity Development | 65% |
| Open Space | 0% |
| Pasture/Hay | 0% |
| Wetlands | 0% |

For fully developed conditions, undeveloped space was assumed to be developed. Undeveloped land in the Knobs area such as deciduous forest, pasture/hay, grassland, cultivated crops, and evergreen forest were classified as low-intensity development due to the steep terrain. Open space east of the knobs and closer to the more developed sections of the city were classified as medium-intensity development. Adjusted percent impervious values used to simulate fully developed conditions in the SWMM model are shown in **Table 4.5**.

**Table 4.5. Percent Impervious Values Assigned to Existing Land Use Areas to Represent Fully Developed Conditions.**

| Existing Land Use Classification | Percent Impervious |
|---|---|
| Cultivated Crops | 38% |
| Deciduous Forest | 38% |
| Evergreen Forest | 38% |
| Grasslands | 38% |
| High-Intensity Development | 85% |
| Low-Intensity Development | 38% |
| Medium-Intensity Development | 65% |
| Open Space | 65% |
| Pasture/Hay | 38% |
| Wetlands | 0% |

Areas identified as wetlands were assumed to remain undeveloped. Percent impervious values for existing land uses in **Table 4.3** were adjusted to reflect changes in imperviousness for fully developed conditions as described above. **Table 4.4** shows the adjusted percent impervious values assigned to each existing land use classification to account for fully developed conditions. Maps of the New Albany watersheds showing land uses for existing and fully developed conditions are shown in **Figure 4.5**.

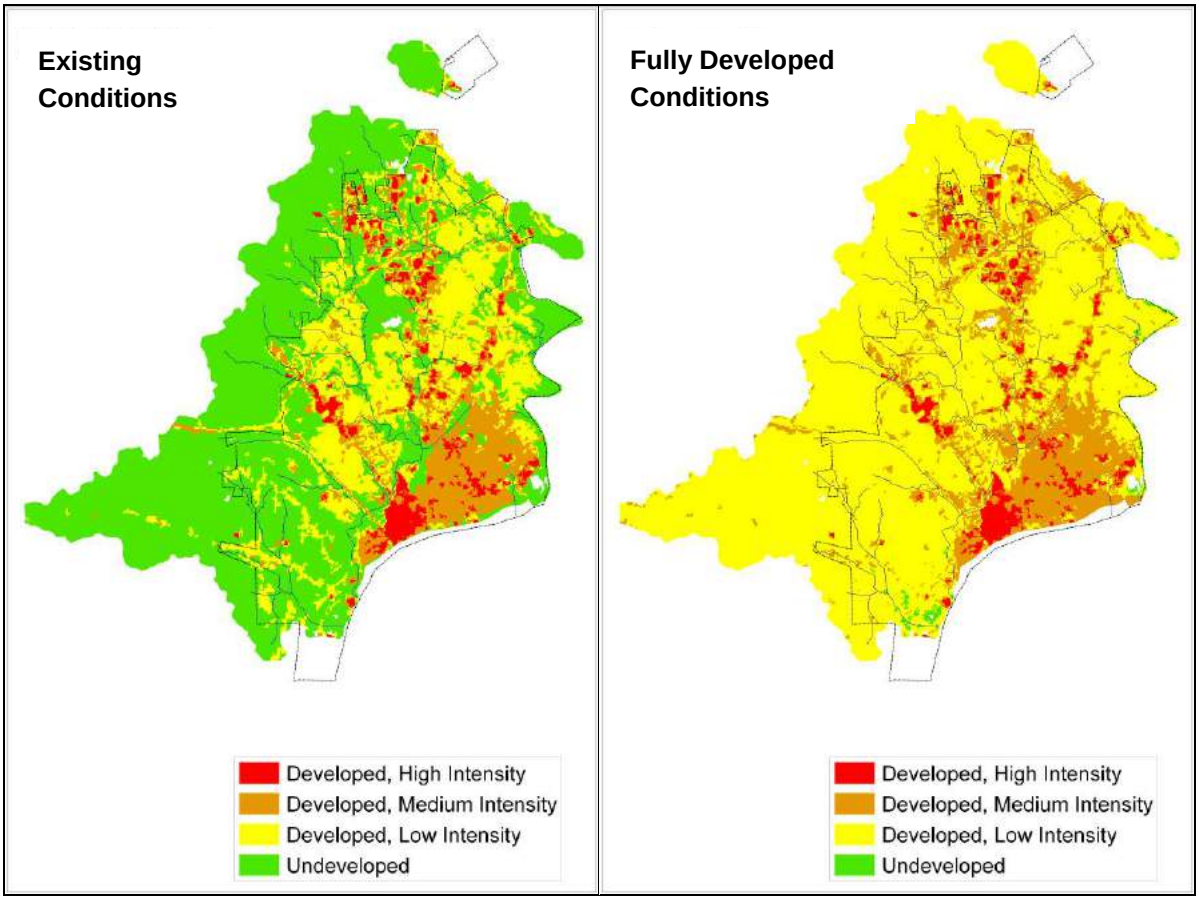



**Figure 4.5. Land Use Maps for Existing Conditions and Fully Developed Conditions.**

The inputs for the Green-Ampt equation were developed based on the dominant Hydrologic Soil Group (HSG) in each sub-basin. Values for saturated hydraulic conductivity ($K_s$) average suction at the wetting front ($S$); and the moisture deficit ($M$) are based on recommended values from LFUCG (2009). The New Albany watersheds include HSG B, C, and D soils. Recommended values of $K_s$, $S$, and $M$ from LFUCG (2009) are shown in **Table 4.6**. These values were used for Green-Ampt inputs for the SWMM models.

**Table 4.6. Hydrologic Soil Groups and Related Hydraulic Conductivity (from LFUCG, 2009).**

| HSG | Saturated Hydraulic Conductivity ($K_s$) | Wetting Front Suction ($M$) | Soil Moisture Deficit ($M$) |
|---|---|---|---|
| **B** | 0.2 in/hr | 6.6 in | 0.17 in/in |
| **C** | 0.1 in/hr | 8.6 in | 0.14 in/in |
| **D** | 0.03 in/hr | 12.5 in | 0.08 in/in |

Details of sub-basin areas and widths; average basin slopes; percent impervious area; Manning's n for pervious and impervious areas; depressional storage depths; percent of impervious areas with zero depressional storage; and Green–Ampt parameters for sub-basins are described in the discussion of inputs for watershed models in watershed master plan sections that follow.

### 4.5.4 Hydraulic Inputs for SWMM

Hydraulic inputs are the parameters that are required to simulate the flow of runoff into and through conduit networks that represent drainage infrastructure in areas of concern. Networks are represented in SWMM as conduits connected to junctions (nodes). Inputs for conduits include the inlet and outlet nodes for the conduit; the conduit shape (for both closed conduits and open channels); the maximum flow depth in the conduit; the conduit length; Manning's n based on conduit material or lining. Required junction parameters are the invert elevation and maximum depth from the ground surface. Additional inputs may include: initial depth of flow in the junction; surcharge depth and ponded area above the junction.

The GIS infrastructure database was used to determine conduit and junction parameters. Field reconnaissance was necessary to obtain some pipe diameters and material/lining data. Survey work was also performed by Jacobi, Toombs, and Lanz (JTL) as part of this master planning effort to obtain invert and rim elevations for some critical junctions and conduits. Manning's roughness values for specific pipe materials were based off those used in the Tier 1 tool as noted in **Table 4.1** in **Section 4.1.1**.

The following assumptions were made for pipe systems with no data in non-critical areas:

- Two feet of cover existed at the outfall of the pipe, if no invert data was available.
- From the outfall, slopes ranging from 0.1% – 1% (based on land slopes in the vicinity) were assumed to determine the inverts of pipes upstream.
- Rim Elevations were obtained using contours.

Cross sections required for open channel modeling were either cut from the existing contour data, if adequate detail was available, or were surveyed. Culvert dimensions for selected road crossings were obtained as part of field reconnaissance efforts. Manning's roughness coefficients were developed using aerial photography and guidelines from Chow (1959). Values of Manning's n developed for open channels are given in **Table 4.7**.

**Table 4.7. Values of Manning's "n" for Modeling Open Channels.**

| Feature | Manning's Value |
|---|---|
| Channel | 0.045 |
| Developed/ Grass Field | 0.06 |
| Forested | 0.1 |

Details of hydraulic input parameters for the SWMM model are provided in the description of drainage infrastructure in following plan sections.

### 4.5.5 SWMM Simulation Scenarios

SWMM simulations were run for three scenarios: existing conditions, fully developed conditions and fully developed conditions with proposed improvements implemented for the 2-YR; 10-YR; 25-YR; and 100-YR, 24-HR design storms.

### 4.5.6 Sub-Watershed Delineation

The StreamStats program was used to delineate watersheds along streams in New Albany based off the HUC watersheds. Watershed delineation points were selected just upstream of stream junctions. Watersheds were also delineated at points where the drainage area increased by approximately 0.25 square miles and at the study limits. For areas within the areas of concern the StreamStats watersheds were delineated further into subwatersheds at stream confluences, catchbasins, and manholes. The subwatershed boundaries were determined from contours, road crowns along street centerlines, rooftops, and pipe flow direction.

## 4.6 MODEL VALIDATION

Rainfall data and high water mark elevations for the August 4, 2009 and September 20, 2009 storm events were evaluated as potential validation data for the SWMM existing conditions models. Rain gage data for the storm events was obtained from the nine rain gage stations identified in **Table 3.1**. Some rain gages failed during the August 4$^{th}$ event. Rain gage data for the September 20$^{th}$ event appears to be complete, so the September 20$^{th}$ rain gage and high water mark elevations were used to validate the SWMM models.

The Mount Tabor Road gage station was used to validate the model because the average of the nine gage stations was closest to the total rainfall (3.84 inches) measured at Mount Tabor Road. The hyetograph from September 20th for the Mt. Tabor Road gage station was input into the model and the water surface elevations results were compared to the surveyed high water marks at the validation points.

The most significant difference in model and high water mark elevations occurred on County Run at Navajo Drive and on Valley View Creek at Cherry Hill Road. In these locations, the modeled water surface elevations were 1.9 feet higher than the high water mark elevations. At these road crossings, the bridge openings were restrictive to the flow and caused significant backwater in the SWMM models.

In other areas where the difference between the modeled and high water marks was significant, the models were calibrated by modifying or adding ineffective flow areas; adjusting Manning's n values, cross section contraction/expansion coefficients, structure entrance/exit coefficients, and bridge modeling approaches; and making minor modifications to the cross section geometry and slope. **Table 4.8** provides the comparison of surveyed and modeled high water marks for the September 20th rain event.

**Table 4.8. Surveyed High Water Mark Elevations Compared to Predicted Water Surface Elevations for the September 20, 2009 Storm Event.**

| Location | Surveyed Elevation | Predicted Elevation |
|---|---|---|
| County Run at Navajo Drive | 462.9 | 464.8 |
| Fall Run at Cannon Street | 450.9 | 452.1 |
| Fall Run at Hickory Vale Drive | 459.9 | 460.8 |
| Valley View Creek at Captain Frank Road | 480.5 | 481.5 |
| Valley View Creek at Cherry Hill Road | 434.2 | 436.1 |
| Tributary to Silver Creek at Old Ford Road | 444.3 | 443.1 |
| Town Run at Old Ford Road | 421.1 | 421.0 |

## 4.7 COORDINATION WITH FEMA MAP MODERNIZATION PROGRAM

Stantec has coordinated with FEMA contractors to obtain models and floodplain mappings associated with the Map Modernization Program that was initiated in Floyd County in 2008. The City received the draft Flood Insurance Study (FIS) report and flood hazard boundary maps when they were made public in 2009. The hydrologic and hydraulic results from this Master Plan have been compared with the FEMA floodplain study.

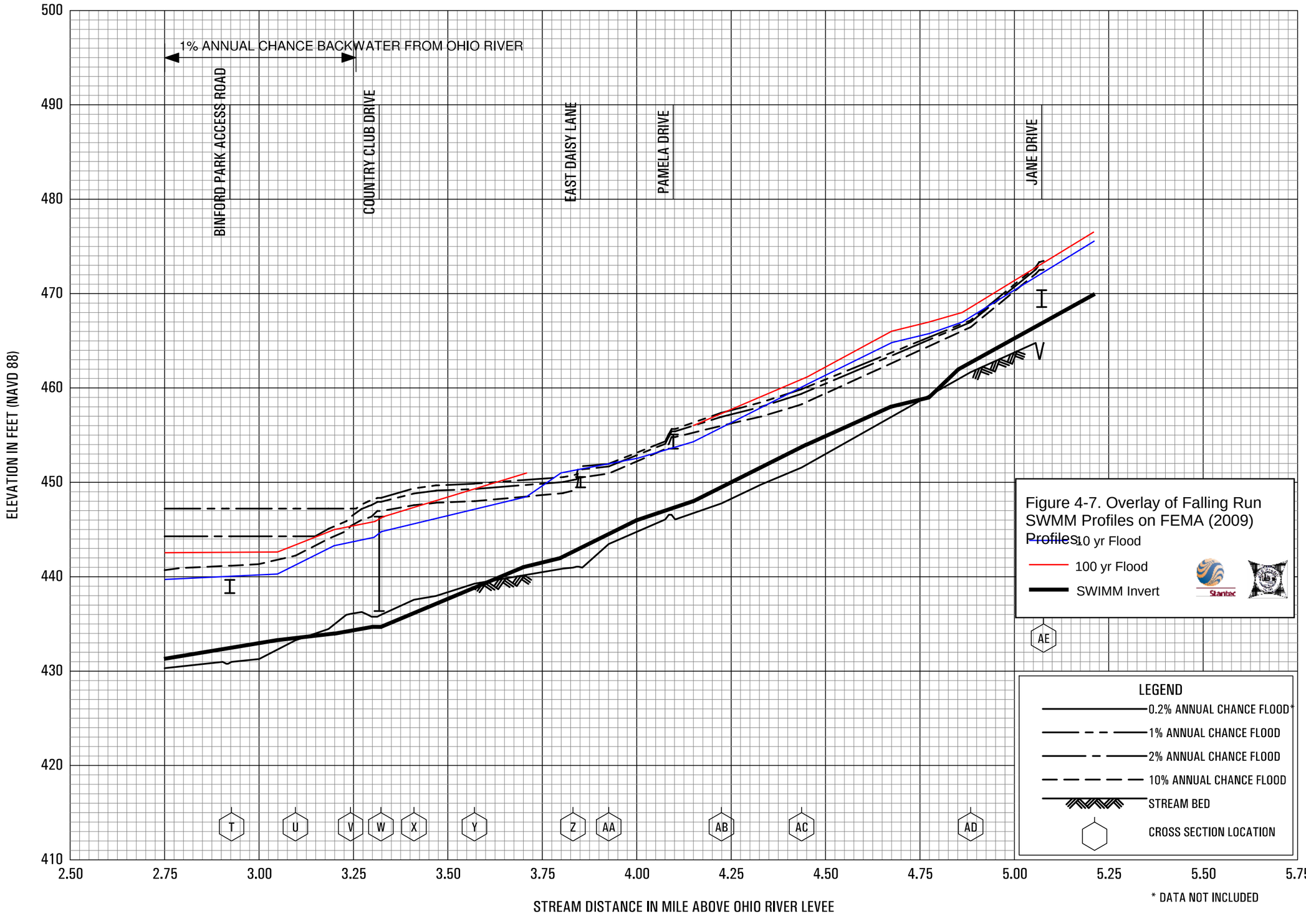
Water surface profiles for the 10-YR, 24-HR and 100-YR, 24-HR storms can be used to compare the results of the hydraulic or routing component of the SWMM models with the results of the HEC-RAS model developed for the FIS (FEMA, 2009).

**Figure 4.6** compares SWMM and HEC-RAS results for the two storms on Middle Creek. The SWMM model was developed using a terrain model developed from a triangulated irregular network that was derived from two-foot contour lines in the New Albany GIS. The SWMM model results do not reflect backwater conditions for the Ohio River and should not be compared in areas impacted by Ohio River flooding.

Differences in the stream bed elevations for the SWMM model and the FIS study reflect differences in the terrain models. The terrain model for the FIS study was not available at the time of this study. While the 10-YR SWMM profile matches the 10-YR profile FIS fairly well, the 100-YR SWMM profile lies well above the 100-YR SWMM profile. The differences in the 100-YR profile are likely due to differences in both channel and floodplain geometry between the two terrain models. The SWMM model for Middle Creek should be revised using section data from the FIS Study when the study and floodplain maps are approved and the FIS model of Middle Creek is made available to the City of New Albany.

10-YR and 100-YR profiles from the SWMM model for Falling Run above the influence of Ohio River backwater are plotted on flood profiles from the FIS study (FEMA, 2009) in **Figures 4.7**. Differences in the terrain models are apparent in the stream bed profiles for the SWMM model and FIS study. Flood profiles for the 10-YR and 100-YR events agree reasonably well with SWMM profiles generally higher than those from the FIS study above areas influenced by backwater from the Ohio River. These differences appear to be consistent with differences in the stream bed profile. The results appear to be appropriate for this study until the SWMM model can be updated with channel geometry from the FIS study models.

SWMM profiles and FIS profiles for Vincennes Run are compared in **Figure 4.8**. This reach exhibits the greatest differences between stream beds derived from the New Albany GIS and the terrain model used in the FEMA, 2009 study. Flood profile elevations from the SWMM model are generally higher than those from the FIS. While flood elevations are not consistent between the two models, predicted flood depths appear to be consistent between the two models except the flood depths predicted in the vicinity of the private drive crossing near River Mile 0.28. The Vincennes Run model should be updated with channel and floodplain geometry data from the FIS study when the models become available.




FLOOD PROFILES

FALLING RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF FLOYD, IN

AND INCORPORATED AREAS

05P

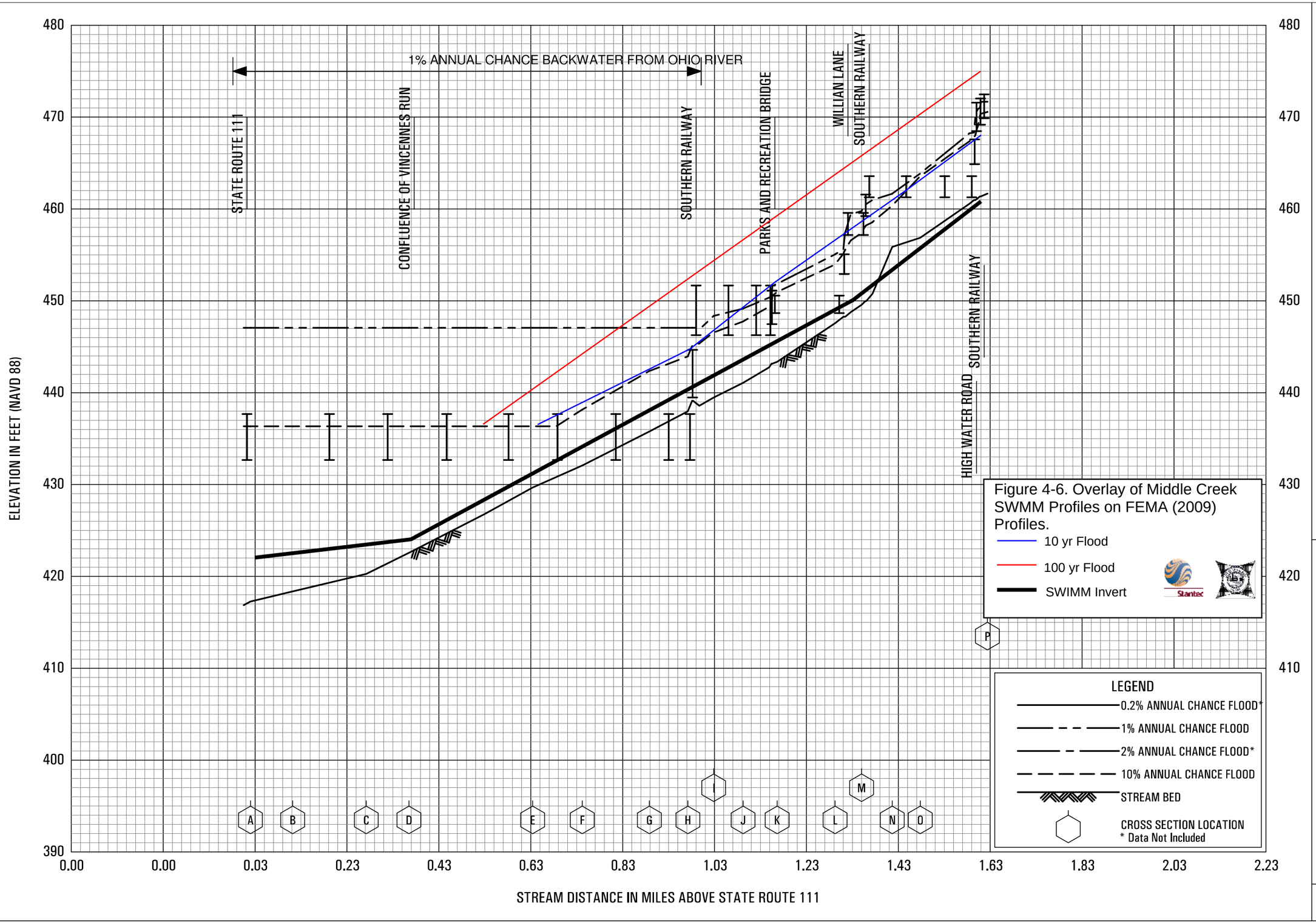



Figure 4-6. Overlay of Middle Creek SWMM Profiles on FEMA (2009) Profiles.

FLOOD PROFILES

MIDDLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF FLOYD, IN

AND INCORPORATED AREAS

20P

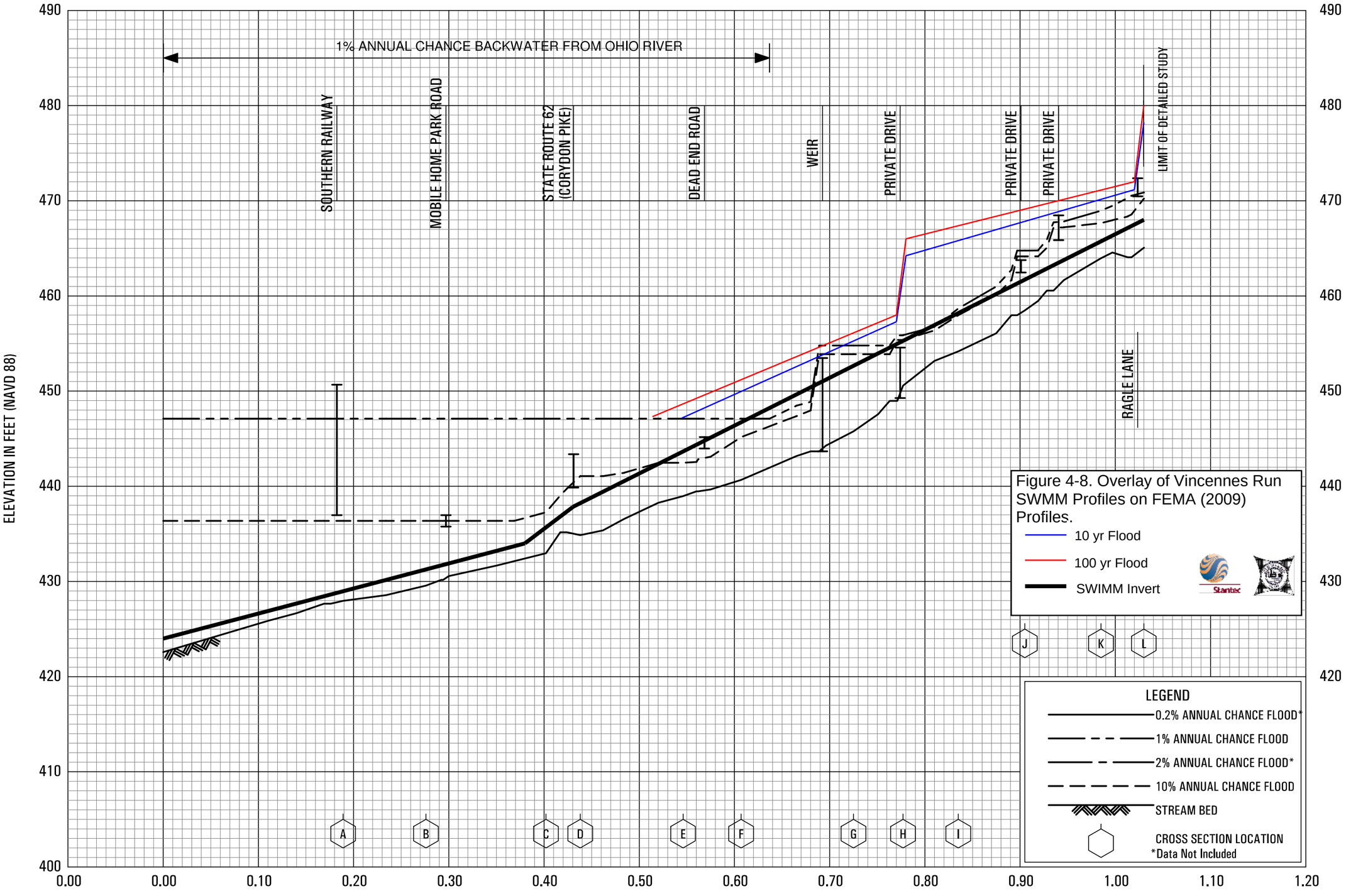



Figure 4-8. Overlay of Vincennes Run SWMM Profiles on FEMA (2009) Profiles.

FLOOD PROFILES

VINCENNES RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY
COUNTY OF FLOYD, IN
AND INCORPORATED AREAS

Comparison of results from the SWMM model and the preliminary FIS report (FEMA, 2009) indicate that the SWMM models should be updated and calibrated when geometry data for the FIS models is made available to the City of New Albany. At this time, the SWMM models appear to be useful for comparing relative differences in flood elevations between storm events and existing conditions and proposed conditions with improvements. However, they should not be used to predict flood elevations until the models can be updated and calibrated with FIS geometry used in the FEMA, 2009 study.

## 4.8 CRITERIA FOR POTENTIAL IMPROVEMENT DEVELOPMENT AND ANALYSES

In the process of modeling and evaluating potential improvements, the following objectives were established:

- The piped stormwater system will convey the 10-YR, 24-HR storm event without flooding;
- The open channel culverts under roads will convey the 25-YR, 24-HR storm event without flooding the road;
- Reduce structural flooding in the 25-YR, 24-HR storm event; and
- Cost and ease of implementation of the proposed improvement.

## 4.9 IMPROVEMENT OPTIONS

Stormwater drainage issues within the City of New Albany are both local and watershed-scale in nature. Local issues generally are those that can be addressed with drainage improvements along a street, in a neighborhood or subdivision that will independently provide relief to areas upstream or downstream of the improvement. Watershed-scale issues are those that are interdependent such as floodplain management and related flood-control projects. In this case, improvements in local conditions can not be realized without improvements upstream and/or downstream of the area of concern. Examples of these types of projects are regional stormwater detention basins and flood pumping stations.

Potential improvements considered for local issues include storm sewer upgrades; relief sewers; culvert improvements, catch basin improvements; construction of detention basins to reduce flows in storm sewers and drainage infrastructure, construction of flood protection measures for individual properties.

Improvements considered on a watershed scale include: construction of regional detention basins with the goal of reducing floodplain elevations downstream; large scale flood protection (such as floodwalls and levees); flood pumping station improvements; and the purchase of flood-prone properties with repetitive losses.

Undersized pipe systems tend to restrict flow and cause significant flooding upstream because the water is forced to come out of the pipe network through catch basins and manhole lids.

Increasing pipe sizes allows more flow to pass through the pipe, thus reducing upstream flooding. The potential disadvantage of these improvements is the possibility of increased flood risks in downstream areas due to loss of storage upstream of the undersized pipe system and increased downstream flows.

Undersized culverts tend to restrict flow and often cause significant flooding upstream of the structure. Culvert enlargement allows more flow to pass through the culvert, thus reducing upstream flooding. The potential disadvantage of these improvements is the possibility of increased flood risks in downstream areas due to loss of storage upstream of the structure and increased downstream flows.

The function of a detention basin is to capture stormwater runoff, store it, and slowly release it over a longer time frame, thus reducing peak flows in the channel. As opposed to an approach of multiple small detention basins that are managed at the development level, Stantec pursued the use of larger regional basins. These regional basins provide the most efficient use of property, requires less aggregate maintenance, and is easier to manage from a performance perspective compared to a system of smaller basins.

Potential storage basin sites were initially identified by using aerial photography to locate open space that would be suitable for a storage basin. Following field reconnaissance of the potential storage basin site, factors were considered such as availability of the basin, location of the basin within city limits, whether or not the property is privately or publicly owned, and the benefits it would have to the areas of concern. Storage basins were modeled within XPSWMM if the proposed volume of the basin could retain the 1$^{st}$ inch of runoff and if adequate elevation data was available to develop stage-storage-discharge curves. Estimates of available storage volumes were made based on SWMM model results for modeled basins and estimates based on assumed basin depths and side slopes for basins that were not modeled.

Storage requirements necessary to affect drops in water surface elevations were developed using the runoff hydrograph at a point of interest on a watershed and the discharge rating curve for the channel at the point of interest. Required storage volumes were compared to available storage volumes above the point of interest to check if available storage is adequate or if other measures will be necessary for effective flood control.

# 5.0 Falling Run Watershed Master Plan

Falling Run drains the central area of the City above its confluence with the Ohio River. Its watershed (drainage area) covers a total area of 10.2 square miles; draining approximately eight square miles within the City of New Albany and 2.2 square miles of unincorporated Floyd County. The watershed extends from its headwaters north-northwest of the City to its confluence at the Ohio River in the south as shown in **Figure 5.1**.

Falling Run is the largest of the Ohio River tributaries that drain the City of New Albany. Valley View Creek, Fall Run, and an un-named tributary north of downtown are its major tributaries within Floyd County.

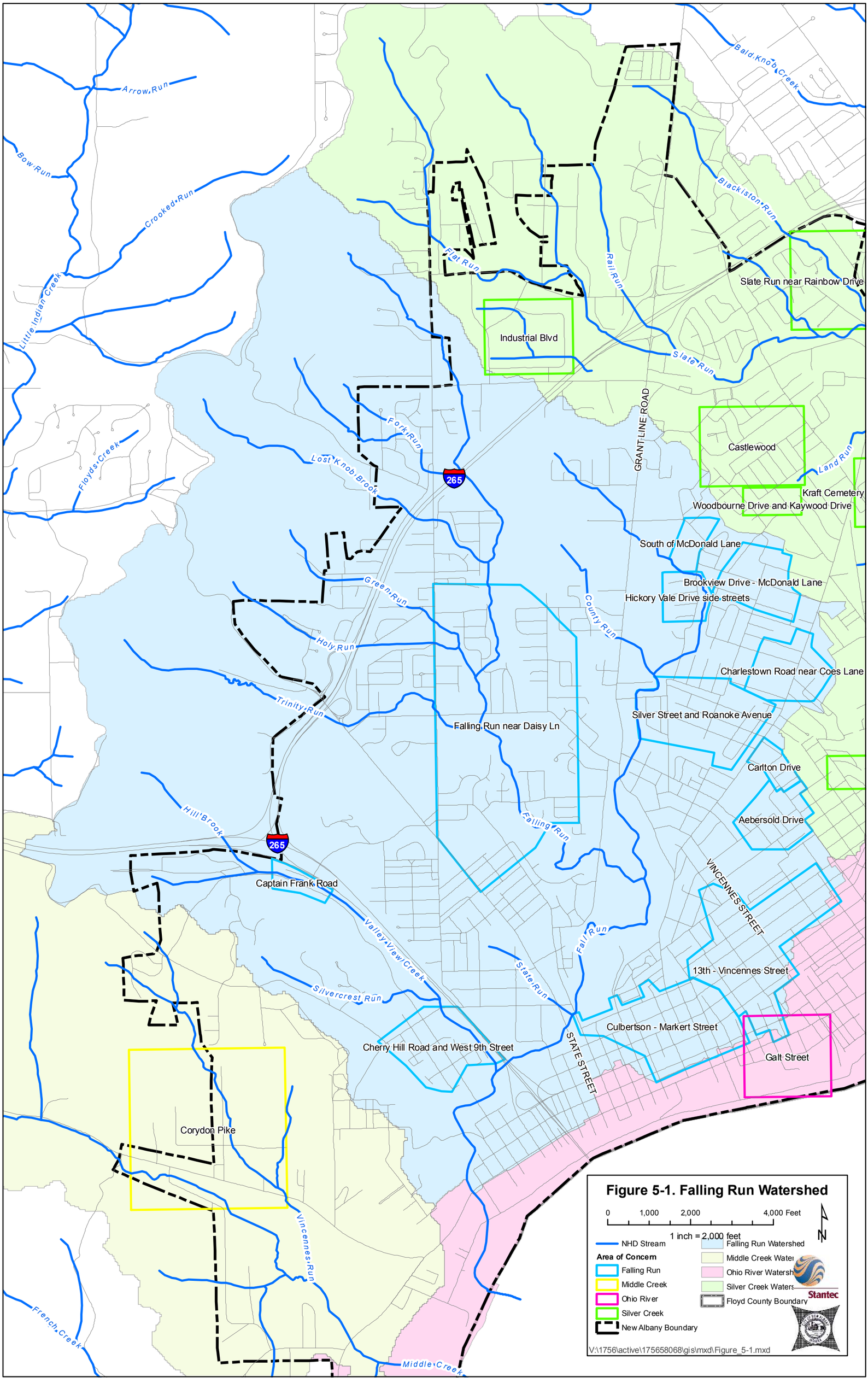
**Section 5** presents the analysis and results of the planning work on the Falling Run watershed. **Section 5.1** includes a discussion of Falling Run watershed characteristics; their representation in SWMM models and drainage issues on the watershed. **Section 5.2** describes Areas of Concern that were identified through discussions with the stormwater board, stormwater utility personnel, and a review of maintenance requests. It focuses on drainage issues in each area, results of SWMM model simulations and presents action plans for each area based on the nature of requests and model results.

**Section 5.3** identifies potential detention basin sites on the watershed to reduce flooding impacts in the Falling Run and Fall Run floodplains. Proposed roadway crossing improvements are presented in **Section 5.4** for selected road crossings. Road crossings were selected based on known problem areas and the need to determine the frequency of overtopping of major and critical road crossings. Priorities for improvements to road crossings are also discussed in this section.

Maintenance needs are discussed and critical areas requiring routine maintenance are identified in **Section 5.5**. The cost of local, watershed-scale and road crossing improvements on the Falling Run Watershed are presented in **Section 5.6** followed by a summary of results in **Section 5.7**.

## 5.1 WATERSHED CHARACTERISTICS

The Falling Run Watershed is characterized by steep slopes in its upper reaches with flatter slopes in the lower reaches. The average slope of the watershed is three percent (3%). The upper reaches are relatively undeveloped while the lower reaches have moderate to high-intensity development. Based on current land use, the watershed is 54% developed with the bulk of undeveloped land lying outside the City limits.


Arrow Run
Bow Run
Crooked Run
Little Indian Creek
Floyds Creek
Bald Knob Creek
Blackiston Run
Flat Run
Rail Run
Slate Run near Rainbow Drive
Industrial Blvd
Slate Run
GRANT LINE ROAD
Fork Run
Lost Knob Brook
265
Castlewood
Land Run
Kraft Cemetery
Woodbourne Drive and Kaywood Drive
South of McDonald Lane
Brookview Drive - McDonald Lane
Hickory Vale Drive side streets
Green Run
County Run
Holy Run
Charlestown Road near Coes Lane
Trinity Run
Silver Street and Roanoke Avenue
Falling Run near Daisy Ln
Carlton Drive
Hill Brook
Aebersold Drive
Falling Run
265
VINCENNES STREET
Captain Frank Road
Valley View Creek
Fall Run
State Run
13th - Vincennes Street
Silvercrest Run
Culbertson - Markert Street
Cherry Hill Road and West 9th Street
STATE STREET
Galt Street
Corydon Pike
Vincennes Run
French Creek
Middle Creek
Figure 5-1. Falling Run Watershed
0
1,000
2,000
4,000 Feet
1 inch = 2,000 feet
N
NHD Stream
Area of Concern
Falling Run
Middle Creek
Ohio River
Silver Creek
New Albany Boundary
Falling Run Watershed
Middle Creek Wate
Ohio River Watersh
Silver Creek Waters
Floyd County Boundary
Stantec
V:\1756\active\175658068\gis\mxd\Figure_5-1.mxd

#### 5.1.1.1 Soils and Sub-Basin Delineations

Soils in the watershed are classified as Hydrologic Soil Group (HSG) B and C in the Clark and Floyd Counties Soil Survey (USDA, 1974). HSG B soils are characterized by saturated hydraulic conductivity that ranges from moderately high to high with water tables that are deep to very deep. Hydraulic conductivity ranges from moderately low to moderately high and water table depths that are not shallow are characteristic of HSG C soils. The infiltration capacity of soils in HSG B and C are moderately low to moderately high.

**Figure 5.2** shows the delineation of sub-basins for use in the SWMM model. The watershed was subdivided into four (4) subwatersheds and 206 sub-basins. The subwatersheds are the main stem of Falling Run (Fall Run 1); Fall Run above its confluence with Falling Run (Fall Run 2); un-named tributary that drains downtown (Fall Run 3); and Valley View Creek (Fall Run 4). Sub-basins range in size from 0.1 to 455 acres, with smaller basins in the areas that are highly developed and larger basins in areas with lighter development.

Effective hydraulic conductivities, moisture deficits and wetting front suction values for the Green-Ampt equation were assigned to each sub-basin based on the dominant HSG in a basin, as described in **Section 4**. Land use and terrain data such as impervious areas, soil types, land slopes were developed from the GIS database. Selected inputs for each sub-basin (drainage area, average slope, representative width, Hydrologic Soil Group (HSG), and Percent Impervious Area for Existing (EC) and Fully Developed Conditions (FD)) are provided in **Appendix 5.1**

#### 5.1.1.2 Flood Pumping Stations

The hydraulics of Falling Run are affected by the capacity of flood pumping stations when the Ohio River is at flood stage. Areas protected by the Ohio River Flood Protection Works are drained by six pumping plants (USACE, 1983). Four (4) of the pumping plants potentially affect flooding in the Falling Run watershed: the Falling Run Pumping Plant; the East 3$^{rd}$ Street Pumping Plant; the East 10$^{th}$ Street Pumping Plant and the Chambers Street Pumping Plant. The Falling Run Pumping Plant is likely the limiting factor in the drainage of Falling Run when the Ohio River is at flood stage. The capacities of the three pumping plants are shown in **Table 5.1.**

During Ohio River floods, flood gates are closed at the mouth of Falling Run and the pumping plant discharges flow in Falling Run to the Ohio River. The East 3$^{rd}$ Street and East 10$^{th}$ Street plants are actually located in the Ohio River drainage area but may provide relief to portions of downtown that normally drain to Falling Run, depending on how storm sewer flows are diverted.

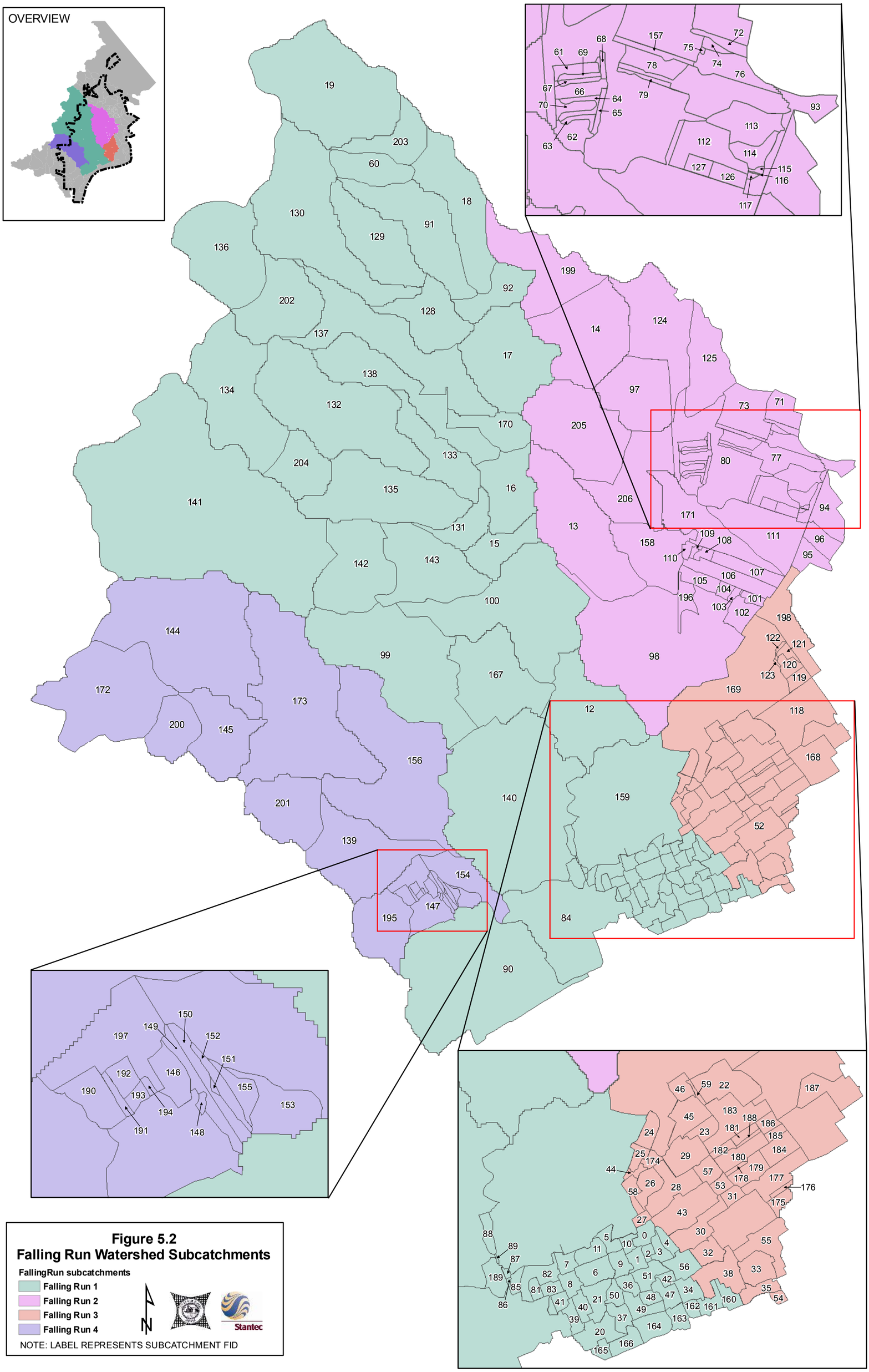

OVERVIEW
Figure 5.2
Falling Run Watershed Subcatchments
FallingRun subcatchments
Falling Run 1
Falling Run 2
Falling Run 3
Falling Run 4
N
Stantec
NOTE: LABEL REPRESENTS SUBCATCHMENT FID

**Table 5.1. Flood Pumping Station Capacities and Operation Stages.**

| Pumping Plant | Location | Capacity | Ohio River Stage to Start Operation | Ohio River Water Flood Elevation |
|---|---|---|---|---|
| Falling Run | Falling Run at Levee | 156,600 gpm (350 cfs) | 56.7 ft | 430.0 ft |
| East 10th Street | Foot of East 10th Street | 21,750 gpm (48 cfs) | 61.2 ft | 434.8 ft |
| East 3rd Street | Landward of Levee between 3rd and 4th Street. | 4350 gpm (10 cfs) | 57.7 ft | 431.3 ft |

The 10-YR, 50-YR, and 100-YR discharge at the mouth of Falling Run are 2,200, 2,950, and 3,180 cfs according to the current flood insurance study for the City of New Albany (FEMA, 2000). The pump stations would require major upgrades and corresponding changes in operational procedures to affect flooding during storm events when the Ohio River is not at flood stage.

#### 5.1.1.3 Flow Restrictions at Road Crossings.

The preliminary FIS for Floyd County and incorporated areas (FEMA, 2009) was prepared when the flood control works for the City of New Albany were not certified. When flood control works are not certified it is assumed that the flood control works are not effective and the higher of the Ohio River flood and free-flowing tributary flood elevations is recognized as the effective flood elevation at a point in the tributary flood profile. In this scenario, the Ohio River flood elevations are projected horizontally upstream (level routing) until they intersect flood profiles that were generated assuming a free-flowing tributary. This is illustrated in the flood profiles shown in **Figures 5.3 and 5.4**. This figure is taken from the preliminary FIS and shows Ohio River flood elevations in the lower reaches of Falling Run where flood elevations are designated as “1% Annual Chance Backwater from Ohio River”.

Although New Albany’s flood control works are not currently certified, they are operational and are in the process of being certified by the U.S. Army Corps of Engineers. It appears the flood control works were certified when the New Albany FIS was revised in 2000 (FEMA, 2000). The reach of Falling Run from its mouth to Country Club Drive shown in **Figures 5.3 and 5.4** is also shown in **Figure 5.5**. The profile in **Figure 5.5** was taken from the 2000 New Albany FIS (FEMA, 2000) and represents free-flow conditions in Falling Run. This profile shows significantly lower flood elevations from its mouth to a point just downstream of Country Club Drive.

More importantly, the free-flow profile shows the impacts of road crossings on floodplain elevations, especially in the downtown area and at Country Club Drive. It can be seen from the profile from West Main Street to State Street there is a cumulative rise of nearly 5 feet in the 100-YR profile that can be directly attributed to inadequate sizing of culvert and/or bridge openings. The most restrictive opening appears to be the State Street crossing which shows a rise of nearly 2 feet across it.

Further upstream, Country Club Drive also appears to be highly restrictive. Although it is overtopped for the 10-YR event, its opening is shown to be only on the order of 1 foot in height on the profile. From the profile in **Figure 5.5**, it appears that a floodplain rise on the order of 4 feet is being caused by the Country Club Drive crossing on Falling Run. These rises are propagated upstream to Daisy Lane and above.

#### 5.1.1.4 Floodplain Encroachments

Currently there are 243 parcels with structures in the floodplains of Falling Run and its tributaries. No floodway is mapped on the current effective floodplain maps. Preliminary floodplain maps based on the draft FIS were overlaid on GIS structure and parcel layers. For comparison, there are 258 parcels with structures encroaching floodplains of the Falling Run watershed when the preliminary floodplain map is evaluated. More importantly, a floodway is mapped on the preliminary floodplain maps. A total of 112 structures encroach the preliminary floodway. This has serious implications for property owners in the preliminary floodway. Once the floodplain map is effective, those property owners in the floodway who do not purchase flood insurance prior to the effective date of the revised maps will not be eligible to participate in the National Flood Insurance Program (NFIP).

The draft FIS indicates that mapped floodways on the preliminary floodplain map are wider than those determined in the analysis for the FIS. The FIS indicates that wider floodways are being used for administrative purposes. The floodway maps, FIS results and HEC-RAS cross-sections and results should be reviewed by the Stormwater Drainage Board to determine if the wider floodways can be justified. If not, comments should be submitted to IDNR to request justification for widening floodways beyond the extents determined in the FIS to minimize the number of properties that will not be eligible for participation in the NFIP.

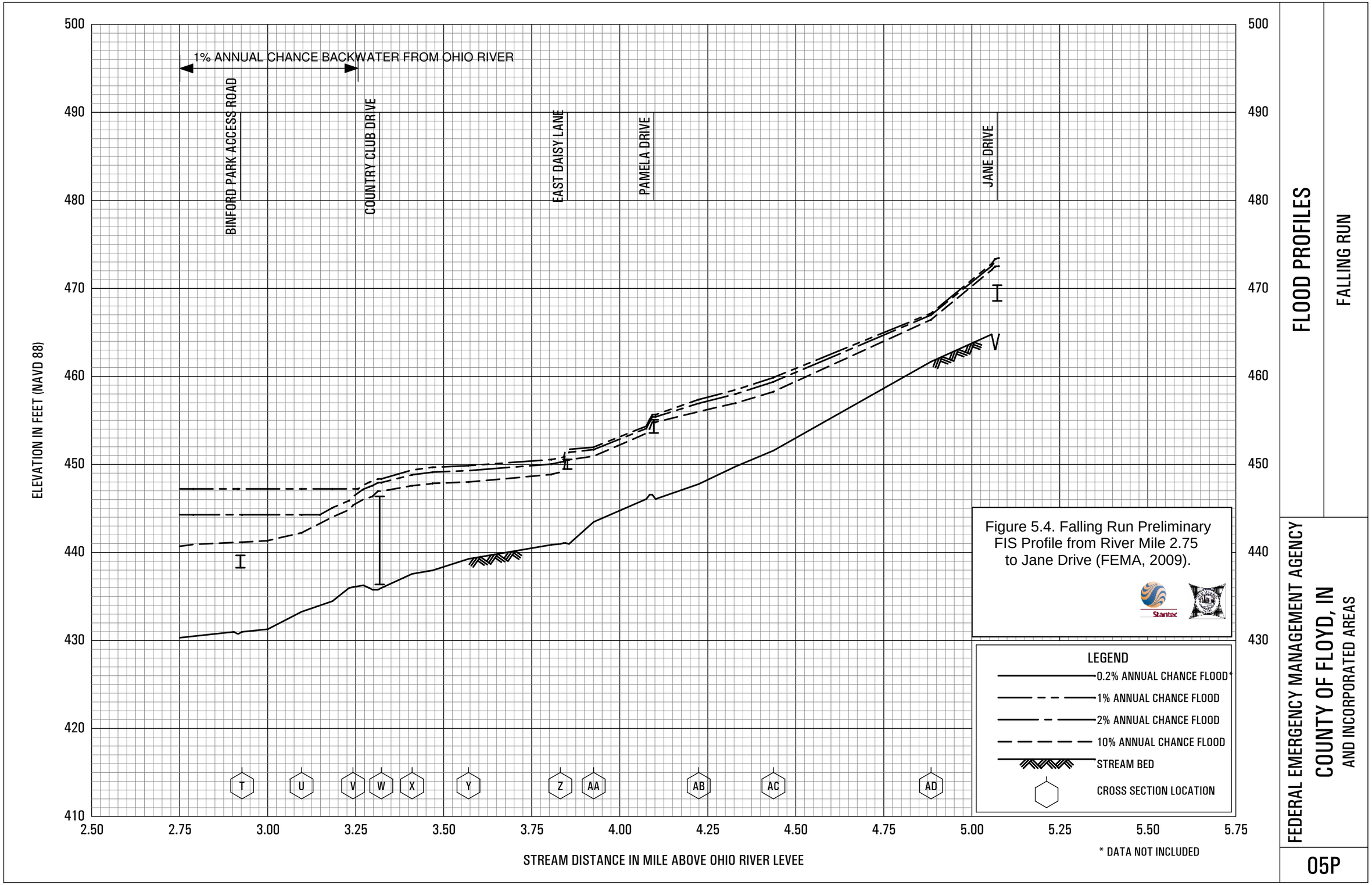



Figure 5.4. Falling Run Preliminary FIS Profile from River Mile 2.75 to Jane Drive (FEMA, 2009).

FLOOD PROFILES

FALLING RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY
COUNTY OF FLOYD, IN
AND INCORPORATED AREAS

05P

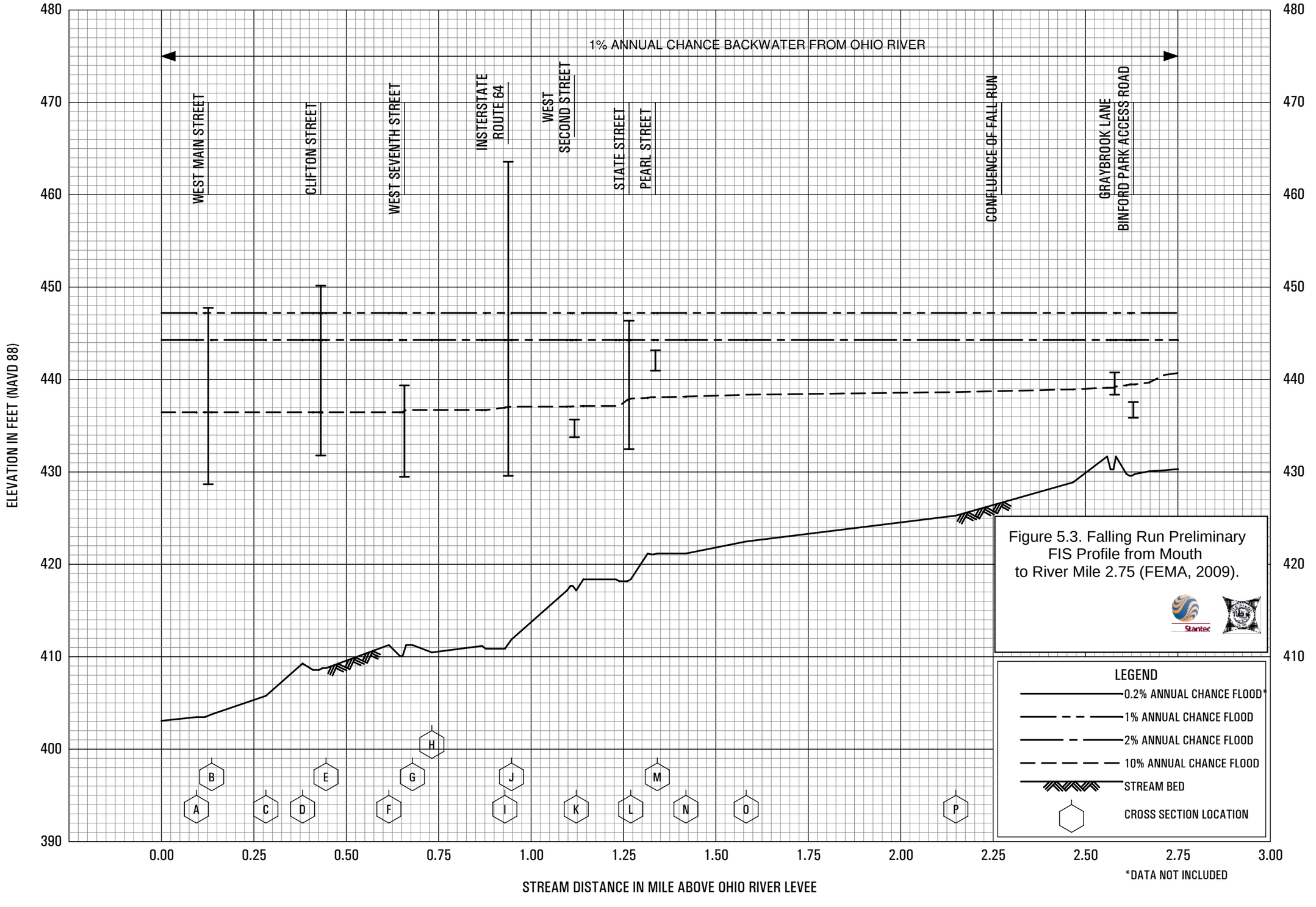



Figure 5.3. Falling Run Preliminary FIS Profile from Mouth to River Mile 2.75 (FEMA, 2009).

FLOOD PROFILES

FALLING RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY
COUNTY OF FLOYD, IN
AND INCORPORATED AREAS

04P

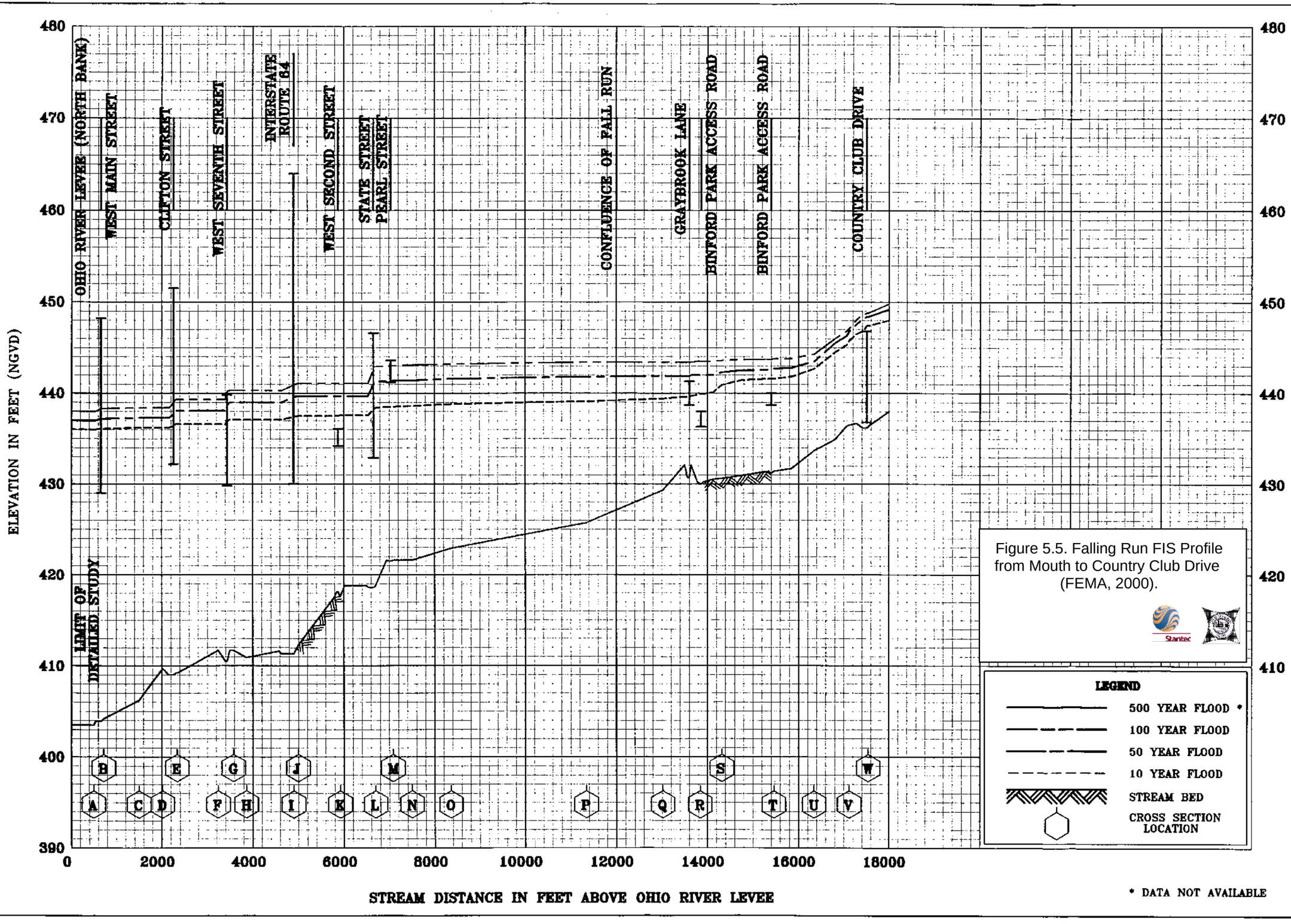



Figure 5.5. Falling Run FIS Profile from Mouth to Country Club Drive (FEMA, 2000).

FLOOD PROFILES

FALLING RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEW ALBANY, IN

(FLOYD CO.)

04P

## 5.2 AREAS OF CONCERN

A significant level of flooding is currently being experienced within the Fall Run Watershed. The 1992 Stormwater Master Plan identified significant overbank flooding in areas around the confluence of Falling Run and Fall Run. The Daisy Lane Area, upstream of the confluence of Trinity Run and Falling Run also has experienced repeated flooding. The causes of flooding appear to be a combination of road culverts, undersized storm drains and accumulation of debris near catchbasins. There are also several structures that encroach in the floodway within this area. In addition to infrastructure issues, channel erosion has been reported along Falling Run, Fall Run and several tributaries.

A total of twelve areas of concern for flooding and streambank erosion issues were identified within the Falling Run watershed. These areas were the focus of more detailed model study to evaluate the adequacy of existing drainage infrastructure and the stability of streambanks where bank erosion is a concern. The locations of these areas are shown in **Figure 5.1**. Descriptions of each area of concern, the issues in each area, findings from the SWMM model, and solution alternatives are provided in the following sections. The descriptions begin with the uppermost area on the watershed and progress downstream.

The figures referenced in the descriptions of the areas of concern are detailed maps of the each area shown in the Falling Run watershed map in **Figure 5.1**. In these maps, a blue line outlines the area of concern while red lines designate primary areas of concern. Areas shaded in dark blue, medium blue, and light blue are floodways, Zone AE floodplains, and Zone A floodplains, respectively that are delineated on the draft Flood Insurance Rate Maps developed in 2009. The lightest areas of blue simply indicate the extent of the Falling Run watershed. Zones A and AE are defined by FEMA as:

> **Zone A**: 100-YR Floodplain with no base flood elevations. Determined by approximate methods.
>
> **Zone AE**: 100-YR Floodplain with base flood elevations. Determined from Detailed Study.

The locations of the Maintenance Requests are shown as yellow dots. Orange lines are existing storm sewer pipe and orange dots are existing stormwater junction structures (catch basin, manhole, etc.). Red dots show the location of surveyed high water marks. Numbers next to these dots are elevations for the August 4, 2009 or September 20, 2009 storm. There are also junctions on the storm sewer networks that are colored red and green. These are junctions that were included in the SWMM analysis. Red junctions overflow during simulations of the 10-YR, 24-HR storm. Green junctions are able to pass the 10-YR, 24-HR flows in the simulations. Outlines of building structures on the maps show the locations of structures that are located within the limits of the FEMA floodplain.

**Appendix 5.2** provides SWMM input parameters for pipe networks in each area of concern. These include pipe sizes and shapes, pipe material, pipe length and Manning's n values.

Fact Sheets were prepared to summarize the drainage issues and alternatives for each area of concern. The sheets include a location map, a map of the area of concern showing existing drainage infrastructure; photos of the area; and brief descriptions of drainage issues and improvement alternatives. Fact Sheets for Fall Run areas of concern are provided in **Appendix 5.3**

### 5.2.1 South of McDonald Lane

**Figure 5.6** shows the Area of Concern south of McDonald Lane. A series of pipes and ditches drain runoff from McDonald Lane and surrounding streets to Fall Run in the southwest. Maintenance requests logged by the City indicate that flooding and drainage issues are a concern in this area. The requests indicate that backups may be due to debris in storm drains. SWMM simulations in this area also indicate that existing storm sewers south of McDonald Lane on Nassau Lane flood during the 10-YR, 24-HR design storm.

Recommendations for improvements include:

- Inspection and cleaning of existing storm sewers and catch basins south of McDonald Lane;
- Development and implementation of a routine maintenance program for the area; and
- Design and construction of relief sewers designed to reduce flow in undersized infrastructure.

Maintenance should include regular catch basin and ditch cleaning.

### 5.2.2 Brookview Drive-McDonald Lane

The Brookview Drive-McDonald Lane area is shown in **Figure 5.7**. A series of pipes and ditches drain runoff from Brookview Drive and McDonald Lane to Fall Run in the southwest.

Maintenance requests in this area include basement, foundation and yard flooding on McDonald Lane between Knobview and Roanoke Avenues; failed storm sewers have been reported on Scheller Avenue and foundation and yard flooding has been reported at 31 Brookview Drive. SWMM model results for the 10-YR, 24-HR storm indicate storm sewer flooding on McDonald and Brookview Drive. Requests have also noted failed storm sewers on McDonald Lane and the use of substandard pipe structures in the roadway.

MCDONALD LANE
LACLEDE AVEN
MURR LANE
KAYWOOD DRIVE
OXFORD DRIVE
NASSAU LANE
KNOBVIEW AVENUE
HICKORY VALE DRIVE
SCOTT ROAD
Falli Run
1-0016
1-0067
1-0017
1-0225
1-0204
1-0009
1-0144
459.9
480
470
490
460
24
15
12

**South of McDonald Lane**

## Figure 5.6
## South of McDonald Lane

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Area of Concern
- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Silver Creek Watershed
- New Albany Boundary

Stantec

0 75 150 300 Feet

1 inch = 150 feet

N

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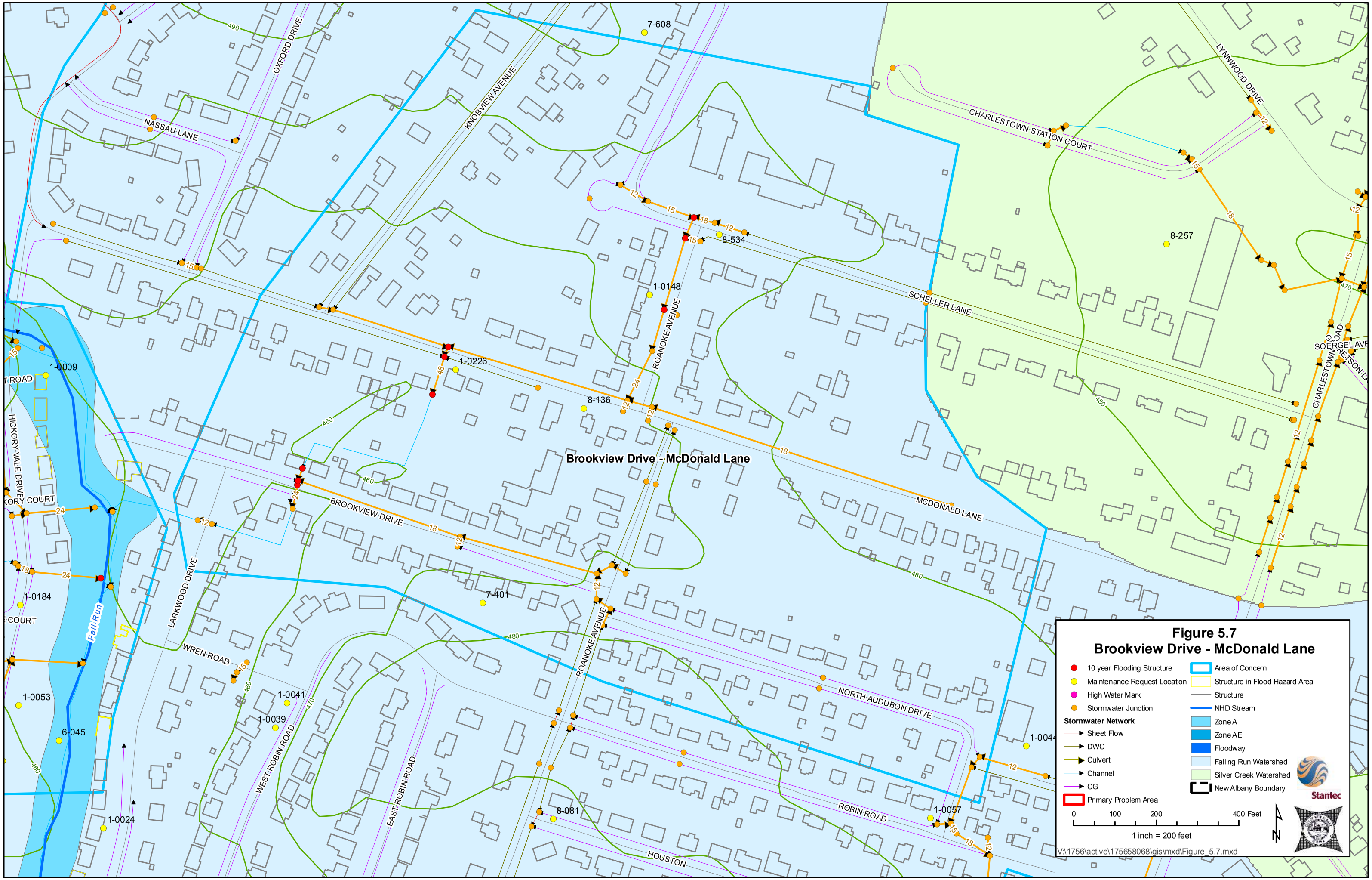
Brookview Drive - McDonald Lane
OXFORD DRIVE
NASSAU LANE
KNOBVIEW AVENUE
7-608
CHARLESTOWN STATION COURT
LYNNWOOD DRIVE
8-257
8-534
1-0148
ROANOKE AVENUE
SCHELLER LANE
1-0226
8-136
1-0009
HICKORY VALE DRIVE
HICKORY COURT
BROOKVIEW DRIVE
MCDONALD LANE
LARKWOOD DRIVE
Fall Run
1-0184
7-401
WREN ROAD
NORTH AUDUBON DRIVE
1-0053
6-045
1-0041
1-0039
WEST ROBIN ROAD
EAST ROBIN ROAD
ROBIN ROAD
8-081
1-0057
1-0024
HOUSTON
CHARLESTOWN ROAD
SOERGEL AVE
Figure 5.7
Brookview Drive - McDonald Lane
10 year Flooding Structure
Maintenance Request Location
High Water Mark
Stormwater Junction
Stormwater Network
Sheet Flow
DWC
Culvert
Channel
CG
Primary Problem Area
Area of Concern
Structure in Flood Hazard Area
Structure
NHD Stream
Zone A
Zone AE
Floodway
Falling Run Watershed
Silver Creek Watershed
New Albany Boundary
Stantec
0
100
200
400 Feet
1 inch = 200 feet
N
V:\1756\active\175658068\gis\mxd\Figure_5.7.mxd

Recommended actions in this area include the following:

- Televideo inspections of storm sewers, catchbasins and pipe inlets along Scheller Avenue, Roanoke Avenue, McDonald Lane and Brookview Drive;

- A study of the results of the televideo inspections that includes detailed analysis of the condition and capacity of the existing infrastructure;

- Design and construction of retrofit and/or replacement of existing infrastructure to bring it up to design standards in terms of both materials and capacity; and

- Development and implementation of a maintenance program for the area for both the existing infrastructure and retrofit/replacement infrastructure.

### 5.2.3 Hickory Vale Drive Side Streets

**Figure 5.8** shows the extent of the Hickory Vale Drive Side Streets Area of Concern. The primary areas of concern are three cul-de-sac streets (Old Hickory Court; Vale Court; and Fall Run Court) that run perpendicular to Hickory Vale Drive. The stormwater system on these streets was designed to direct stormwater runoff from the front of the homes to catchbasins on Hickory Vale Drive. The stormwater conveyance for drainage from the front of homes is the roadway.

The stormwater runoff from the back of the homes drains to a swale in the backyard to catchbasins on Hickory Vale Drive. Request logs indicate general drainage problems, the capacity and condition of the existing culvert near the intersection of Hickory Vale Drive and Scott Road; a basement flooding incident on Hickory Vale Drive; eroding creek banks on Fall Run; sinkholes over drainage infrastructure; water standing in curb lines; and poor drainage including the lack of storm sewers and catchbasins along Scott Road, Old Hickory Court and Vale Court. Residents have indicated that standing water in cul-de-sacs is contributing to pavement failures.

Hickory Vale Drive side streets

459.94
1-0204
1-0144
1-0009
1-0226
8-136
8-160
1-0184
6-010
1-0071
1-0053
6-049
6-045
1-0069
1-0024
1-0104
1-0039
1-0041
7-401

SCOTT ROAD
HICKORY VALE DRIVE
OLD HICKORY COURT
VALE COURT
FALL RUN COURT
Fall Run
OXFORD DRIVE
MCDONALD LANE
KNOBVIEW AVENUE
BROOKVIEW DRIVE
LARKWOOD DRIVE
WREN ROAD
WEST ROBIN ROAD
NORTH AUDUBON
ROANOKE AVENUE

470
460
480
15
12
18
24
48

## Figure 5.8
## Hickory Vale Drive Side Streets

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Area of Concern
- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- New Albany Boundary

Stantec

0 75 150 300 Feet

1 inch = 150 feet

N

V:\1756\active\175658068\gis\mxd\Figure_5-5.mxd

Three alternatives were identified for improvements in this area:

- Install catchbasins and a pipe in each of the three cul-de-sacs to direct flow to the drainage ditch running in the backyards. The catchbasins will allow surface runoff to drain out of the cul-de-sac since the grading of the street does not direct the flow towards Hickory Vale Drive;

- Construct storm drains along one side of Old Hickory Court, Vale Court and Fall Run Court in the right-of-way. Outlet the pipes the existing 24" storm drains on Hickory Vale Drive. Install yard drains in front yards and construct leaders to the proposed storm drains. Grade so runoff from yards and roadways readily drains to proposed yard inlets; or

- Construct storm drains in the right-of-way along both sides of Old Hickory, Vale, and Fall Run Courts. Install yard drains in front yards and connect to the proposed storm sewers. Outlet the proposed storm drains to the existing 24" storm sewers on Hickory Vale Drive. Grade right-of-way areas to drain to the proposed yard inlets.

In addition, the culvert at the intersection of Scott Road and Hickory Vale Drive should be inspected; its capacity and condition should be checked and brought up to design standards if it is deficient.

### 5.2.4 Charlestown Road near Coes Lane

The Charlestown Road near Coes Lane Area of Concern is shown in **Figure 5.9**. The stormwater system on Charlestown Road near Coes Lane is sheet flow with various catchbasins directing flow to a box culvert draining to the northwest. Drainage requests indicate surface runoff drains off Charlestown Road to a low area near Coes Lane which floods some businesses during storm events. Other reported flooding includes water in garages, homes and yards located on or near Terry Lane.

The following issues were also identified in the review of maintenance request logs for the area: requests for cleaning drainage ditch behind the Shell station on Charlestown Road; a flooded property on Woodlawn Drive; failure of a storm sewer and related sinkholes between 2592 and 2580 Charlestown Road; a failed storm sewer on Twin Oaks Drive that produced a hole in the road; standing water in a drainage easement in rear of Woodlawn Drive; tree roots and other drainage issues causing flooding on Woodlawn Drive; and yard flooding caused by a blocked storm sewer on Woodlawn Drive. Runoff from rear yards on Terry Lane was reported to cause flooding of yards to the point of entering a home and garage on Long Meadow Drive.

During field reconnaissance it was observed that although catchbasins do exist along Charlestown Road, there is no specific means of directing the flow to the catchbasins. SWMM model results indicate the current pipe infrastructure along Charlestown Road and Coes Lane is sufficient to convey runoff generated by a 10-YR, 24-HR design storm.

Terry Lane is drained by front yard ditches that appear to be inadequate for conveying runoff from residences along Terry Lane. A drainage easement in the rear of Terry Lane was cited in a request call. Terry Lane ditches drain to a 12-inch corrugated HDPE pipe that parallels Charlestown Road.

The following action should be taken in this area:

- Video inspection of stormwater infrastructure along Woodlawn Drive and inspect ditches and rear yards along Terry Lane and 12" storm sewer along Charlestown Road. Determine condition and capacity of ditches and 12" storm sewer. Develop plans for infrastructure improvements to meet design standards along Terry Lane front and rear yards based on results of inspection.

- Alternatives in the Charlestown Road And Coes Lane vicinity include:

    - Retrofit or replace catch basins to improve hydraulics at Charlestown Road and Coes Lane. Add new catch basins if required. Regrade the right-of-way to provide positive drainage to catch basins;

    - Installation of a curb and gutter system along Charlestown road near Coes Lane and update catch basins. Curb and gutters would allow water to travel along the road and into the stormwater system without affecting businesses alongside the road; or

    - Construct roadside swales to direct runoff to catch basin locations. Retrofit catch basins to improve hydraulics and reset inlet at the grade of swale bottoms.

# Charlestown Road near Coes Lane

## Figure 5.9
## Charlestown Road near Coes Lane

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Area of Concern
- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Silver Creek Watershed
- New Albany Boundary

0 100 200 400 Feet

1 inch = 200 feet

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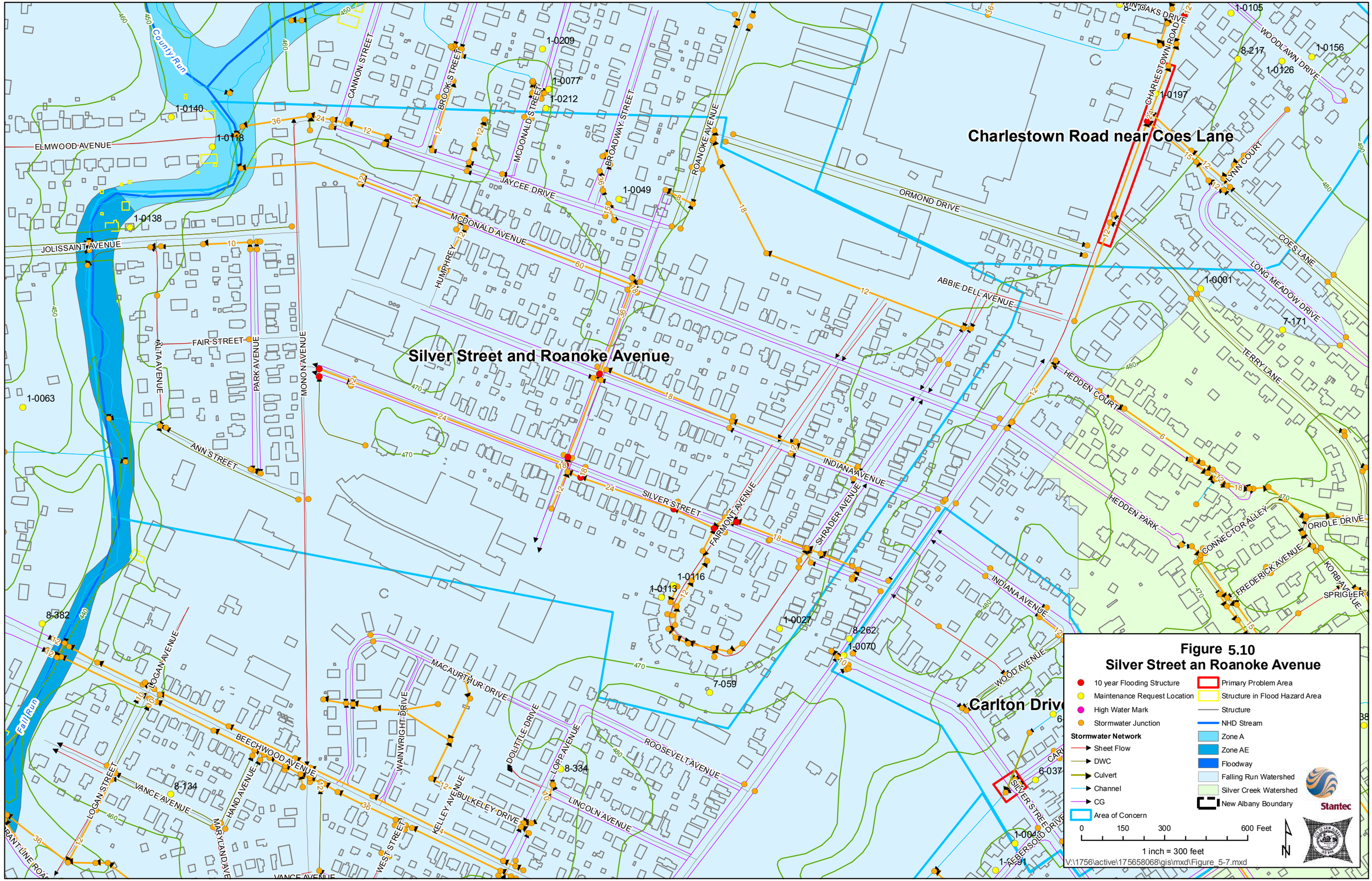
### 5.2.5 Silver Street and Roanoke Avenue

**Figure 5.10** shows the Area of Concern at Silver Street and Roanoke Avenue. The drainage system along Silver Street, near Roanoke Avenue is curbs and gutters with storm sewers that flow north along Roanoke Ave and then west to Fall Run. Storm sewers range in size from 12-inch to 60-inch. The system outfall is a 60-inch RCP that discharges to Fall Run. SWMM results indicate flooding of catchbasins along Silver Street and on Roanoke Avenue.

Maintenance requests in this area are located on Mann Court in the upper reaches of the drainage area. The requests cite incidents of basement and yard flooding with one request indicating runoff from an apartment complex south of Mann Court as a contributing factor.

Work in this area should focus on the Mann Court Area. Recommended action includes:

- Develop routine inspection and maintenance schedule for the area;
- Conduct a focused inspection of drainage infrastructure and runoff sources along Mann Court, Silver Street, and Roanoke Avenue;
- Develop more detailed models of the area to evaluate capacity of the existing system and to identify runoff hot spots and drainage system bottlenecks;
- Develop alternatives for providing relief to the existing system based on the findings of inspections and detailed model results; then
- Design and Construct relief storm sewers.


Charlestown Road near Coes Lane
Silver Street and Roanoke Avenue
Carlton Drive
County Run
Fall Run
ELMWOOD AVENUE
JOLISSAINT AVENUE
CANNON STREET
BROOK STREET
MCDONALD STREET
BROADWAY STREET
ROANOKE AVENUE
JAYCEE DRIVE
MCDONALD AVENUE
HUMPHREY
ORMOND DRIVE
ABBIE DELL AVENUE
WINTOAKS DRIVE
CHARLESTOWN ROAD
WOODLAWN DRIVE
LYNN COURT
COES LANE
LONG MEADOW DRIVE
TERRY LANE
HEDDEN COURT
HEDDEN PARK
CONNECTOR ALLEY
ORIOLE DRIVE
FREDERICK AVENUE
KORBA AVENUE
SPRIGLER
FAIR STREET
ALTA AVENUE
PARK AVENUE
MONON AVENUE
ANN STREET
SILVER STREET
FAIRMONT AVENUE
SHRADER AVENUE
INDIANA AVENUE
WOOD AVENUE
SILVER STREET DRIVE
HOGAN AVENUE
BEECHWOOD AVENUE
LOGAN STREET
VANCE AVENUE
MARYLAND AVE
HAND AVENUE
WAINWRIGHT DRIVE
KELLEY AVENUE
WEST STREET
MACARTHUR DRIVE
DOLITTLE DRIVE
BULKELEY DRIVE
LOPP AVENUE
LINCOLN AVENUE
ROOSEVELT AVENUE
GRANT LINE ROAD
1-0140
1-0118
1-0138
1-0063
1-0209
1-0077
1-0212
1-0049
1-0116
1-0113
1-0027
1-0070
7-059
8-382
8-134
8-334
8-262
8-217
1-0105
1-0156
1-0126
1-0197
1-0001
7-171
6-037
1-0041
1-0091
Figure 5.10
Silver Street an Roanoke Avenue
10 year Flooding Structure
Maintenance Request Location
High Water Mark
Stormwater Junction
Stormwater Network
Sheet Flow
DWC
Culvert
Channel
CG
Area of Concern
Primary Problem Area
Structure in Flood Hazard Area
Structure
NHD Stream
Zone A
Zone AE
Floodway
Falling Run Watershed
Silver Creek Watershed
New Albany Boundary
0 150 300 600 Feet
1 inch = 300 feet
V:\1756\active\175658068\gis\mxd\Figure_5-7.mxd
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### 5.2.6 Falling Run near Daisy Lane

The Falling Run near Daisy Lane Area of Concern is shown in **Figure 5.11**. Falling Run drains from the north-northwest to its confluence with Fall Run in the south of this area. The map in **Figure 5.11** shows that there are several complaints and existing structures that lie within the floodway. There are two primary issues in this area: (1) Structure flooding in the Pamela Drive, Linda Drive and Daisy Lane areas has been documented as a recurring problem; and (2) flooding and streambank erosion. Erosion issues were initially identified through maintenance requests near Daisy Lane.

#### 5.2.6.1 Structural Flooding

**Figure 5.11** shows approximately 28 structures (including garages and/or out-buildings) have encroached on the preliminary floodway in the area of concern. Approximately 36 more structures are located in the preliminary 100-YR floodplain. Structures in the Falling Run floodplain include several homes along Linda Drive, Pamela Drive and Zurschmeide Drive. There are also garages and outbuildings along these roads that encroach the floodway. Further downstream, several structures are located in the floodway and/or floodplain both upstream and downstream of both Daisy Lane and Country Club Drive. Encroachments on the floodplain and floodway of Falling Run are the primary cause of structural flooding in this area. Alternatives for providing flood relief in this area must be evaluated and designed as part of a comprehensive flood control plan for the Falling Run watershed.

Improvement alternatives that can be considered for reducing flooding impacts include increasing channel, culvert and bridge flow capacities, increasing channel storage capacity, or construction of storage basins in the watershed to attenuate runoff to streams. Increasing channel flow capacity typically is not feasible because it would increase flooding downstream of Daisy Lane. The stream corridor is also highly developed, making the volume of floodplain storage obtainable along the reach too small to be effective. What volume is available would be expensive to construct given the degree of development and property costs along the stream corridor.

These issues make increasing conveyance and storage in the channel impractical, which probably leaves the construction of detention and/or retention basins on the watershed as a practical option for reducing the extent and frequency of most of the structural flooding in this area. Floodwalls and levees may also be feasible, but they must be part of a comprehensive flood control plan that typically includes storage basins to mitigate the impacts of floodwalls on other areas.

Given the number of structures in the floodway, there may be properties that are considered repetitive loss structures that may be candidates for buy-out through a FEMA grant. Structural flooding in this area is a watershed-scale or regional problem that requires a comprehensive flood control plan for the Falling Run floodplain in the City of New Albany. Reductions in structural flooding severity and frequency will rely on the development of a comprehensive flood control plan and property buy-outs in areas where repetitive losses can not be avoided.

A simple analysis using runoff hydrographs from the SWMM model and the stream rating curve at Country Club Drive, downstream of Daisy Lane, was used to evaluate storage volumes necessary to reduce flood elevations along Falling Run. **Table 5.2** shows the storage volume required to reduce flood elevations one, two, and three feet on Falling Run in the vicinity of Daisy Lane for the 2-YR, 10-YR, 25-YR, and 100-YR, 24-HR design storms.

**Table 5.2. Required Basin Storage Volumes for 1-, 2-, and 3-Foot Flood Level Reductions of Falling Run above Country Club Lane.**

| 100-YR, 24-HR | 25-YR, 24-HR | 10-YR, 24-HR | 2-YR, 24-HR | Expected Drop in Flood Level |
|---|---|---|---|---|
| 38.4 ac-ft | 35.7 ac-ft | 30.5 ac-ft | 13.1 ac-ft | **1 Foot** |
| 69.2 ac-ft | 65-9 ac-ft | 58.3 ac-ft | 38.9 ac-ft | **2 Feet** |
| 109.5 ac-ft | 105 ac-ft | 88.5 ac-ft | 87.7 ac-ft | **3 Feet** |

The results shown in **Table 5.2** indicate that storage basins constructed above Country Club Lane can be effective in reducing flood stages on this reach of Falling Run. For example, construction of basins with a combined storage capacity of 40 ac.-ft. have the potential to reduce flood levels by two feet for the 2-YR, 24-HR storm and one foot for the 100-YR, 24-HR storm. Construction of a total of 70 ac.-ft. of storage should produce a two-foot drop in 100-YR flood levels and between a two- and three-foot drop in 2-YR flood levels. Construction of stormwater detention basins will reduce the severity and frequency of flooding but will not eliminate it. Other factors such as debris jams, sedimentation and channel blockages can also contribute to flooding in this area.

Eight locations above Country Club Drive were identified as potential sites for storage basins in the Falling Run watershed. These include sites located east of Green Valley Rd/North of I-265, north of Meide Drive, northwest of Clearstream Court, southwest of Spickert Knob Road, west of Pamela Drive, and at the 4-H Fairgrounds. It is estimated that these basins can provide up to 24.5 acre-feet of storage. Based on interpolations of **Table 5.2**, the basins have the potential to reduce flood elevations on Falling Run in the vicinity of Daisy Lane 1.4 feet for the 2-YR,24-HR; 0.8 feet for the 10-YR, 24-HR; 0.6 feet for the 25-YR, 24-HR; and 0.5 feet for the 100-YR, 24-HR design storms. Selection criteria for basin sites and site descriptions are provided in **Section 5.3** below.

Given the flood elevation rises caused by culverts and bridges downstream of the Daisy Lane area, it would be prudent to evaluate the impacts on culvert and bridge improvements on flood reduction in the Daisy Lane area.

# Falling Run near Daisy Ln

## Figure 5.11
## Falling Run near Daisy Lane

**10 year Flooding Structure**
**Maintenance Request Location**
**High Water Mark**
**Stormwater Junction**

**Stormwater Network**
- Sheet Flow
- DWC
- Culvert
- Channel
- CG

- Area of Concern
- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- New Albany Boundary

0 250 500 1,000 Feet

1 inch = 500 feet

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#### 5.2.6.2 Planned Road Improvements on Daisy Lane

Planned road improvements along Daisy Lane include the replacement of the Daisy Lane crossing on Falling Run. Impacts of the road crossing on flooding severity and frequency need to be considered in the design of the proposed bridge. Flood profiles from both the current effective FIS and the preliminary FIS show that the Country Club Drive crossing on Falling Run is restricting storm flows with backwater effects that limit the hydraulics of the Daisy Lane crossing. Since it is a restriction and potentially creates a rise as large as 4 feet in floodplain elevations, replacement of the Country Club Drive crossing should also be a priority for the City.

Both the hydraulics of the proposed Daisy Lane crossing and the Country Club Drive crossing should be evaluated during the design of the proposed Daisy Lane crossing. The dimensions of a proposed crossing to replace the existing Country Club crossing should be determined during the design of the proposed Daisy Lane crossing. The hydraulic design of the proposed crossings should be done concurrently with the goal of maximizing flood elevation reductions in the Daisy Lane area once both crossings are replaced. Impacts of the State Street Bridge on flood elevations in the Daisy Lane area and below should also be evaluated.

#### 5.2.6.3 Streambank Erosion

Field reconnaissance observations confirmed that many stream banks in the area are steeply sloped with few or no bank stabilization measures in place. Modeling results indicate that the stream in this area has a velocity of about 3 ft/s for a 25YR-24HR existing condition run. This velocity exceeds the range of permissible velocity (1.75 to 2.25 ft/s) for unvegetated, silt loam soils (Fischenich, 2001) which are common in the area.

Alternatives that may be implemented to control bank erosion include armoring of the stream bank with rip-rap, quarried boulder walls, modular concrete block walls or plantable segmented retaining walls (SRWs). Soil bioengineering approaches using live branch layering and boulder toes, live cribs or other treatments may also be feasible. Structures based on natural channel design techniques such as rock cross vanes and j-hooks coupled with bankfull benches are also useful in controlling bank erosion.

Upstream storage basins designed to reduce flood levels in Falling Run should also be effective in reducing flow velocities and shear stresses in the channel.

### 5.2.7 Carlton Drive

The area of concern in the vicinity of Carlton Drive and Silver Street is shown in **Figure 5.12**. Carlton Drive and alleys north and south of it are in a low-lying area between Wood and Lake Avenues. Curbs and gutters along Carlton Drive drain stormwater along the road. Roughly half the road drains to catch basins (one on each side of the street) at the Silver Street intersection. The other half of Carlton drains to catchbasins near its intersection with Indiana Avenue. Storm sewers drain an area north of Indiana Avenue, part of Wood Avenue and discharge to an open channel that parallels the alley north of Carlton Drive. From here, flow enters a headwall and is

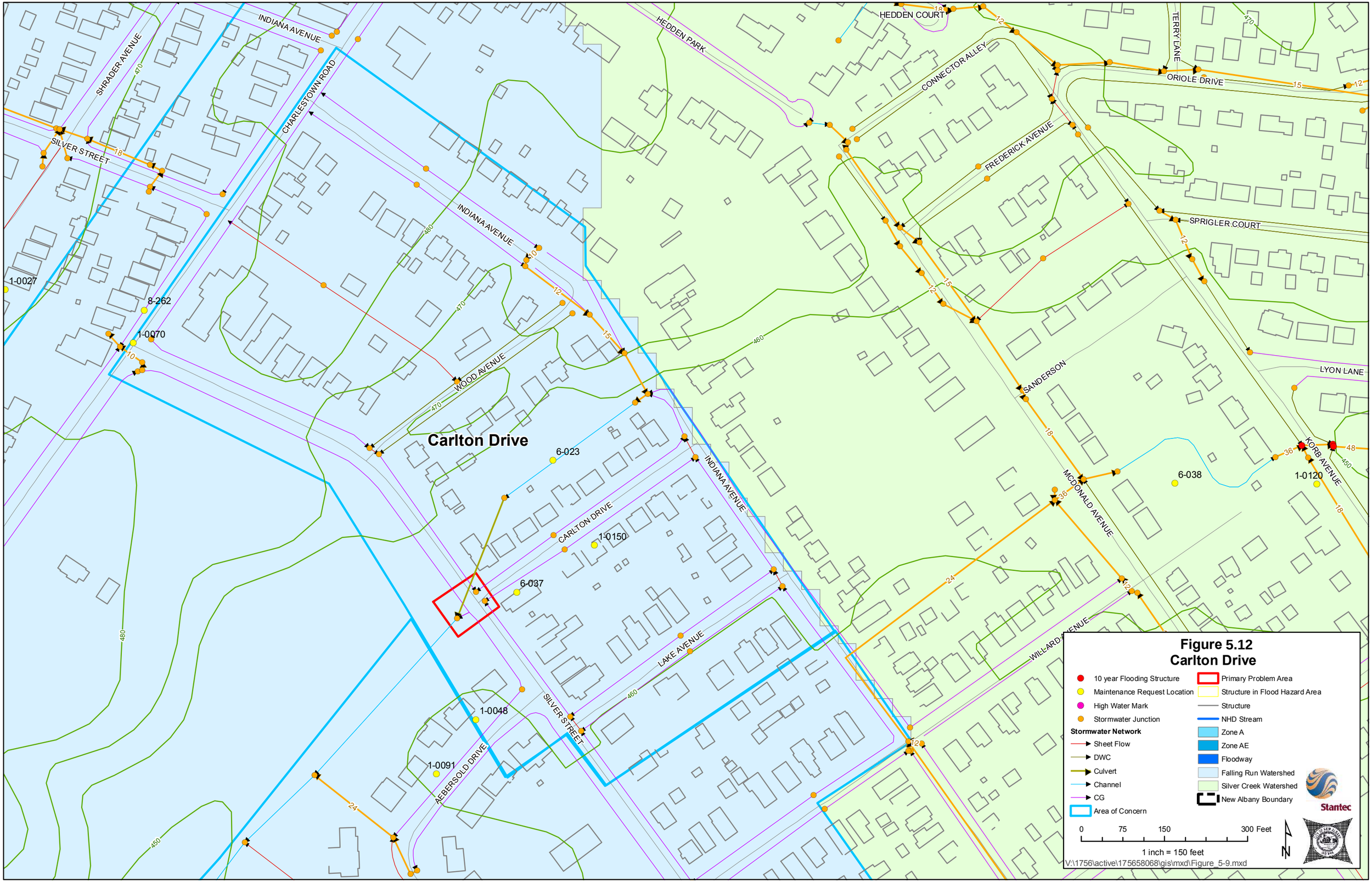
conveyed through a culvert across Silver Street to another channel that runs west along the boundary of St. Mary's Catholic Cemetery. The only apparent drainage in alleys is the ditch along the north alley and a single catch basin near its intersection with Indiana Avenue.

Flooding in the alleys and Carlton Street has been reported in maintenance requests. One request reports an incident of a basement flooding to a depth of five feet. Flooding in the alley south of Carlton has been described as "flows like a river" in the maintenance request log. During field reconnaissance activities, it was observed that the outlet of the pipe under Silver Street was almost fully blocked with sediment. A maintenance request note indicates that the ditch was cleaned on March 20, 2007.

Aerial photography shows a disturbed area within approximately 20 feet of the ditch downstream of Silver Street. The disturbed area covers approximately one acre with evidence of both fill placement and vegetation removal. It appears that eroded soil from this area is contributing to sedimentation of the channel and culvert outlet below Silver Street. While it appears that sedimentation and blockage of the outfall are contributing factors to flooding in the area, SWMM model results indicate that the current pipe is undersized and should be replaced with a larger pipe to help reduce flooding in the area. It also appears that drainage improvements, including catchbasins and storm sewers are needed along Carlton Drive and the alleys to the rear.

The recommended course of action for this area is:

- Maintenance of the channel and culvert downstream of Silver Street to remove sediment;
- Determine condition of disturbed area downstream of Silver Street. If area is currently disturbed, persuade the property owner to stabilize the disturbed area adjacent to the channel either voluntarily or enforcing the Construction Site Runoff Control Ordinance as appropriate;
- Complete a study to determine drainage requirements for the area;
- Design and construct drainage improvements for Carlton Drive and both alleys following recommendations of the study; and
- Develop and implement a routine maintenance plan for the area. Routine inspections related to enforcement of the Construction Site Runoff Control Ordinance should be implemented if land disturbance is an ongoing issue in the area downstream of Silver Street.




## Figure 5.12
## Carlton Drive

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Area of Concern
- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Silver Creek Watershed
- New Albany Boundary

Stantec

0 75 150 300 Feet

1 inch = 150 feet

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### 5.2.8 Aebersold Drive

The stormwater drainage system along Aebersold Drive is shown in **Figure 5.13**. It consists of curb and gutter with pipes draining to an open channel in the northwest that is a tributary to an unnamed tributary of Fall Run. The storm sewers in this area are 12 to 36 inches in diameter.

Sinkhole development, street flooding, creek flooding and general drainage problems have been reported in maintenance requests for this area. SWMM results indicate that catchbasins on the 36-inch main line flood just upstream of its outfall in simulations for the 10-YR, 24-HR design storm.

The action plan for this area should include:

- Inspections should be completed to determine the condition of the existing storm sewers prior to the development of drainage improvement plans;
- Upgrade the existing drainage infrastructure with additional storm sewers to increase system capacity and provide relief for the existing infrastructure;
- If existing pipe is in poor condition, replacement of existing 36” storm sewers with larger diameter pipe should be considered instead of augmenting the existing system; and
- Development and implementation of the maintenance schedule for this area. Maintenance should include routine inspection and cleaning of catchbasins and the system outlet, including the drainage channel below the storm sewer outfall.

# Aebersold Drive

## Figure 5.13
## Aebersold Drive

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG

- Area of Concern
- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Silver Creek Watershed
- New Albany Boundary

0 100 200 400 Feet

1 inch = 200 feet

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### 5.2.9 Captain Frank Road

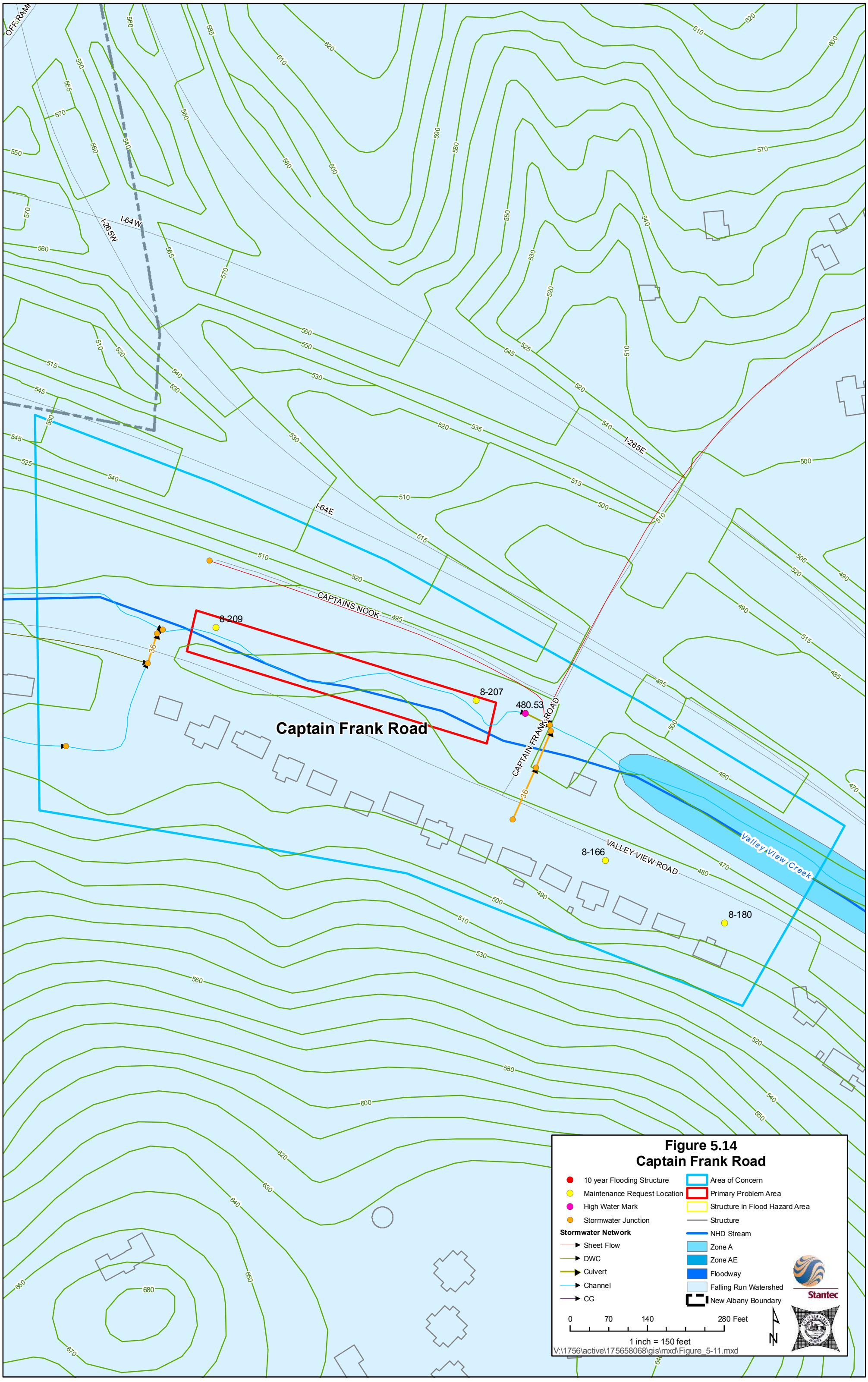
Valley View Creek is a tributary of Fall Run and flows southeast, parallel to Valley View Road, as shown in **Figure 5.14**. There is significant streambank erosion along Valley View Creek near homes on Captain Frank Road. Maintenance requests in this area describe creek bank erosion with loss of yard area and standing water in roads and driveways.

The problem area is upstream of Captain Frank Road and along the length of Captains Nook Drive. The surrounding terrain is steep and runoff is very flashy. The area also receives runoff from I-64. High runoff rates result generate high flow velocities in Valley View Creek. The I-64 embankment may have encroached the floodplain in this area. This could effectively eliminate the floodplain as a means of reducing bank stresses. Findings during field reconnaissance indicate that one or more homeowners in the area have placed rip-rap to provide some armoring of the banks as a stop-gap measure.

Alternatives include treatments similar to those identified in **Section 5.2.6.2** including: boulder walls, modular block walls; and/or plantable SRWs. Soil bioengineering options and use of structures such as cross vanes, j-hooks and log vanes to reduce near-bank stresses should be considered.

Requests are related to street and driveway flooding along Valley View Road, east of Captain Frank Road. There is no drainage structure in the street. Two 36-inch culverts pass runoff under the road. Alternatives to address street drainage issues include construction of drainage ditches along the road to direct water to culvert inlets and drainage swales, construction of storm sewers, and yard inlets or catchbasins in the street to serve the same purpose.

While there is not any evidence of either an acute or chronic flooding problems along this reach of Valley View Creek based on maintenance requests and model results, one potential detention basin site was identified above this area that may provide relief for downstream areas. This site is located South of Wildwood Drive along an upper reach of the creek. Features of the potential basin site are presented in more detail in **Section 5.3** below.


I-64W
I-265W
I-64E
I-265E
CAPTAINS NOOK
CAPTAIN FRANK ROAD
VALLEY VIEW ROAD
Valley View Creek
8-209
8-207
8-166
8-180
480.53
Captain Frank Road
Figure 5.14
Captain Frank Road
10 year Flooding Structure
Maintenance Request Location
High Water Mark
Stormwater Junction
Stormwater Network
Sheet Flow
DWC
Culvert
Channel
CG
Area of Concern
Primary Problem Area
Structure in Flood Hazard Area
Structure
NHD Stream
Zone A
Zone AE
Floodway
Falling Run Watershed
New Albany Boundary
0
70
140
280 Feet
1 inch = 150 feet
V:\1756\active\175658068\gis\mxd\Figure_5-11.mxd
Stantec

### 5.2.10 13th-Vincennes Street

**Figure 5.15** shows the storm sewer system serving downtown New Albany. The stormwater system between 13th and Vincennes Street is curb and gutter with catchbasins and pipes draining to a brick culvert on 15th Street. The brick culvert on 15th Street drains from the southeast to a drainage ditch in the northwest. The drainage systems in the downtown area are some of the oldest infrastructure in the city.

The review of maintenance request logs in the area indicates that some of the catchbasins have deteriorated and contribute to some localized or frequent flooding that is not related to overall system capacity. As shown by the red nodes in **Figure 5.15**, SWMM results indicate that forty-five of the ninety-seven nodes along the main sections of pipe overflow in a simulation of a 10-YR, 24-HR rainfall event for existing conditions. For design work, further pipe investigation is needed to confirm sizes of pipes and to add pipes smaller than 24 inches in diameter that were not included in this study. Verification of pipe sizes will be difficult in some area because many of the manholes are in high traffic areas and are not easily accessible.

#### 5.2.10.1 Preliminary SWMM Simulations

Preliminary SWMM simulations were run to determine the affects of increasing outfall sizes and/or adding relief sewers to the drainage network. In general, increasing pipe sizes had little effect on catch basin flooding in this area. More detailed assessments of the area will be necessary to determine effective system improvements. Future modeling should include the effects of backwater conditions in the outfall due to flood stages in Falling Run and its tributaries. The analysis should include the effects of upstream detention basins and flood stages in the downtown area. In addition, the analysis should also include an evaluation of the Falling Run Flood Pumping Station capacity. The results of this analysis should be used to determine if upgrades to the pump station are warranted to relieve downtown flooding.

#### 5.2.10.2 The “North Y” Area

The “North Y” area is in the vicinity of the junction of Charlestown Road, Grant Line Road and East 8th Street on the north side of downtown New Albany. An unnamed tributary to Fall Run flows from the east/southeast from outfalls at Locust Street through culverts under Chartres Street, the CSX railroad and East 8th Street. The tributary is fed by the 84-inch outfall for the storm sewers serving the 13th Street - Vincennes Street Area downtown.

The culverts at the railroad crossing restrict flow from the 15th-Vincennes outfall causing backwater conditions in its outlet. This limits its capacity to effectively drain the 13th-Vincennes area which has chronic drainage problems. The completion of this project will provide an improved outlet for planned drainage improvements in the 13th Street – Vincennes Street area and make them more effective in relieving flooding in downtown New Albany. The project will also reduce flooding along the unnamed tributary in the “North Y” area.

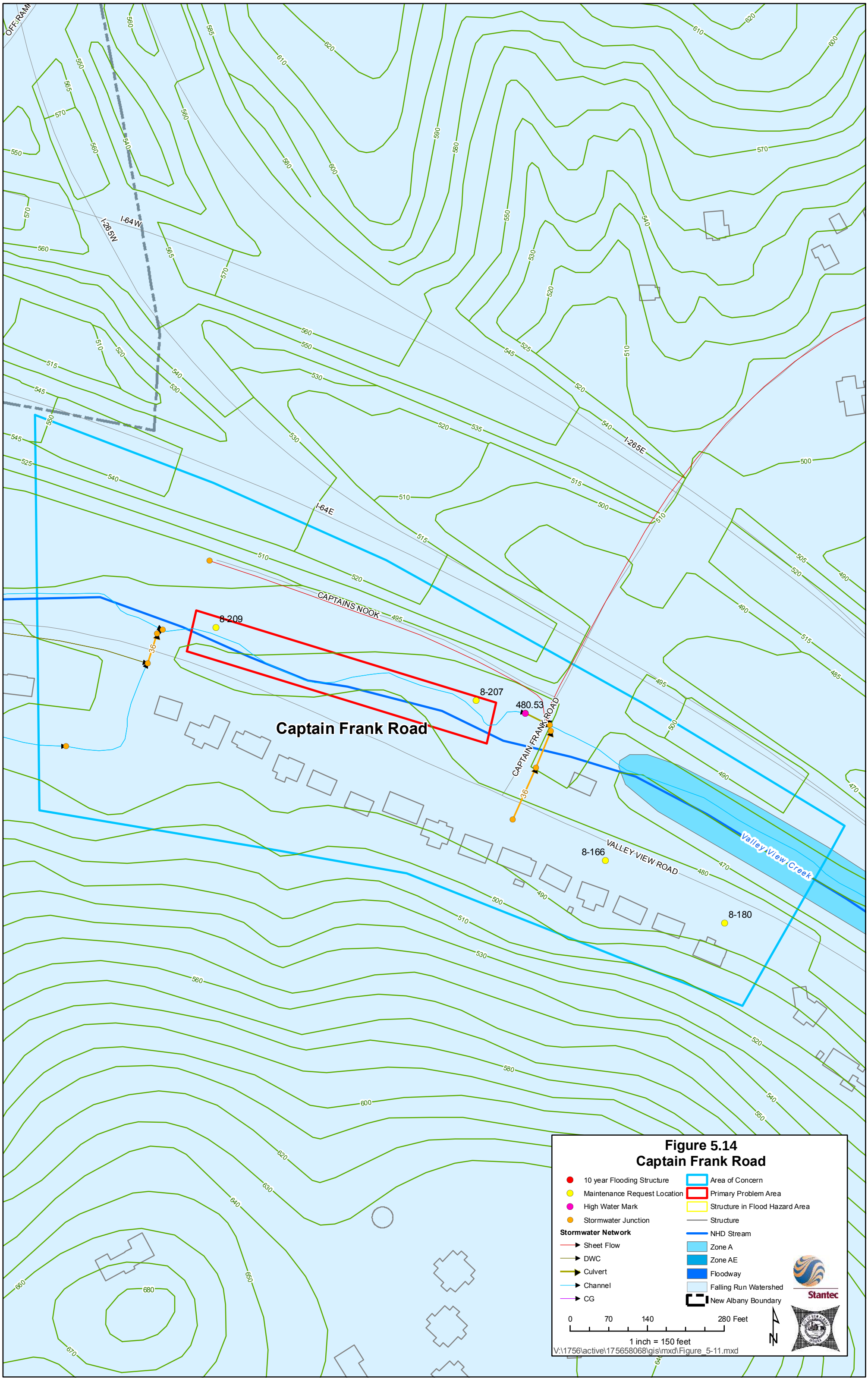
### 5.2.10.3 15th Street Storm and Sanitary Sewer Rehabilitation

The 15th Street Storm and Sanitary Sewer Rehabilitation project is currently under design. The purpose of the project is to rehabilitate the existing brick storm sewer, improve drainage and rehabilitate an existing sanitary sewer along the 15th Street corridor. The project includes spot repairs of the brick storm sewer, storm manhole rehabilitation, construction of catchbasins to improve drainage and spot repairs, manhole rehabilitation and lining of selected reaches of the existing storm sewer. The project should improve drainage in the 15th Street corridor up to the point where the outlet at Locust Creek limits drainage.

The following action plan is recommended for this area:

- Conduct surveys and inspections (including televideo inspections) of the existing drainage infrastructure to verify and/or determine the size and condition of the storm sewer network, document the condition and identify system failures that may need immediate repairs;
- Design (as necessary) and construct repairs to infrastructure such as deteriorated or failed pipes, catchbasins and manholes) identified in the system survey and inspections;
- Develop and implement a routine maintenance and inspection program for the area; and
- Conduct a study of the system to identify system improvements necessary to reduce flood risks including storm sewer upgrades to mains and laterals; opportunities to reduce runoff such as development of green space; and urban rain gardens, and to determine if other system improvements such as flood pump station upgrades or additional pump stations can effectively reduce flooding risks.
- Conduct design study to identify improvement alternatives and to determine size requirements necessary to provide additional relief for planned drainage improvements in the 13th Street – Vincennes Streets and other areas drained by the tributary;
- Design and permitting of improvements to increase the capacity of the railroad and East 8th Street culverts on the unnamed tributary to Fall Creek; and
- Construction of improvements to the railroad and East 8th Street culverts.

The project should be phased with rehabilitation of the 15th Street storm sewer as the first phase, followed by improvements to lateral lines and catchbasins constructed. This will improve drainage in the area up to the limits of the outlet. The third phase should be improvements to the outlet in the “North Y” area. It is expected that the “North Y” area may provide the most benefit. If this proves to be true, it should be the first phase of the project.


I-64W
I-265W
I-64E
I-265E
CAPTAINS NOOK
CAPTAIN FRANK ROAD
VALLEY VIEW ROAD
Valley View Creek
8-209
8-207
8-166
8-180
480.53
Captain Frank Road
Figure 5.14
Captain Frank Road
10 year Flooding Structure
Maintenance Request Location
High Water Mark
Stormwater Junction
Stormwater Network
Sheet Flow
DWC
Culvert
Channel
CG
Area of Concern
Primary Problem Area
Structure in Flood Hazard Area
Structure
NHD Stream
Zone A
Zone AE
Floodway
Falling Run Watershed
New Albany Boundary
0
70
140
280 Feet
1 inch = 150 feet
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### 5.2.11 Cherry Street and West 9th Street

The Cherry Street and West 9th Street Area of Concern is shown in **Figure 5.16**. Pipes between West 10th and 5th Streets, south of Cherry Street, drain to the east through RCP ranging from 12 inches to 48 inches in diameter that outlet to Valley View Creek above a large diameter CMP culvert that passes under the I-64E off ramp.

Streets in the area are drained with roadside ditches and culverts. The drainage system receives runoff from a steep watershed with slopes exceeding 50%. Two tributaries draining the hillside converge in the area between Cherry Street and Ohio Street. Results of SWMM simulations for the 10-YR, 24-HR storm indicate inlet flooding the western or upstream reach of the 36-inch main line between west 10th and 8th Streets and in the existing 48" main downstream of 7th Street.

Maintenance requests in this area include: street, yard and property flooding; failed or damaged infrastructure; general drainage problems; erosion in drainage ditches and incidents of fill placement in the creek and ditches.

The recommended plan of action for this area is:

- Development and implementation of a regular inspection and maintenance schedule for the area;
- A detailed survey and inspection of the system (including televideo inspection as necessary) to document the type, size, elevations, grades and condition of the existing drainage infrastructure;
- Completion of a design study to identify drainage improvement alternatives for the area that meet design standards;
- Design and construction of drainage improvements based on the results of the detailed survey and inspection and the design study.

CHERRY STREET
VALLEY VIEW ROAD
OLD VINCENNES ROAD
WEST TENTH STREET
WEST NINTH STREET
NINTH STREET
WEST EIGHTH STREET
SEVENTH STREET
OHIO STREET
WEST OHIO STREET
CEDAR STREET
YOUNG STREET
WEST NINTH STREET
MOSIER AVENUE
WEST 5TH STREET
WEST 6TH STREET
COMMERCE STREET
WEST FIFTH STREET
GRIFFIN STREET
I-64W
OFF-RAMP
I-64E
ON RAMP
Valley View Creek
Fall Run
1-0185
8-173
1-0125
1-0216
7-578
8-190
1-0107
8-428

## Figure 5.16
## Cherry Street and West 9th Street

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG

- Primary Problem Area
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Area of Concern
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- New Albany Boundary

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0 100 200 400 Feet

1 inch = 200 feet

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### 5.2.12 Culbertson-Market Street

The Culbertson-Market Street Area of Concern is shown in **Figure 5.17**. It extends roughly from Culbertson Street south to Market Street, between East 11th and 13th Streets to the east, and East Fifth and Pear Streets to the west. The stormwater drainage system between Culbertson and Market Street is curb and gutter with catchbasins leading to storm sewers ranging in size from 12 inches to 24 inches. The drainage outlet is a large diameter brick storm sewer approximately 48 inches in size that discharges to Falling Run east of the Pearl Street Bridge.

Maintenance requests include collapsed catch basin inlets; rear yard flooding; blocked or partially collapsed pipe in catchbasins; catch basin cave-in and road failure; road failures around drainage infrastructure; clogged catchbasins; drain backups; clogged storm sewers and a flooded house. SWMM simulations indicate that sixty-six of the eighty-eight nodes along the main sections of pipe overflowed during a 10-YR, 24-HR rainfall event for existing conditions assuming no blockages in the drainage system. Further pipe investigation is needed to confirm existing pipe sizes. Many of the manholes are difficult to access because they are in high traffic areas.

SWMM simulations were also run for the preliminary analysis of potential improvements to the system. These included the addition of relief lines on the mains and laterals in the system. This analysis found that relief sewers along laterals in Oak, Elm and Spring Streets were effective in reducing catch basin flooding for the 10-YR, 24-HR design storm. The placement of relief lines for the map that runs down East 5th Street then roughly northwest to Pearl Street and north to Falling Run are not effective in relieving catch basin flooding along 5th Street.

This project should be phased with construction of lateral lines along Oak, Elm and Spring Streets to improve drainage up to the limitations of the outlet. The second phase should be the construction of an improved outlet for the area.

Similar to the 13th Street – Vincennes Street area, the recommended action plan for the Culbertson-Market Street area is:

- Conduct surveys and televideo inspections to verify and/or determine the size, shape, material, elevations, grades and condition of the drainage network and identify system failures that may need immediate repairs;
- Design and construct repairs to failed infrastructure identified in the system survey and inspections;
- Develop and implement a routine maintenance and inspection program for the area;
- Conduct a more detailed study of the system to identify system improvements necessary to reduce flood risks. Alternatives should include a combination of storm sewer upgrades to mains and laterals; opportunities to reduce runoff such as green space development; rain gardens, and green roofs; and
- Determine if other system improvements such as detention basin construction, flood pump station upgrades or additional pump stations can effectively reduce flooding risks.

# Culbertson - Market Street

428.04999

SUMMIT STREET
UNNAMED ALLEY
PROSPECT STREET
Fall Run
CHERRY STREET
PEARL STREET
State Run
CULBERTSON AVENUE
WEST OAK STREET
ELM STREET
WEST FIRST STREET
SCRIBNER STREET
WEST SPRING STREET
UNNAMED RAMP
RAMP
STATE STREET
BANK STREET
EAST THIRD STREET
FOURTH STREET
EAST FIFTH STREET
EAST SIXTH STREET
EAST ELM STREET
EAST SIXTH STREET
EAST SEVENTH STREET
EAST NINTH STREET
TWELFTH STREET
MARKET STREET
MAIN STREET
SPRING STREET
EAST ELEVENTH STREET
EAST THIRTEENTH STREET
EAST OAK STREET
CULBERTSON AVENUE
ELEVENTH STREET
EAST EIGHTH STREET
SHELBY STREET
LINDEN AVENUE
LAUREL AVENUE
LAKE SIDE AVENUE
MAPLE AVENUE
MAIN STREET
OAK AVENUE
SIXTH STREET
EAST SIXTH STREET

## Figure 5.17
## Culbertson - Market Street

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Structure

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG

- Area of Concern
- Structure in Flood Hazard Area
- Structure
- NHD Stream
- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Ohio River Watershed
- New Albany Boundary

0 150 300 600 Feet

1 inch = 300 feet

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## 5.3 PROPOSED STORAGE BASINS

Areas filled in red on **Figure 5.1** show the locations of fifteen sites that were identified as potential stormwater detention basin sites within the Fall Run Watershed. Six of these sites are on Falling Run above Daisy Lane and eight are on Falling Run above Country Club Lane. Initially, aerial photography was used to identify open space that may be suitable for a storage basin site. Field reconnaissance was conducted on each site. Later factors such as availability of land for the basin, location of the basin within city limits, whether or not the property is privately or publicly owned, and its potential benefits were considered. Areas of concern that benefit from the proposed storage basins include the "Falling Run near Daisy Lane"; "Captain Frank Road"; "Culbertson - Market Streets" and "13$^{th}$ – Vincennes Street" areas of concern. Storage basins were modeled in SWMM if the proposed volume of the basin could retain the first inch of runoff and if adequate elevation data was available to develop stage-storage-discharge curves. A list of the basins not modeled and modeled are in **Tables 5.3** and **5.4** respectively. Details for each of the potential storage basins can be found on the fact sheets in **Appendix 5.4.**

**Table 5.3. Potential Fall Run Storage Basins – Not Modeled.**

| Basin Location | Basin Area (acres) | Potential Basin Volume (acre-ft) | Drainage Area (acres) |
|---|---|---|---|
| 4-H Fairgrounds | 1.3 | 3.5 | 74 |
| Binford Park | 0.7 | 2.3 | 2850 |
| East of Green Valley Rd/North of 265 | 1.6 | 2.1 | 143 |
| Green Valley School | 1.7 | 3.6 | 32 |
| Pamela Drive | 0.9 | 3.0 | 491 |
| Silver Street-South | 1.7 | 6.2 | 131 |
| South of Cherry Valley GC | 4.8 | 26.9 | 1126 |
| South of Daisy Lane | 2.8 | 10.5 | 2509 |
| Southeast of Kroger's | 1.0 | 3.5 | 100 |

**Table 5.4. Potential Fall Run Storage Basins – Modeled.**

| Basin Location | Surface Area (acres) | Drainage Area (acres) | 25-YR Volume (ac-ft) | Peak Inflow (cfs) | Peak Outflow (cfs) | % Reduction |
|---|---|---|---|---|---|---|
| North of Meide Drive | 6.1 | 191 | 4.05 | 685 | 12 | 98 |
| Southwest of Spickert Knob Road | 1.5 | 95 | 10.16 | 349 | 18 | 95 |
| Northwest of Clearstream Court | 2.5 | 115 | 8.21 | 443 | 17 | 96 |
| North of Christian Academy | 4.7 | 70 | 11.1 | 278 | 12 | 96 |
| South of Wildwood Drive | 2.4 | 164 | 16.57 | 591 | 16 | 97 |
| North of Old Vincennes | 1.6 | 64 | 4.11 | 227 | 14 | 94 |

## 5.4 ROAD CROSSING IMPROVEMENTS

Culverts were modeled sequentially starting with the 100-YR, 24-HR event for existing conditions. Those that overtopped were then analyzed for 25-YR, 24-HR. Culverts that were overtopped by the 25-YR event were evaluated using the 10-YR, 24-HR storm. Finally, culverts overtopped by the 10-YR storm were modeled using the 2-YR, 24-HR storm. **Table 5.5** provides a summary of overtopped culverts and the events in which they are overtopped.

In **Table 5.5**, green cells indicate culverts that are overtopped for the 100-YR or higher, 24-HR storm; Yellow cells indicate culverts that overtop for the 25-YR and greater events; orange indicates overtopping for the 10-YR and greater events; and red indicates a culvert is overtopped for 2-YR and greater events. If level of service for culverts is used as a ranking to set priorities for culvert improvements, culverts highlighted in red are first priority; those highlighted in orange are second priority; and those in yellow are third priority. Culverts with green highlights have no priority based on level of service since they exceed the 25-YR service level for culverts. Other conditions such as culvert integrity or failure; emergency road accessibility; etc. should move any culvert to a higher priority if warranted.

The culverts shown in the table below represent some of the most critical and problematic culverts in the Falling Run Watershed. Other culverts may become critical or problematic as they age and/or their sub-basins become more developed. The proposed improvements to the Daisy Lane crossing and roadway are not included in the priority analysis because the project is funded and design is underway.

**Table 5.5. Culvert Performance on Fall Run Watershed.**

| Location | Location in Sub-Basin | Overtopping for Existing Conditions | | | |
|---|---|---|---|---|---|
| | | 100-YR, 24-HR | 25-YR, 24-HR | 10-YR, 24-HR | 2-YR, 24-HR |
| Hickory Vale Drive on Fall Run | high | Yes | No | No | No |
| Cherokee Drive on County Run | low | No | No | No | No |
| Navajo Drive on County Run | high | No | No | No | No |
| Cannon Street on Fall Run | middle | Yes | No | No | No |
| Jolissaint Ave on Fall Run | middle | No | No | No | No |
| Braeview Drive on Valley View Creek | low | Yes | No | No | No |
| Valley View Road on Silvercrest Run | low | No | No | No | No |
| Cherry Street on Valley View Creek | high | No | No | No | No |
| Greenview Drive – North on Fork Run | low | No | No | No | No |
| Chadwood Drive on Tributary of Fork Run | low | No | No | No | No |
| Glenmill Road - North on Fork Run | middle | No | No | No | No |
| Glenmill Road – Middle on Lost Knob Brook | middle | No | No | No | No |
| Baldwin Drive on Lost Knob Brook | low | No | No | No | No |
| Glenmill Road/ I-265 on Green Run | low | No | No | No | No |
| Redwood Drive on Green Run | high | No | No | No | No |
| Bono Road on Tributary of Falling Run | middle | No | No | No | No |
| Country Club Drive - West on Tributary of Falling Run | middle | No | No | No | No |
| Country Club Drive - East on Falling Run | low | Yes | Yes | Yes | No |
| Ealy Street on State Run | middle | No | No | No | No |
| Cherry Street on State Run | low | No | No | No | No |
| Spring Hill Road on Falling Run | middle | No | No | No | No |
| Glenmill Road - south on Tributary of Falling Run | middle | No | No | No | No |
| Floyd Street/ RR/ Thru levee wall on Falling Run | low | No | No | No | No |
| Rolling Creek Drive/ Creekwood Court* on Fall Run | middle | Yes | Yes | No | No |
| Grant Line Road^ on Fall Run | high | Yes | Yes | No | No |
| Beechwood^ on Tributary of Falling Run | middle | Yes | Yes | No | No |
| Vance Ave^ on Tributary of Falling Run | middle | Yes | Yes | No | No |
| Wildwood Drive[1] on Valley View Creek | middle | Yes | Yes | Yes | Yes |
| Captain Frank Road[1] on Valley View Creek | middle | Yes | Yes | Yes | Yes |

**Table 5.5 (Continued). Culvert Performance on Fall Run Watershed.**

| Location | Location in Sub-Basin | Overtopping for Existing Conditions | | | |
|---|---|---|---|---|---|
| | | 100-YR, 24-HR | 25-YR, 24-HR | 10-YR, 24-HR | 2-YR, 24-HR |
| Wildwood Road^ on Silvercrest Run | high | Yes | Yes | No | No |
| Falcon Run* on Silvercrest Run | middle | Yes | Yes | No | No |
| Greenview Drive - South[1] on Tributary of Fork Run | low | Yes | Yes | Yes | Yes |
| Wellington Drive[1] on Fork Run | middle | Yes | Yes | Yes | No |
| Tingle Drive[1] on Green Run | middle | Yes | Yes | Yes | No |
| Clearstream Court* on Holy Run | middle | Yes | Yes | No | No |
| Wooded Valley Drive* on Holy Run | low | Yes | Yes | No | No |
| Harris Court[1] on Trinity Run | low | Yes | Yes | Yes | No |
| Graybrook Lane* on Falling Run | middle | Yes | Yes | No | No |

[1] *Culvert not in good condition.*
*^ Roadway was modeled as being overtopped for the 25yr-24hr event due to the conservative approach used for drainage basins but was not considered as a replacement because minimal flow was modeled over the roadway and/or the location of the culvert inside the watershed.*
** Roadway was modeled as being overtopped for the 25yr-24hr event but was not considered as a replacement because possible locations of storage basins upstream would reduce the flow at the culvert.*

Priorities for culvert improvements or replacement can be assigned based on the frequencies of overtopping from **Table 5.5**, priorities for culvert replacements can be assigned as follows:

- **Priority 1:** Culverts that are overtopped for the 2-YR, 24-HR design storm or smaller (shown in red in **Table 5.5**);
- **Priority 2:** Culverts that overtop for the 10-YR, 24-HR storm or smaller (shown in orange in **Table 5.5**); and
- **Priority 3:** Culverts that are overtopped by the 25-YR, 24-HR storm or smaller Shown in yellow in **Table 5.5**).

Using the frequency-based priorities above, and given the impacts of the Country Club Drive culvert on upstream flood elevations, the priorities for improvements to the culverts shown in **Table 5.5** are:

**Priority 1:**

Country Club Drive on Falling Run

Wildwood Drive on Valley View Creek

Captain Frank Road on Valley View Creek

Greenview Drive – South on Tributary of Fork Run

**Priority 2:**

Wellington Drive on Fork Run

Tingle Drive on Green Run

Harris Court on Trinity Run

**Priority 3:**

Rolling Creek Drive/Creekwood Court on Fall Run

Grant Line Road on Fall Run

Beechwood on Tributary of Falling Run

Vance Avenue on Tributary of Falling Run

Wildwood Road on Silvercrest Run

Falcon Run Road on Silvercrest Run

Clearstream Court on Holy Run

Wooded Valley Drive on Holy Run

Graybrook Lane on Falling Run

In addition to frequency of flooding, the condition of existing culverts also needs to be considered in setting priorities for improvements. As indicated in **Table 5.5**, all the Priority 2 culverts also have a deteriorating condition to some degree. The degree of deterioration may cause some Priority 2 culverts to be moved up to Priority 1.

Priority 3 culverts were found in generally good condition so their priority should not change due to their condition. Within Priorities 1 and 2, culverts should be prioritized based on their condition as well as hydraulic capacity. A study of the condition of Priority 1 and Priority 2 culverts should be completed to determine alternatives and refine priorities for culvert improvements or replacement based on both hydraulic capacity and structural integrity. Shallow water depths on roadways were predicted by SWMM for many of the Priority 3 culverts for the 25-YR, 24-HR storm. The hydrology and hydraulics of these culverts should also be evaluated in greater detail before they are considered for improvements.

## 5.5 MAINTENANCE ISSUES

Routine maintenance of the Fall Run stormwater system should be a major priority. Routine maintenance schedules should be developed for those area covered in **Section 5.2**, as well as areas that historically have required routine or preventative maintenance within the Fall Run Watershed, as listed in **Table 5.6** below.

**Table 5.6. Fall Run Routine Maintenance Recommendations.**

| Location | Headwall/Ditch Cleaning | Catchbasin Cleaning |
|---|---|---|
| Beacon Drive at Laclede Avenue | | X |
| Beechwood Avenue near Depauw Avenue | X | |
| Cannon Street | X | |
| Carlton Drive | | X |
| Daisy Lane (Green Valley Rd – Stover Dr) | | X |
| Depauw Avenue and Florence Street | X | |
| East 15th Street | | X |
| Falling Run at West 10th Street WWTP | X | |
| Glenview Heights and Redbud Road | X | X |
| Grantline Road near Daisy Lane | X | X |
| Grantline Rd and Charlestown Rd (North Y) | X | |
| Hickory Vale Road | X | |
| Indian Heights (Mohawk Drive) | | X |
| Linda Dr near Greenlawn Drive | | X |
| Main Street (15th – Vincennes) | | X |
| Roanoke Avenue (behind Cart & Craft) | X | |
| Silver Street near Reno Avenue | | X |
| South Street | | X |
| Spring Street at Spring Avenue | | X |
| Spring Street at West 4th Street | | X |
| Vincennes Street | | X |
| West 9th Street and Cedar Street | X | |

## 5.6 PROJECT COSTS

Opinions of Cost were developed for each capital improvement project identified in **Section 5** for the Falling Run Watershed. Most improvements to the areas of concern are local improvements that will provide relief in the areas served by existing infrastructure. These are smaller in scale and include storm sewer improvements, catch basin and inlet upgrades; drainage ditches; and other improvements that reduce flooding hazards in local stormwater drainage systems.

The "Daisy Lane near Falling Run" area experiences flooding that is primarily the result of construction in the floodplain and floodway. Relief in this area and other areas with encroachments in the floodplain or floodway depends upon projects that provide storage above them. Providing detention storage will lower flood elevations in floodways along Falling Run and its major tributaries downstream of the basins. Lower flood elevations will mean less frequent and less severe flooding for owners of structures that encroach floodplains. By their nature, flooding in floodplains along streams require watershed-scale solutions to reduce flood frequency and severity.

Opinions of Cost for capital improvement projects are presented in three categories: Local Improvements; Watershed-Scale Improvements; and Road Crossing Improvements. **Table 5.7** presents a summary of probable costs for local improvements for the areas of concern on the Falling Run Watershed. The total probable cost for these projects is $6,663,000.

**Table 5.7. Opinion of Probable Cost for Falling Run Watershed Capital Improvements - Local Improvements.**

| Area of Concern | Probable Cost |
|---|---|
| South of McDonald Lane | $272,000 |
| Brookview Drive – McDonald Lane | $231,000 |
| Hickory Vale Drive Side Streets | $451,000 |
| Charlestown Road near Coes Lane | $142,000 |
| Silver Street and Roanoke Avenue | $418,000 |
| Carlton Drive | $283,000 |
| Aebersold Drive | $529,000 |
| Captain Frank Road | $358,000 |
| 13th – Vincennes Street | $1,139,000 |
| Cherry Street and West 9th Street | $473,000 |
| Culbertson – Market Street | $1,301,000 |
| Total | $5,597,000 |

**Table 5.8** presents a summary of probable costs for Watershed-Scale Improvements on the Falling Run Watershed. Watershed-Scale Improvements are the construction of stormwater detention basins that will reduce the frequency and severity of flooding along Falling Run and its major tributaries. Probable costs for each basin identified in the Falling Run Watershed are shown in the table. The total cost of detention basins identified on Falling Run and its tributaries is $4,231,000.

***Bold italic*** entries in **Table 5.8** indicate those basins that lie above the Daisy Lane near Falling Run area of concern. Construction of these basins would reduce flooding in the Daisy Lane area. The total cost of reducing flood hazards along Falling Run above Daisy Lane is $2,038,000 as shown in **Table 5.8**.

**Table 5.8. Opinions of Cost for Watershed-Scale Capital Improvements (Detention Basins).**

| Basin Location | Probable Cost |
|---|---|
| ***4-H Fairgrounds*** | ***$233,000*** |
| Binford Park | $173,000 |
| ***East of Green Valley Rd/North of I- 265*** | ***$233,000*** |
| Green Valley School | $207,000 |
| ***Pamela Drive*** | ***$206,000*** |
| Silver Street-South | $344,000 |
| South of Cherry Valley GC | $989,000 |
| South of Daisy Lane | $490,000 |
| Southeast of Kroger's | $20,000 |
| ***North of Meide Drive*** | ***$417,000*** |
| ***Southwest of Spickert Knob Road*** | ***$470,000*** |
| ***Northwest of Clearstream Court*** | ***$427,000*** |
| North of Christian Academy | $493,000 |
| South of Wildwood Drive | $658,000 |
| North of Old Vincennes | $272,000 |
| **Total** | **$5,632,000** |
| ***Total for Falling Run near Daisy Lane*** | ***$1,753,000*** |

Probable costs for improvements at high priority road crossings are summarized in **Table 5.9** for crossings on Falling Run and its tributaries. High priority crossings are Priority 1 culverts and Priority 2 culverts found in less than good condition. The total cost of these improvements is $1,314,000 as shown below.

**Table 5.9. Probable Costs of High Priority Road Crossing Improvements on Falling Run.**

| Location | Probable Cost |
|---|---|
| Wildwood Drive on Valley View Creek | $127,000 |
| Captain Frank Road on Valley View Creek | $229,000 |
| Greenview Drive - South on Tributary of Fork Run | $413,000 |
| Wellington Drive on Fork Run | $127,000 |
| Tingle Drive on Green Run | $122,000 |
| Harris Court on Trinity Run | $323,000 |
| "North Y" Area | $185,000 |
| Total | $1,526,000 |

The Falling Run Watershed is the largest watershed and has the highest level of development of all the watersheds that drain the City of New Albany. As might be expected, it appears to have the more maintenance requests and flood control issues of all the watersheds as well. The combined probable costs for local improvements, watershed-scale improvements and high-priority road crossing improvements is $10,015,000 for the Falling Run Watershed. In terms of cost, it represents 52% of the capital improvement needs in the City of New Albany.

## 5.7 SUMMARY

The Falling Run Watershed is the largest and most developed of the watersheds that drain the City of New Albany. It covers 10.2 square miles with 8 square miles that lie within the corporate boundary of the City of New Albany and is approximately 54% developed. Most of the remaining developable land lies in the upper reaches of the watershed.

**Section 5** has presented an overview of the characteristics of the Falling Run Watershed; presented 12 areas of concern that were identified through reviews of maintenance requests received by the Stormwater Board and the City of New Albany and through observations and experience of board and city personnel. A SWMM model was developed for Falling Run and its major tributaries. The model included storm sewers 24 inches and larger. Model results were used to locate problem areas and to evaluate alternatives. Local and watershed-scale alternatives were identified to reduce drainage and flooding issues at the neighborhood and watershed levels, respectively.

Local alternatives include storm sewer improvements, inlet and catch basin upgrades, culvert improvements; and local detention basins to improve capacity or reduce loadings on the storm drainage system. The study identified 15 potential sites for stormwater detention basins that have the potential reduce flood frequency and impacts along Falling Run and its major tributaries as watershed-scale alternatives.

Roadway flooding was evaluated at critical road crossings identified in the watershed based on observations of stormwater utility and city personnel. Improvements to 6 road crossings were

identified as high priorities based on the frequency of flooding and the condition of the existing culverts.

Clogged inlets, catchbasins and storm sewers have been proven to be problematic in many areas on the watershed. A total of 21 areas were identified as areas where routine maintenance is critical to maintain the capacity of existing storm drainage systems.

The probable costs of capital improvements have been placed in three categories: local improvements; watershed-scale improvements and road crossing improvements. The cost of each of these is:

- Local Improvements: $5,597,000
- Watershed-Scale Improvements: $5,632,000
- Road Crossing Improvements: $1,526,000

The total cost of improvements identified on the Falling Run Watershed is $12,755,000. A system-wide prioritization of capital improvement projects is provided in **Section 9** of this report. Based on costs, drainage improvements in the Falling Run watershed represent 57% of the stormwater capital improvement needs in the City of New Albany.

# Appendix 5.1

Table 5.1 Falling Run Watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 2.95 | 0.01 | 640 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 1 | 2.56 | 0.01 | 550 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 2 | 1.24 | 0.01 | 368 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 3 | 2.65 | 0.01 | 584 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 4 | 2.07 | 0.01 | 362 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 5 | 2.81 | 0.01 | 793 | C | 0.1 | 0.14 | 8.6 | 49 | 65 |
| 6 | 5.90 | 0.015 | 907 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 7 | 2.83 | 0.015 | 602 | C | 0.1 | 0.14 | 8.6 | 47 | 66 |
| 8 | 3.07 | 0.01 | 570 | C | 0.1 | 0.14 | 8.6 | 82 | 82 |
| 9 | 3.37 | 0.01 | 486 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 10 | 1.67 | 0.01 | 1025 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 11 | 3.95 | 0.01 | 1007 | C | 0.1 | 0.14 | 8.6 | 49 | 65 |
| 12 | 91.09 | 0.015 | 8050 | C | 0.1 | 0.14 | 8.6 | 17 | 49 |
| 13 | 117.58 | 0.05 | 8866 | C | 0.1 | 0.14 | 8.6 | 36 | 43 |
| 14 | 93.44 | 0.045 | 4000 | C | 0.1 | 0.14 | 8.6 | 27 | 50 |
| 15 | 29.15 | 0.04 | 2880 | C | 0.1 | 0.14 | 8.6 | 23 | 39 |
| 16 | 49.06 | 0.105 | 4200 | C | 0.1 | 0.14 | 8.6 | 20 | 38 |
| 17 | 94.46 | 0.075 | 4935 | C | 0.1 | 0.14 | 8.6 | 12 | 40 |
| 18 | 79.20 | 0.11 | 7700 | C | 0.1 | 0.14 | 8.6 | 13 | 46 |
| 19 | 160.49 | 0.2 | 7225 | B | 0.2 | 0.17 | 6.6 | 2 | 39 |
| 20 | 7.29 | 0.01 | 531 | C | 0.1 | 0.14 | 8.6 | 80 | 80 |
| 21 | 5.67 | 0.01 | 610 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 22 | 14.05 | 0.015 | 1136 | C | 0.1 | 0.14 | 8.6 | 74 | 74 |
| 23 | 3.48 | 0.01 | 463 | C | 0.1 | 0.14 | 8.6 | 71 | 71 |
| 24 | 3.97 | 0.01 | 1162 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 25 | 2.39 | 0.01 | 893 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 26 | 5.01 | 0.01 | 1065 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 27 | 1.44 | 0.01 | 241 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 28 | 10.27 | 0.015 | 685 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 29 | 9.10 | 0.015 | 775 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 30 | 8.47 | 0.01 | 702 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 31 | 2.27 | 0.01 | 275 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 32 | 4.75 | 0.015 | 652 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 33 | 7.21 | 0.01 | 740 | C | 0.1 | 0.14 | 8.6 | 66 | 66 |
| 34 | 3.83 | 0.01 | 504 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 35 | 3.88 | 0.01 | 234 | C | 0.1 | 0.14 | 8.6 | 68 | 68 |
| 36 | 2.53 | 0.015 | 522 | C | 0.1 | 0.14 | 8.6 | 71 | 71 |
| 37 | 3.82 | 0.015 | 580 | C | 0.1 | 0.14 | 8.6 | 66 | 66 |
| 38 | 10.29 | 0.015 | 945 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 39 | 2.83 | 0.01 | 690 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 40 | 2.91 | 0.01 | 425 | C | 0.1 | 0.14 | 8.6 | 74 | 74 |
| 41 | 1.92 | 0.01 | 690 | C | 0.1 | 0.14 | 8.6 | 72 | 72 |
| 42 | 1.43 | 0.01 | 80 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 43 | 13.17 | 0.015 | 1170 | C | 0.1 | 0.14 | 8.6 | 66 | 66 |
| 44 | 1.22 | 0.01 | 287 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 45 | 8.24 | 0.015 | 1130 | C | 0.1 | 0.14 | 8.6 | 71 | 71 |
| 46 | 3.42 | 0.02 | 549 | C | 0.1 | 0.14 | 8.6 | 77 | 77 |
| 47 | 3.80 | 0.015 | 583 | C | 0.1 | 0.14 | 8.6 | 66 | 66 |
| 48 | 1.84 | 0.01 | 394 | C | 0.1 | 0.14 | 8.6 | 73 | 73 |
| 49 | 4.53 | 0.01 | 676 | C | 0.1 | 0.14 | 8.6 | 72 | 72 |
| 50 | 2.54 | 0.01 | 589 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 51 | 4.57 | 0.01 | 775 | C | 0.1 | 0.14 | 8.6 | 68 | 68 |
| 52 | 16.94 | 0.01 | 1125 | C | 0.1 | 0.14 | 8.6 | 68 | 68 |
| 53 | 2.18 | 0.01 | 320 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 54 | 1.23 | 0.015 | 436 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 55 | 10.24 | 0.01 | 525 | C | 0.1 | 0.14 | 8.6 | 73 | 73 |
| 56 | 5.24 | 0.01 | 855 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 57 | 3.79 | 0.01 | 709 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 58 | 2.80 | 0.01 | 570 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |

Table 5.1 Falling Run Watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 59 | 0.74 | 0.01 | 110 | C | 0.1 | 0.14 | 8.6 | 85 | 85 |
| 60 | 29.32 | 0.25 | 3825 | B/C | 0.15 | 0.155 | 7.6 | 5 | 38 |
| 61 | 2.51 | 0.015 | 1496 | C | 0.1 | 0.14 | 8.6 | 44 | 44 |
| 62 | 4.60 | 0.04 | 945 | C | 0.1 | 0.14 | 8.6 | 40 | 40 |
| 63 | 1.12 | 0.01 | 612 | C | 0.1 | 0.14 | 8.6 | 44 | 44 |
| 64 | 2.09 | 0.01 | 100 | C | 0.1 | 0.14 | 8.6 | 41 | 41 |
| 65 | 1.28 | 0.01 | 142 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 66 | 3.74 | 0.01 | 1470 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 67 | 1.05 | 0.01 | 760 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 68 | 0.74 | 0.01 | 100 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 69 | 1.22 | 0.01 | 114 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 70 | 2.24 | 0.01 | 1100 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 71 | 12.51 | 0.04 | 1074 | C | 0.1 | 0.14 | 8.6 | 44 | 45 |
| 72 | 2.43 | 0.01 | 78 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 73 | 27.33 | 0.03 | 2713 | C | 0.1 | 0.14 | 8.6 | 31 | 38 |
| 74 | 1.23 | 0.01 | 198 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 75 | 0.15 | 0.01 | 102 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 76 | 8.04 | 0.02 | 1470 | C | 0.1 | 0.14 | 8.6 | 37 | 38 |
| 77 | 18.25 | 0.02 | 2093 | C | 0.1 | 0.14 | 8.6 | 34 | 41 |
| 78 | 5.80 | 0.01 | 805 | C | 0.1 | 0.14 | 8.6 | 32 | 38 |
| 79 | 1.15 | 0.01 | 100 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 80 | 63.12 | 0.02 | 4710 | C | 0.1 | 0.14 | 8.6 | 35 | 40 |
| 81 | 1.72 | 0.02 | 447 | C | 0.1 | 0.14 | 8.6 | 75 | 75 |
| 82 | 6.14 | 0.02 | 1818 | C | 0.1 | 0.14 | 8.6 | 78 | 78 |
| 83 | 2.72 | 0.01 | 255 | C | 0.1 | 0.14 | 8.6 | 85 | 85 |
| 84 | 100.69 | 0.016 | 2665 | C | 0.1 | 0.14 | 8.6 | 57 | 71 |
| 85 | 1.84 | 0.02 | 289 | C | 0.1 | 0.14 | 8.6 | 69 | 69 |
| 86 | 0.22 | 0.01 | 185 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 87 | 0.49 | 0.01 | 254 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 88 | 2.92 | 0.02 | 1370 | C | 0.1 | 0.14 | 8.6 | 46 | 46 |
| 89 | 0.14 | 0.01 | 320 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 90 | 214.57 | 0.05 | 7335 | C | 0.1 | 0.14 | 8.6 | 23 | 47 |
| 91 | 83.85 | 0.14 | 5912 | B/C | 0.15 | 0.155 | 7.6 | 13 | 39 |
| 92 | 30.71 | 0.05 | 1123 | C | 0.1 | 0.14 | 8.6 | 16 | 53 |
| 93 | 9.44 | 0.01 | 2889 | C | 0.1 | 0.14 | 8.6 | 72 | 72 |
| 94 | 17.54 | 0.015 | 1425 | C | 0.1 | 0.14 | 8.6 | 58 | 61 |
| 95 | 9.79 | 0.015 | 1469 | C | 0.1 | 0.14 | 8.6 | 39 | 47 |
| 96 | 9.78 | 0.02 | 510 | C | 0.1 | 0.14 | 8.6 | 39 | 50 |
| 97 | 59.43 | 0.065 | 3433 | C | 0.1 | 0.14 | 8.6 | 27 | 55 |
| 98 | 205.37 | 0.02 | 7361 | C | 0.1 | 0.14 | 8.6 | 45 | 53 |
| 99 | 164.00 | 0.051 | 7720 | C | 0.1 | 0.14 | 8.6 | 44 | 55 |
| 100 | 155.85 | 0.02 | 5614 | C | 0.1 | 0.14 | 8.6 | 36 | 42 |
| 101 | 2.96 | 0.01 | 945 | C | 0.1 | 0.14 | 8.6 | 50 | 50 |
| 102 | 10.07 | 0.01 | 150 | C | 0.1 | 0.14 | 8.6 | 46 | 49 |
| 103 | 1.39 | 0.01 | 290 | C | 0.1 | 0.14 | 8.6 | 51 | 51 |
| 104 | 2.91 | 0.01 | 612 | C | 0.1 | 0.14 | 8.6 | 52 | 52 |
| 105 | 7.68 | 0.01 | 1729 | C | 0.1 | 0.14 | 8.6 | 52 | 52 |
| 106 | 17.77 | 0.01 | 592 | C | 0.1 | 0.14 | 8.6 | 50 | 50 |
| 107 | 12.52 | 0.01 | 593 | C | 0.1 | 0.14 | 8.6 | 42 | 43 |
| 108 | 2.56 | 0.01 | 461 | C | 0.1 | 0.14 | 8.6 | 58 | 58 |
| 109 | 1.16 | 0.01 | 269 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 110 | 2.14 | 0.01 | 297 | C | 0.1 | 0.14 | 8.6 | 83 | 83 |
| 111 | 51.12 | 0.01 | 4050 | C | 0.1 | 0.14 | 8.6 | 56 | 59 |
| 112 | 11.79 | 0.02 | 830 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 113 | 10.72 | 0.02 | 1731 | C | 0.1 | 0.14 | 8.6 | 36 | 41 |
| 114 | 4.55 | 0.015 | 720 | C | 0.1 | 0.14 | 8.6 | 56 | 56 |
| 115 | 0.38 | 0.01 | 70 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 116 | 0.08 | 0.01 | 35 | C | 0.1 | 0.14 | 8.6 | 62 | 62 |
| 117 | 0.28 | 0.01 | 263 | C | 0.1 | 0.14 | 8.6 | 53 | 53 |

Table 5.1 Falling Run Watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 118 | 39.37 | 0.02 | 3250 | C | 0.1 | 0.14 | 8.6 | 53 | 62 |
| 119 | 4.39 | 0.01 | 594 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 120 | 4.76 | 0.015 | 810 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 121 | 2.46 | 0.015 | 1023 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 122 | 0.74 | 0.01 | 72 | C | 0.1 | 0.14 | 8.6 | 46 | 65 |
| 123 | 0.31 | 0.01 | 76 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 124 | 79.27 | 0.015 | 5990 | C | 0.1 | 0.14 | 8.6 | 61 | 63 |
| 125 | 46.50 | 0.04 | 4801 | C | 0.1 | 0.14 | 8.6 | 40 | 41 |
| 126 | 3.12 | 0.01 | 936 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 127 | 2.25 | 0.01 | 135 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 128 | 49.24 | 0.035 | 3074 | C | 0.1 | 0.14 | 8.6 | 25 | 41 |
| 129 | 66.57 | 0.16 | 6822 | B/C | 0.15 | 0.155 | 7.6 | 7 | 38 |
| 130 | 158.67 | 0.2 | 11532 | B | 0.2 | 0.17 | 6.6 | 2 | 38 |
| 131 | 23.10 | 0.025 | 1175 | B/C | 0.15 | 0.155 | 7.6 | 26 | 38 |
| 132 | 155.88 | 0.23 | 5825 | C | 0.1 | 0.14 | 8.6 | 12 | 39 |
| 133 | 46.43 | 0.015 | 1582 | B | 0.2 | 0.17 | 6.6 | 40 | 42 |
| 134 | 118.05 | 0.26 | 7440 | C | 0.1 | 0.14 | 8.6 | 3 | 39 |
| 135 | 108.86 | 0.06 | 7189 | B | 0.2 | 0.17 | 6.6 | 27 | 42 |
| 136 | 96.22 | 0.3 | 6050 | B/C | 0.15 | 0.155 | 7.6 | 0 | 38 |
| 137 | 113.53 | 0.12 | 10900 | B/C | 0.15 | 0.155 | 7.6 | 17 | 39 |
| 138 | 79.93 | 0.09 | 10125 | B/C | 0.15 | 0.155 | 7.6 | 20 | 40 |
| 139 | 90.49 | 0.105 | 6400 | C | 0.1 | 0.14 | 8.6 | 9 | 41 |
| 140 | 253.39 | 0.02 | 8410 | B/C | 0.15 | 0.155 | 7.6 | 38 | 46 |
| 141 | 455.38 | 0.23 | 15680 | C | 0.1 | 0.14 | 8.6 | 4 | 40 |
| 142 | 78.20 | 0.045 | 4200 | C | 0.1 | 0.14 | 8.6 | 31 | 50 |
| 143 | 79.31 | 0.015 | 6495 | B | 0.2 | 0.17 | 6.6 | 32 | 43 |
| 144 | 201.44 | 0.19 | 8766 | C | 0.1 | 0.14 | 8.6 | 2 | 38 |
| 145 | 58.77 | 0.12 | 2950 | C | 0.1 | 0.14 | 8.6 | 2 | 38 |
| 146 | 2.25 | 0.015 | 300 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 147 | 15.62 | 0.06 | 1504 | C | 0.1 | 0.14 | 8.6 | 27 | 39 |
| 148 | 0.24 | 0.015 | 78 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 149 | 2.10 | 0.015 | 80 | C | 0.1 | 0.14 | 8.6 | 45 | 45 |
| 150 | 1.93 | 0.015 | 80 | C | 0.1 | 0.14 | 8.6 | 50 | 50 |
| 151 | 0.11 | 0.02 | 90 | C | 0.1 | 0.14 | 8.6 | 56 | 38 |
| 152 | 1.30 | 0.02 | 170 | C | 0.1 | 0.14 | 8.6 | 38 | 43 |
| 153 | 4.73 | 0.04 | 1305 | B/C | 0.15 | 0.155 | 7.6 | 39 | 39 |
| 154 | 28.45 | 0.105 | 4375 | C | 0.1 | 0.14 | 8.6 | 35 | 47 |
| 155 | 1.45 | 0.04 | 180 | B/C | 0.15 | 0.155 | 7.6 | 38 | 38 |
| 156 | 179.49 | 0.08 | 3854 | C | 0.1 | 0.14 | 8.6 | 23 | 39 |
| 157 | 2.43 | 0.01 | 156 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 158 | 48.38 | 0.05 | 3631 | C | 0.1 | 0.14 | 8.6 | 35 | 45 |
| 159 | 150.80 | 0.015 | 6240 | C | 0.1 | 0.14 | 8.6 | 27 | 54 |
| 160 | 3.11 | 0.01 | 851 | C | 0.1 | 0.14 | 8.6 | 66 | 66 |
| 161 | 3.24 | 0.01 | 675 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 162 | 1.75 | 0.01 | 300 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 163 | 3.32 | 0.01 | 512 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 164 | 5.97 | 0.015 | 976 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 165 | 2.08 | 0.01 | 715 | C | 0.1 | 0.14 | 8.6 | 78 | 78 |
| 166 | 4.20 | 0.01 | 1151 | C | 0.1 | 0.14 | 8.6 | 71 | 71 |
| 167 | 85.67 | 0.05 | 5940 | C | 0.1 | 0.14 | 8.6 | 44 | 49 |
| 168 | 19.97 | 0.015 | 1614 | C | 0.1 | 0.14 | 8.6 | 63 | 63 |
| 169 | 111.64 | 0.03 | 7809 | C | 0.1 | 0.14 | 8.6 | 48 | 56 |
| 170 | 27.29 | 0.05 | 3015 | C | 0.1 | 0.14 | 8.6 | 17 | 44 |
| 171 | 48.91 | 0.01 | 2263 | C | 0.1 | 0.14 | 8.6 | 37 | 50 |
| 172 | 128.87 | 0.4 | 4645 | B/C | 0.15 | 0.155 | 7.6 | 9 | 42 |
| 173 | 202.75 | 0.3 | 5693 | B/C | 0.15 | 0.155 | 7.6 | 12 | 39 |
| 174 | 1.67 | 0.01 | 425 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 175 | 2.61 | 0.015 | 377 | C | 0.1 | 0.14 | 8.6 | 71 | 71 |
| 176 | 0.92 | 0.01 | 80 | C | 0.1 | 0.14 | 8.6 | 72 | 72 |

Table 5.1 Falling Run Watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 177 | 9.79 | 0.01 | 489 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 178 | 0.69 | 0.01 | 30 | C | 0.1 | 0.14 | 8.6 | 72 | 72 |
| 179 | 5.78 | 0.015 | 684 | C | 0.1 | 0.14 | 8.6 | 68 | 68 |
| 180 | 6.44 | 0.015 | 590 | C | 0.1 | 0.14 | 8.6 | 66 | 66 |
| 181 | 1.87 | 0.015 | 175 | C | 0.1 | 0.14 | 8.6 | 67 | 67 |
| 182 | 1.61 | 0.015 | 215 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 183 | 14.14 | 0.015 | 683 | C | 0.1 | 0.14 | 8.6 | 70 | 70 |
| 184 | 5.84 | 0.01 | 425 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 185 | 1.53 | 0.01 | 282 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 186 | 2.40 | 0.07 | 115 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 187 | 11.14 | 0.02 | 930 | C | 0.1 | 0.14 | 8.6 | 45 | 58 |
| 188 | 0.66 | 0.01 | 768 | C | 0.1 | 0.14 | 8.6 | 65 | 68 |
| 189 | 4.93 | 0.016 | 945 | C | 0.1 | 0.14 | 8.6 | 57 | 71 |
| 190 | 3.18 | 0.02 | 368 | C | 0.1 | 0.14 | 8.6 | 40 | 40 |
| 191 | 0.54 | 0.015 | 120 | C | 0.1 | 0.14 | 8.6 | 40 | 40 |
| 192 | 1.18 | 0.02 | 140 | C | 0.1 | 0.14 | 8.6 | 39 | 39 |
| 193 | 0.59 | 0.015 | 208 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 194 | 0.22 | 0.015 | 75 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 195 | 47.85 | 0.14 | 3975 | B/C | 0.15 | 0.155 | 7.6 | 6 | 38 |
| 196 | 7.75 | 0.02 | 400 | C | 0.1 | 0.14 | 8.6 | 45 | 53 |
| 197 | 10.09 | 0.13 | 65 | B/C | 0.15 | 0.155 | 7.6 | 38 | 41 |
| 198 | 29.37 | 0.03 | 950 | C | 0.1 | 0.14 | 8.6 | 58 | 63 |
| 199 | 74.36 | 0.045 | 5800 | C | 0.1 | 0.14 | 8.6 | 27 | 38 |
| 200 | 34.09 | 0.12 | 2220 | C | 0.1 | 0.14 | 8.6 | 2 | 38 |
| 201 | 59.90 | 0.105 | 4320 | C | 0.1 | 0.14 | 8.6 | 2 | 41 |
| 202 | 68.16 | 0.3 | 4100 | B/C | 0.15 | 0.155 | 7.6 | 0 | 38 |
| 203 | 33.47 | 0.11 | 1950 | C | 0.1 | 0.14 | 8.6 | 13 | 46 |
| 204 | 38.36 | 0.26 | 3200 | C | 0.1 | 0.14 | 8.6 | 3 | 39 |
| 205 | 97.81 | 0.0475 | 4670 | C | 0.1 | 0.14 | 8.6 | 27 | 46 |
| 206 | 69.96 | 0.0475 | 3215 | C | 0.1 | 0.14 | 8.6 | 27 | 46 |

*The sub-subasin slope reflects the average along the pathway of overland flow to inlet locations.

**Irregularly shaped subcatchments with drainage channels off-centre can be handled by computing a skew factor:

Sk = (A2 - A1) / A

W = (2 - Sk) * L

*where*

Sk = skew factor

A1 = area to one side of the channel

A2 = area to other side of the channel

A = total area

W = subcatchment width

L = length of main drainage channel

# Appendix 5.2

Appendix 5.2 currently under development

# Appendix 5.3

Appendix 5.3 XPSWMM Input Parameters For Drainage Infrastructures for Falling Run Watershed



In Areas Of Concern

| Hickory Vale Drive side streets | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (H x W) | Roughness | Material | Shape | Length (ft) |
| 8 | 2 | 0.013 | RCP | Circular | 36 |
| 10 | 2 | 0.013 | RCP | Circular | 243 |
| 12 | 2 | 0.013 | RCP | Circular | 113 |
| 13 | 2 | 0.013 | RCP | Circular | 71 |
| 14 | 2 | 0.013 | RCP | Circular | 77 |
| 15 | 2 | 0.013 | RCP | Circular | 171 |
| 26 | 2 | 0.013 | RCP | Circular | 32 |
| 27 | 2 | 0.013 | RCP | Circular | 168 |
| 28 | 2 | 0.013 | RCP | Circular | 166 |

| Charlestown Road near Coes Lane | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 1 | 3 | 0.013 | RCP | Circular | 18 |
| 2 | 3 | 0.013 | RCP | Circular | 90 |
| 7 | 3 | 0.022 | CMP | Circular | 262 |
| 19 | 2.5 | 0.013 | RCP | Circular | 55 |
| 20 | 3.17 x 2 | 0.022 | CMP | Elliptical | 67 |
| 21 | 3.17 x 2 | 0.013 | RCP | Elliptical | 84 |
| 22 | 3.58 x 5.67 | 0.013 | RCP | Rectangular | 130 |
| 23 | 5.67 x 3.58 | 0.013 | RCP | Elliptical | 61 |
| 24 | 2 | 0.013 | RCP | Circular | 85 |
| 25 | 2 | 0.013 | RCP | Circular | 181 |
| 38 | 3 | 0.013 | RCP | Circular | 413 |
| 39 | 2.5 | 0.013 | RCP | Circular | 71 |
| 40 | 2.5 | 0.013 | RCP | Circular | 77 |
| 41 | 3 | 0.013 | RCP | Circular | 125 |
| 42 | 3 | 0.013 | RCP | Circular | 249 |
| 43 | 3 | 0.013 | RCP | Circular | 369 |
| 44 | 2 | 0.013 | RCP | Circular | 33 |

In Areas Of Concern

| Culbertson Ave - Market Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 1 | 2 | 0.013 | RCP | Circular | 285 |
| 2 | 3 x 4.875 | 0.015 | Brick | Arch | 176 |
| 3 | 2 | 0.013 | RCP | Circular | 158 |
| 4 | 2 | 0.013 | RCP | Circular | 43 |
| 5 | 2 | 0.013 | RCP | Circular | 328 |
| 6 | 2 | 0.015 | Brick | Circular | 363 |
| 7 | 2 | 0.015 | Brick | Circular | 25 |
| 8 | 2 | 0.015 | Brick | Circular | 649 |
| 9 | 2 | 0.013 | RCP | Circular | 342 |
| 10 | 2 | 0.013 | RCP | Circular | 414 |
| 11 | 2 | 0.013 | RCP | Circular | 300 |
| 12 | 2 | 0.013 | RCP | Circular | 58 |
| 13 | 2 | 0.013 | RCP | Circular | 631 |
| 14 | 2 | 0.013 | RCP | Circular | 614 |
| 15 | 2 | 0.013 | RCP | Circular | 290 |
| 16 | 2 | 0.013 | RCP | Circular | 368 |
| 17 | 2 | 0.013 | RCP | Circular | 37 |
| 18 | 2 | 0.013 | RCP | Circular | 167 |
| 19 | 2 | 0.013 | RCP | Circular | 259 |
| 20 | 2 | 0.013 | RCP | Circular | 274 |
| 21 | 2 | 0.013 | RCP | Circular | 50 |
| 22 | 2 | 0.013 | RCP | Circular | 306 |
| 23 | 2 | 0.013 | RCP | Circular | 30 |
| 24 | 2 | 0.013 | RCP | Circular | 31 |
| 25 | 2 | 0.013 | RCP | Circular | 350 |
| 26 | 2 | 0.013 | RCP | Circular | 218 |
| 27 | 2 | 0.013 | RCP | Circular | 178 |
| 28 | 2 | 0.013 | RCP | Circular | 299 |
| 29 | 3 x 4.875 | 0.015 | Brick | Arch | 28 |
| 30 | 3 x 4.875 | 0.015 | Brick | Arch | 363 |
| 31 | 2 | 0.013 | RCP | Circular | 304 |
| 32 | 2 | 0.013 | RCP | Circular | 48 |
| 33 | 2 | 0.015 | Brick | Circular | 94 |
| 34 | 2 | 0.015 | Brick | Circular | 143 |
| 35 | 2 | 0.015 | Brick | Circular | 299 |
| 36 | 2 | 0.013 | RCP | Circular | 332 |
| 37 | 2 | 0.013 | RCP | Circular | 53 |
| 38 | 2 | 0.013 | RCP | Circular | 10 |
| 39 | 2 | 0.013 | RCP | Circular | 281 |
| 40 | 2 | 0.013 | RCP | Circular | 255 |
| 41 | 2 | 0.013 | RCP | Circular | 25 |
| 42 | 2 | 0.013 | RCP | Circular | 286 |
| 43 | 2 | 0.013 | RCP | Circular | 27 |
| 44 | 2 | 0.013 | RCP | Circular | 337 |
| 45 | 2 | 0.013 | RCP | Circular | 12 |
| 46 | 2 | 0.013 | RCP | Circular | 303 |
| 47 | 2 | 0.013 | RCP | Circular | 148 |
| 48 | 3 x 4.875 | 0.015 | Brick | Arch | 706 |
| 49 | 2 | 0.013 | RCP | Circular | 31 |
| 50 | 2 | 0.013 | RCP | Circular | 117 |

In Areas Of Concern

| Culbertson Ave - Market Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 51 | 3 x 4.875 | 0.015 | Brick | Arch | 157 |
| 52 | 3 x 4.875 | 0.015 | Brick | Arch | 22 |
| 53 | 3 x 4.875 | 0.015 | Brick | Arch | 339 |
| 54 | 3 x 4.875 | 0.015 | Brick | Arch | 40 |
| 55 | 2 | 0.013 | RCP | Circular | 26 |
| 67 | 2 | 0.013 | RCP | Circular | 629 |
| 68 | 2 | 0.013 | RCP | Circular | 31 |
| 69 | 2 | 0.013 | RCP | Circular | 26 |
| 70 | 2 | 0.013 | RCP | Circular | 356 |
| 71 | 2 | 0.013 | RCP | Circular | 18 |
| 72 | 2 | 0.013 | RCP | Circular | 46 |
| 73 | 2 | 0.013 | RCP | Circular | 29 |

| 13th Street - Vincennes Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 1 | 2 | 0.01 | PVC | Circular | 57 |
| 2 | 2 | 0.01 | PVC | Circular | 36 |
| 3 | 2 | 0.013 | RCP | Circular | 82 |
| 4 | 2 | 0.014 | VCP | Circular | 32 |
| 5 | 2 | 0.013 | RCP | Circular | 315 |
| 10 | 3 | 0.015 | Brick | Circular | 137 |
| 14 | 7 x 7 | 0.013 | RCP | Rectangular | 18 |
| 15 | 7 x 7 | 0.013 | RCP | Rectangular | 16 |
| 16 | 7 x 7 | 0.013 | RCP | Rectangular | 165 |
| 17 | 7 x 7 | 0.013 | RCP | Rectangular | 351 |
| 18 | 2 | 0.013 | RCP | Circular | 20 |
| 19 | 3 | 0.015 | Brick | Circular | 269 |
| 20 | 2 | 0.014 | VCP | Circular | 382 |
| 21 | 7 | 0.015 | Brick | Circular | 435 |
| 22 | 2 | 0.013 | RCP | Circular | 26 |
| 23 | 2 | 0.013 | RCP | Circular | 35 |
| 24 | 2 | 0.013 | RCP | Circular | 4 |
| 25 | 2 | 0.013 | RCP | Circular | 285 |
| 26 | 2 | 0.014 | VCP | Circular | 303 |
| 30 | 2 | 0.013 | RCP | Circular | 69 |
| 31 | 2 | 0.013 | RCP | Circular | 238 |
| 32 | 2 | 0.013 | RCP | Circular | 345 |
| 33 | 3 | 0.015 | Brick | Circular | 333 |
| 34 | 3 | 0.015 | Brick | Circular | 70 |
| 35 | 2 | 0.013 | RCP | Circular | 49 |
| 36 | 2 | 0.013 | RCP | Circular | 416 |
| 37 | 2 | 0.013 | RCP | Circular | 53 |
| 38 | 3 | 0.015 | Brick | Circular | 23 |
| 39 | 3 | 0.015 | Brick | Circular | 35 |
| 40 | 2 | 0.013 | RCP | Circular | 393 |
| 41 | 2 | 0.013 | RCP | Circular | 74 |
| 42 | 3 | 0.015 | Brick | Circular | 64 |
| 43 | 3 | 0.015 | Brick | Circular | 510 |

In Areas Of Concern

| 13th Street - Vincennes Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 44 | 3 | 0.015 | Brick | Circular | 37 |
| 45 | 3 | 0.015 | Brick | Circular | 17 |
| 46 | 3 | 0.015 | Brick | Circular | 403 |
| 47 | 2 | 0.013 | RCP | Circular | 339 |
| 48 | 2 | 0.013 | RCP | Circular | 26 |
| 49 | 2 | 0.013 | RCP | Circular | 43 |
| 50 | 2 | 0.013 | RCP | Circular | 35 |
| 51 | 2 | 0.013 | RCP | Circular | 22 |
| 52 | 2 | 0.013 | RCP | Circular | 34 |
| 53 | 2 | 0.013 | RCP | Circular | 404 |
| 54 | 2 | 0.013 | RCP | Circular | 382 |
| 55 | 2 | 0.013 | RCP | Circular | 378 |
| 56 | 7 x 7 | 0.013 | RCP | Rectangular | 53 |
| 57 | 2 | 0.014 | VCP | Circular | 677 |
| 58 | 2 | 0.014 | VCP | Circular | 472 |
| 59 | 2 | 0.014 | VCP | Circular | 198 |
| 60 | 2 | 0.014 | VCP | Circular | 22 |
| 61 | 2 | 0.014 | VCP | Circular | 331 |
| 62 | 2 | 0.014 | VCP | Circular | 336 |
| 63 | 2 | 0.014 | VCP | Circular | 28 |
| 64 | 2 | 0.013 | RCP | Circular | 376 |
| 65 | 2 | 0.013 | RCP | Circular | 348 |
| 66 | 2 | 0.013 | RCP | Circular | 132 |
| 67 | 2 | 0.013 | RCP | Circular | 49 |
| 68 | 2 | 0.013 | RCP | Circular | 162 |
| 69 | 2 | 0.013 | RCP | Circular | 11 |
| 70 | 2 | 0.013 | RCP | Circular | 41 |
| 71 | 2 | 0.013 | RCP | Circular | 554 |
| 72 | 2 | 0.013 | RCP | Circular | 303 |
| 73 | 2 | 0.013 | RCP | Circular | 399 |
| 74 | 2 | 0.013 | RCP | Circular | 26 |
| 75 | 2 | 0.013 | RCP | Circular | 351 |
| 76 | 2 | 0.013 | RCP | Circular | 66 |
| 77 | 2 | 0.013 | RCP | Circular | 137 |
| 78 | 2 | 0.013 | RCP | Circular | 22 |
| 79 | 2 | 0.013 | RCP | Circular | 212 |
| 80 | 2 | 0.013 | RCP | Circular | 695 |
| 81 | 2 | 0.013 | RCP | Circular | 664 |
| 82 | 2 | 0.014 | VCP | Circular | 8 |
| 83 | 2 | 0.014 | VCP | Circular | 21 |

In Potential Areas Of Concern

| Aebersold Drive | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 6 | 2 | 0.02 | ADS | Circular | 181 |
| 7 | 2 | 0.014 | VCP | Circular | 35 |
| 8 | 3 | 0.022 | CMP | Circular | 305 |
| 9 | 2 | 0.014 | VCP | Circular | 234 |
| 11 | 3 | 0.022 | CMP | Circular | 59 |
| 12 | 3 | 0.022 | CMP | Circular | 143 |
| 13 | 3 | 0.022 | CMP | Circular | 395 |
| 27 | 2 | 0.022 | CMP | Circular | 73 |
| 28 | 2 | 0.022 | CMP | Circular | 13 |
| 29 | 3 | 0.022 | CMP | Circular | 133 |

| Silver Street and Roanoke Avenue | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 11 | 5 | 0.013 | RCP | Circular | 446 |
| 16 | 3 | 0.013 | RCP | Circular | 162 |
| 17 | 3 | 0.013 | RCP | Circular | 354 |
| 30 | 5 | 0.013 | RCP | Circular | 207 |
| 31 | 3 | 0.013 | RCP | Circular | 83 |
| 45 | 5 | 0.013 | RCP | Circular | 661 |
| 46 | 5 | 0.013 | RCP | Circular | 185 |
| 47 | 2 | 0.013 | RCP | Circular | 27 |
| 48 | 2 | 0.013 | RCP | Circular | 130 |
| 49 | 2 | 0.013 | RCP | Circular | 827 |
| 50 | 3 | 0.013 | RCP | Circular | 321 |
| 51 | 3 | 0.013 | RCP | Circular | 79 |
| 52 | 3 | 0.013 | RCP | Circular | 30 |
| 53 | 3 | 0.013 | RCP | Circular | 343 |

| South of McDonald Lane | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 34 | 2 | 0.014 | VCP | Circular | 33 |
| 33 | 2 | 0.013 | RCP | Circular | 437 |

In Potential Areas Of Concern

| Brookview Drive - McDonald Lane | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 3 | 1.75 | 0.013 | RCP | Circular | 180 |
| 4 | 1.75 | 0.013 | RCP | Circular | 104 |
| 5 | 1.75 | 0.013 | RCP | Circular | 134 |
| 6 | 2 | 0.013 | RCP | Circular | 30 |
| 9 | 1.75 | 0.013 | RCP | Circular | 55 |
| 18 | 3.5 | 0.022 | CMP | Circular | 95 |
| 32 | 3.5 | 0.022 | CMP | Circular | 26 |
| 35 | 2 | 0.013 | RCP | Circular | 32 |
| 36 | 2 | 0.013 | RCP | Circular | 9 |
| 37 | 2 | 0.013 | RCP | Circular | 29 |

| Cherry Hill Road and West 9th Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 1 | 5 | 0.013 | RCP | Circular | 100 |
| 2 | 5 | 0.013 | RCP | Circular | 220 |
| 3 | 5 | 0.013 | RCP | Circular | 16 |
| 4 | 5 | 0.013 | RCP | Circular | 34 |
| 5 | 5 | 0.013 | RCP | Circular | 18 |
| 6 | 5 | 0.013 | RCP | Circular | 103 |
| 7 | 5 | 0.013 | RCP | Circular | 121 |
| 8 | 5 | 0.013 | RCP | Circular | 45 |
| 9 | 4 | 0.013 | RCP | Circular | 273 |
| 10 | 4 | 0.013 | RCP | Circular | 54 |
| 11 | 2.5 | 0.013 | RCP | Circular | 243 |
| 12 | 2.5 | 0.013 | RCP | Circular | 47 |
| 13 | 2.5 | 0.013 | RCP | Circular | 133 |
| 14 | 2.5 | 0.013 | RCP | Circular | 94 |
| 15 | 2.5 | 0.013 | RCP | Circular | 131 |
| 16 | 2.5 | 0.013 | RCP | Circular | 23 |

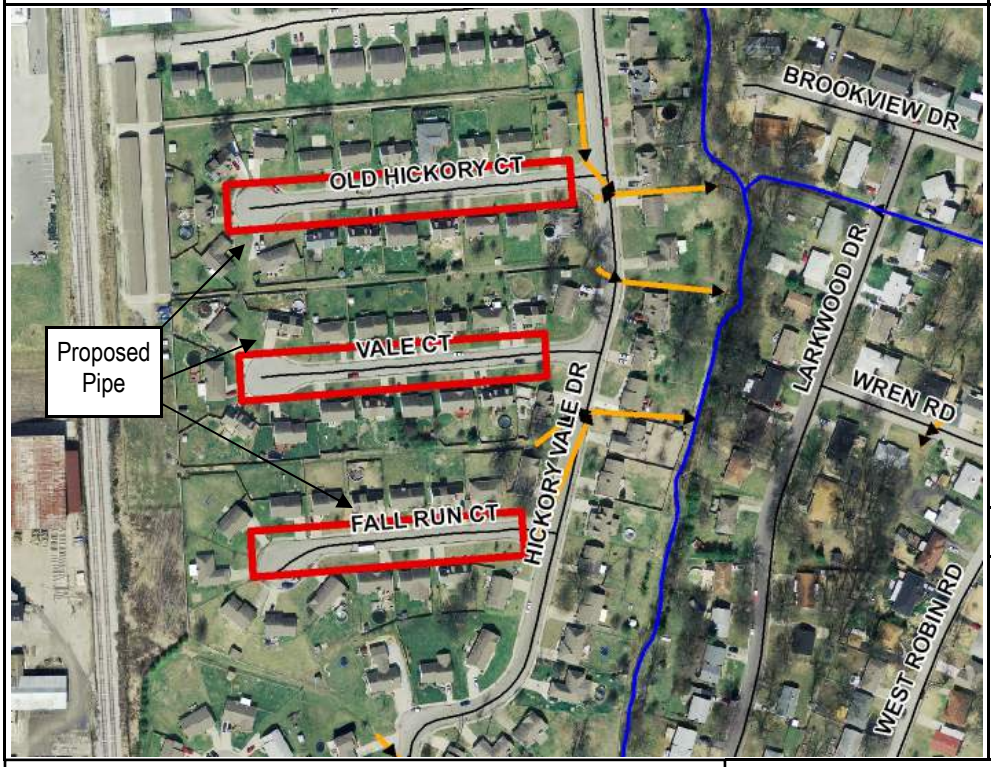
# Appendix 5.4

# Stormwater Master Planning
# City of New Albany

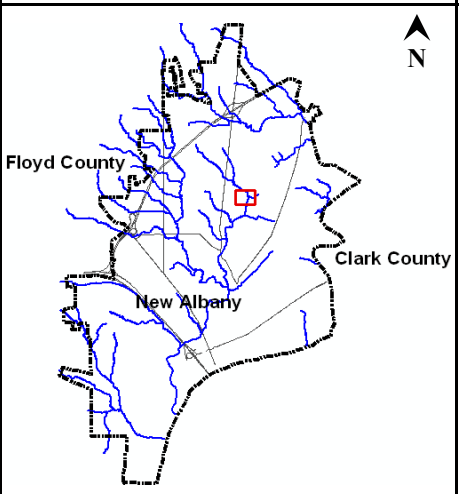
Capital Improvement

## Hickory Vale Drive Side Streets Fact Sheet

### Project Map




### Key Map




### Site Description

Three cul-de-sac streets run perpendicular into Hickory Vale Drive. The area lacks adequate stormwater infrastructure.
City Council District 6.

### Current Concerns

Stormwater runoff from the front of the homes in the cul-de-sac is not able to reach the catchbasins at Hickory Vale Drive and therefore ponds in the cul-de-sac and along the curb and gutter.

### Site Picture


### Recommended Improvements

- Install catchbasins and storm sewers along roads to provide effective drainage.
- Routine maintenance plan of stormwater infrastructure

### Scope of Work

- Right-of-way requirements
- Install 36 catchbasins
- Construct 3,050 linear feet of storm sewer

### Probable Cost

$451,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

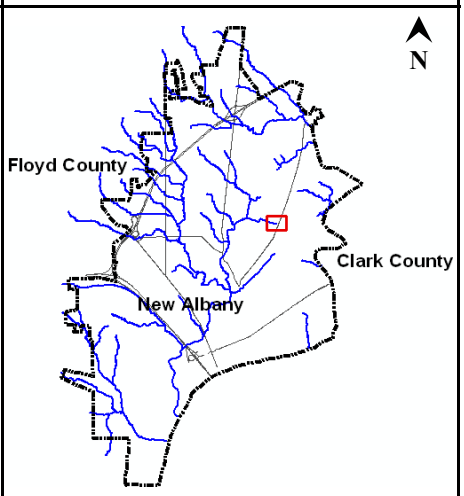
# Stormwater Master Planning
# City of New Albany

Capital Improvement

## Charlestown Road near Coes Lane Fact Sheet

### Project Map


### Key Map




### Site Description

Surface runoff drains off Charlestown Road from the south and north to a low point near Coes Lane. On boundary of

City Council Districts 5 and 6.

### Current Concerns

Lack of stormwater collection system is causing flooding to some of the businesses along Charlestown Road.

### Site Picture

### Recommended Improvements

- Install curb and gutter system along Charlestown Road.
- Update and install additional catchbasins to pipe running parallel to Charlestown Road.
- Routine maintenance plan of stormwater infrastructure

### Scope of Work

- Right-of-way requirements
- Existing infrastructure removal
- 8 catchbasins to be replaced/installed
- Construct 700 linear feet of storm sewer

### Probable Cost

$142,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

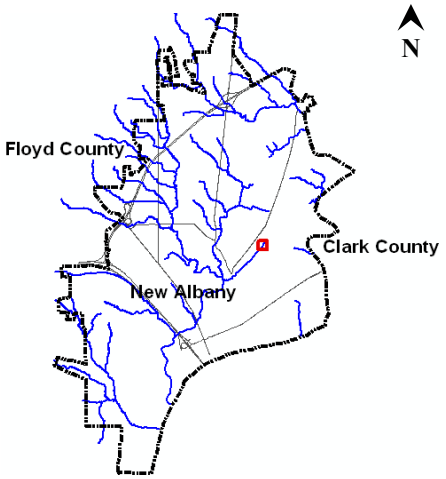
# Stormwater Master Planning
# City of New Albany

Capital Improvement

## Carlton Drive Fact Sheet

**Project Map**


**Key Map**




**Site Description**

Carlton Drive currently drains by curb and gutter to a pipe that runs under Silver St and outlets to a ditch adjacent to St. Mary's Catholic Cemetery.
City Council District 4.

**Site Pictures**


**Current Concerns**

Flooding has been reported by several homes along Carlton Drive and outlet pipe under Silver Street is almost completely blocked with sediment.

**Scope of Work**

- Construct 1,500 linear feet of storm sewer
- Install 22 catchbasins
- Provide an improved outlet

**Cost $283,000**

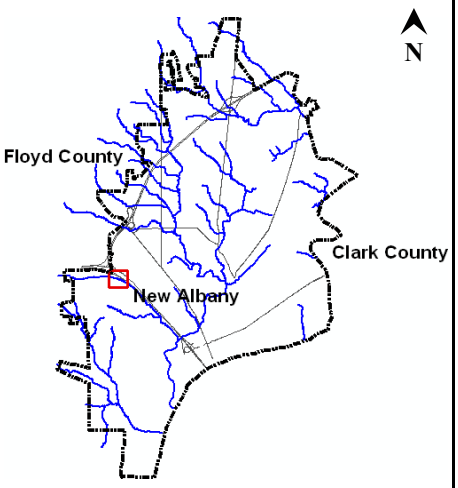
# Stormwater Master Planning
# City of New Albany

Capital Improvement

## Captain Frank Road Fact Sheet

### Project Map

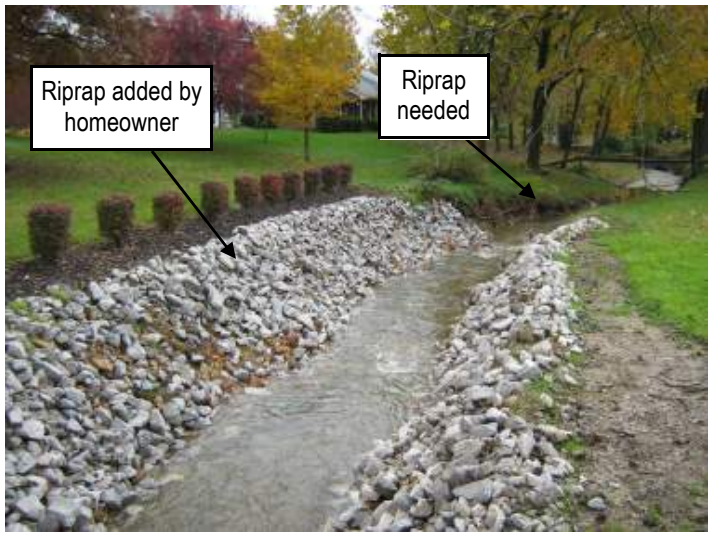

### Key Map




### Site Description

A tributary of Falling Run flows southeast between Valley View Road and Captains Nook. City Council District 2.

### Site Pictures


### Current Concerns

Significant erosion is present within the tributary near homes on Captain Frank Road due to the steep slopes and high velocities caused by the surrounding hills. A homeowner has installed rip-rap for stream bank stabilization, but additional riprap is needed for other homeowners.

### Scope of Work

- Construct 9,600 square feet of plantable segmented retaining wall
- Install 6 catchbasins

**Cost $358,000**

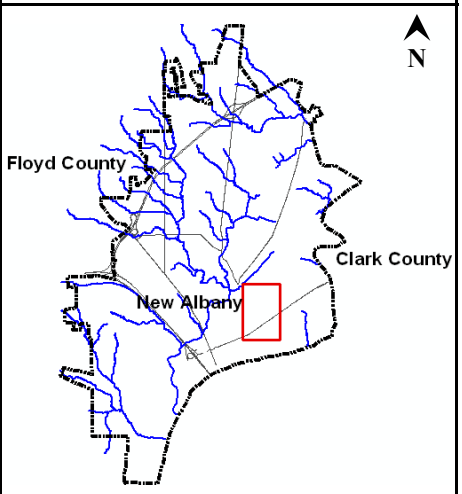
# Stormwater Master Planning
# City of New Albany

Capital Improvement

## 13th - Vincennes Street Fact Sheet

### Project Map


### Key Map




### Site Description

The stormwater system between 13th and Vincennes Street is curb and gutter with catchbasins and pipes draining to a brick culvert on 15th street. City Council District 3 and 5.

### Current Concerns

Complaint data in the area indicates that some of the catchbasins have deteriorated causing additional flooding or flooding is occurring where catchbasins do not exist. Modeling also indicates flooding throughout the system due to undersized pipes.

### Site Picture

### Recommended Improvements

- Replacement and rehabilitation of deteriorated catchbasins
- Rehabilitation of existing storm sewers
- Construct relief sewers
- Routine maintenance plan of stormwater infrastructure

### Scope of Work

- Right-of-way requirements
- Existing infrastructure removal
- 75 catchbasins to be replaced
- 4,800 linear feet of storm sewers

### Probable Cost

$1,139,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

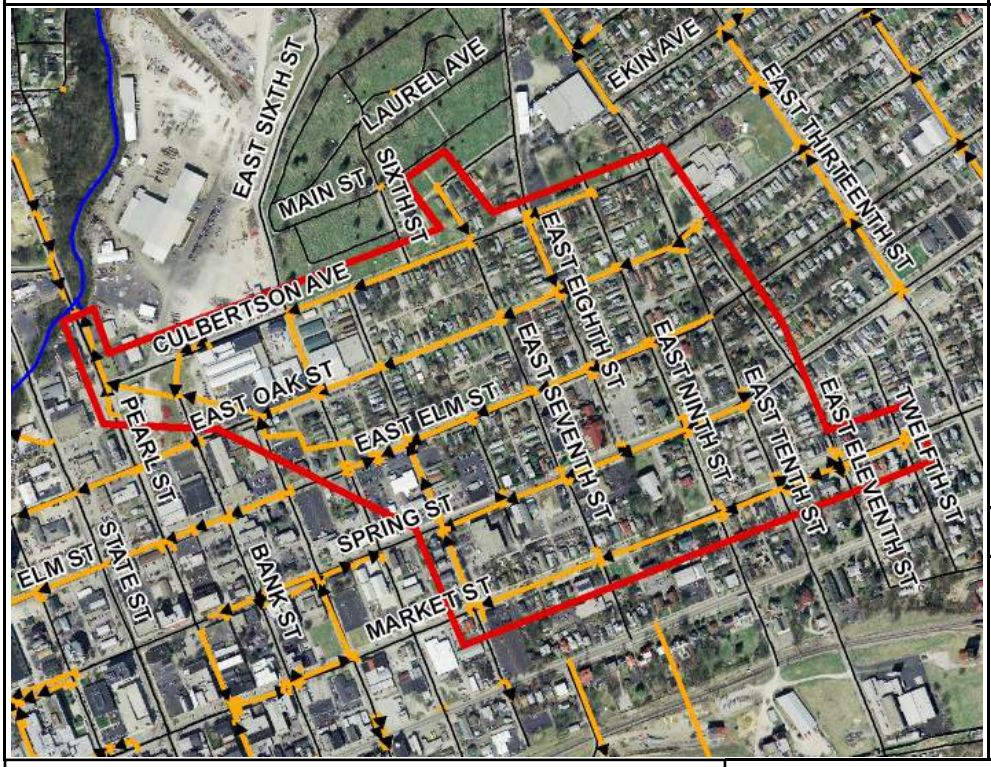
*Costs reflect replacement of entire system. A phased approach may be more financially feasible.*

# Stormwater Master Planning
# City of New Albany

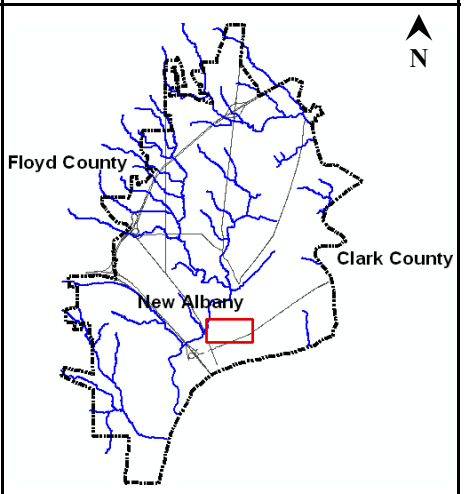
Capital Improvement

## Culbertson - Market Street Fact Sheet

### Project Map




### Key Map




### Site Description

The stormwater system between Culbertson and Market Street is curb and gutter with catchbasins and pipes draining to a brick storm sewer to Falling Run. City Council District 3.

### Current Concerns

Complaint data in the area indicates that some of the catchbasins have deteriorated causing additional flooding or flooding is occurring where catchbasins do not exist. Modeling also indicates flooding throughout the system due to undersized pipes.

### Site Picture

### Recommended Improvements

- Replacement of deteriorated catchbasins
- Replace existing undersized pipes with larger pipes
- Routine maintenance plan of stormwater infrastructure

### Scope of Work

- Right-of-way requirements
- Existing infrastructure rehabilitation
- 100 catchbasins to be replaced
- 5,000 linear feet of storm sewers

### Probable Cost

$1,301,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

*Costs reflect replacement of entire system. A phased approach may be more financially feasible.*

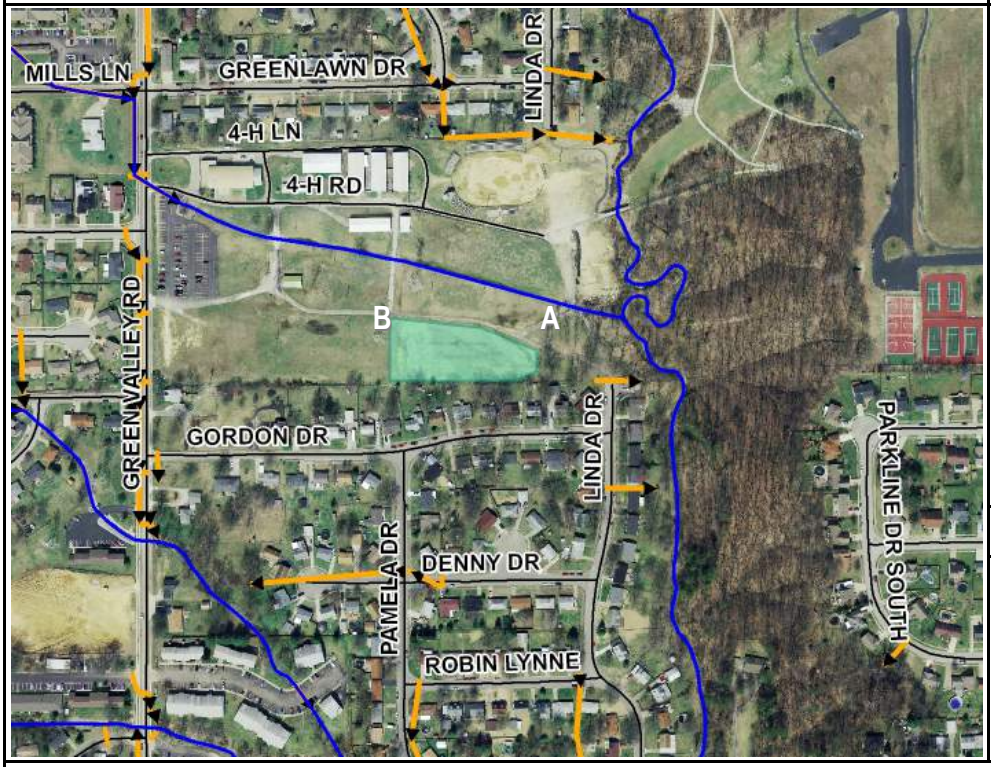
# Appendix 5.5

# Stormwater Master Planning
# City of New Albany

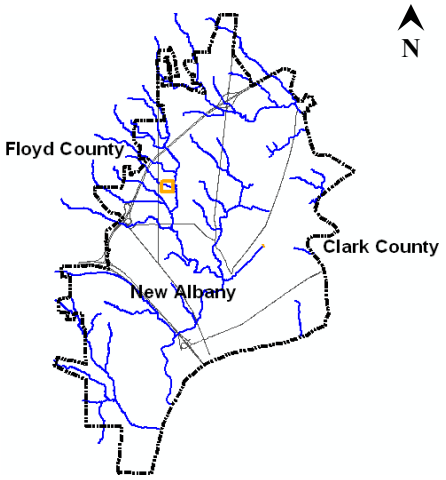
Storage Basin

## 4-H Fairgrounds Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on public property on the 4-H fairgrounds and adjacent to Falling Run. City Council District 2.

### Site Picture


Picture A – Looking southwest at site


Picture B – Looking southeast at site

### Basin Information

Basin Area: 1.3 acres
Basin Volume: 3.5 ac-ft
Contributing Drainage Area: 74 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Public – Floyd County
Modeled: No

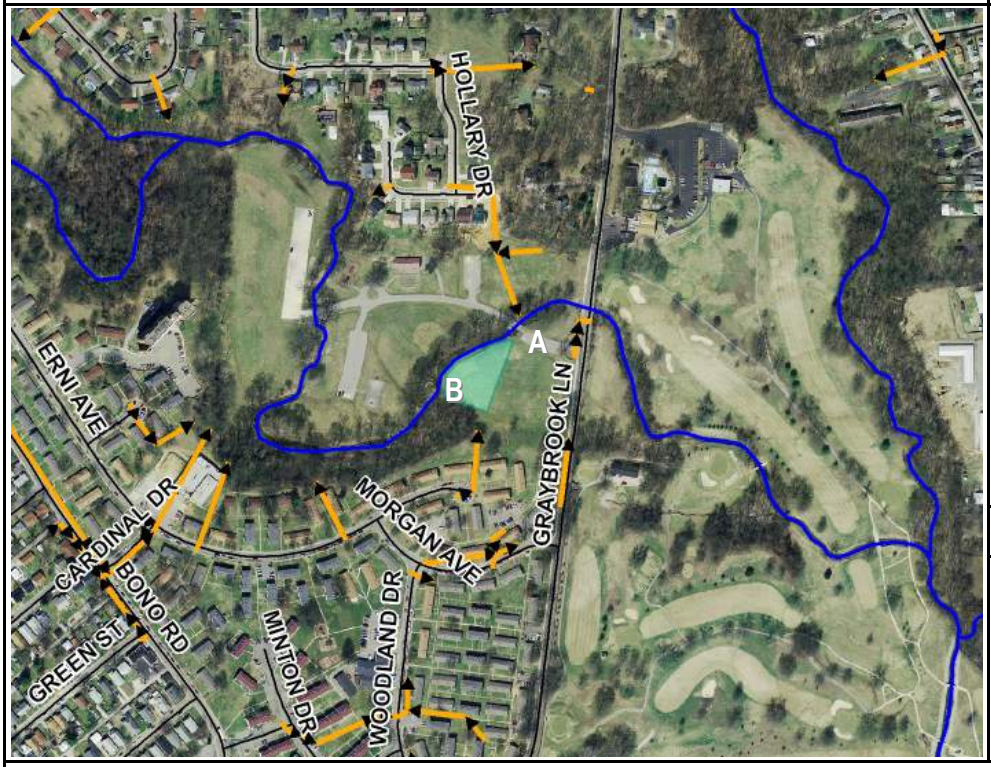
Probable Cost: $233,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

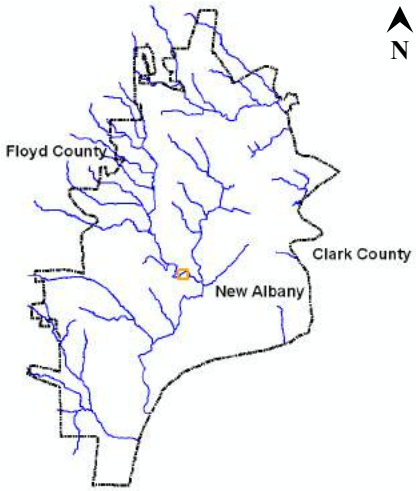
Storage Basin

## Binford Park Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on public property west of Graybrook Lane adjacent to Falling Run. City Council District 1.

### Site Pictures

Picture A – Looking southwest at site

Picture B – Looking southwest upstream

### Basin Information

Basin Area: 0.7 acres
Basin Volume: 2.3 ac-ft
Contributing Drainage Area: 2850 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Public - Floyd County
Modeled: No

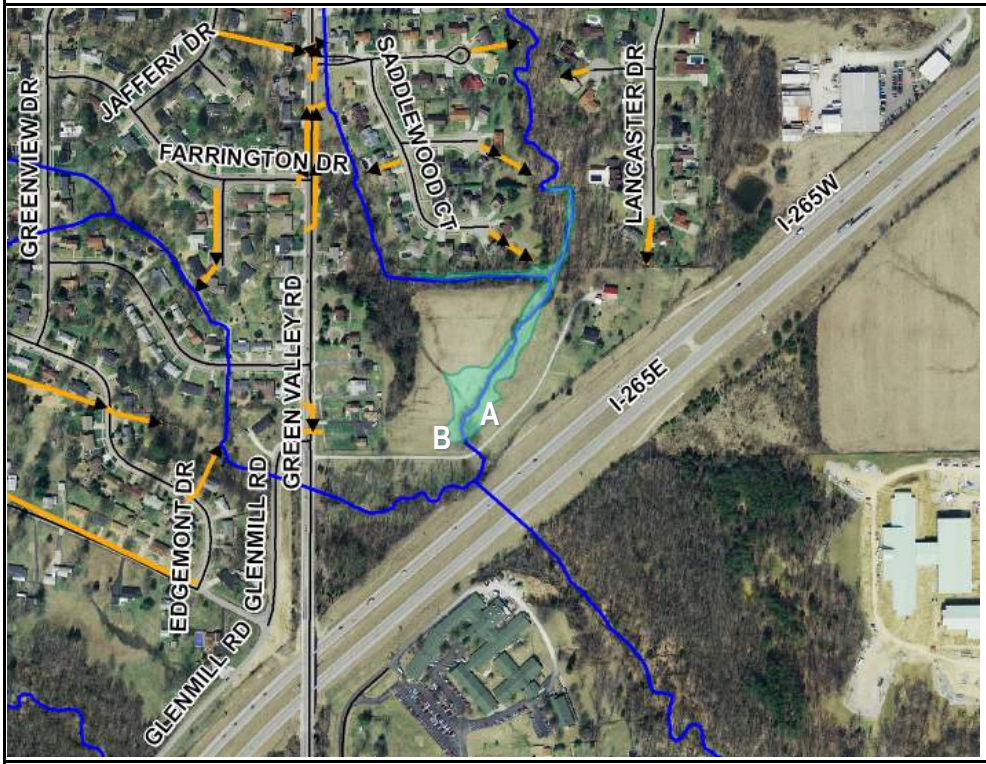
Probable Cost: $173,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

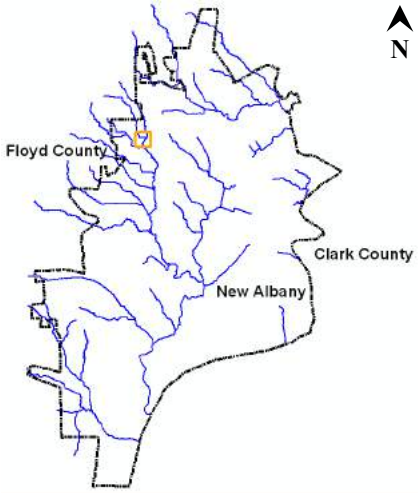
Storage Basin

## East of Green Valley Road Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property east of Green Valley Road and north of Interstate 265 adjacent to Falling Run. City Council District 2.

### Site Pictures

Picture A – Looking northeast upstream at site

Picture B – Looking southeast at road crossing.

### Basin Information

Basin Area: 1.6 acres
Basin Volume: 2.1 ac-ft
Contributing Drainage Area: 143 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Residential
Modeled: No

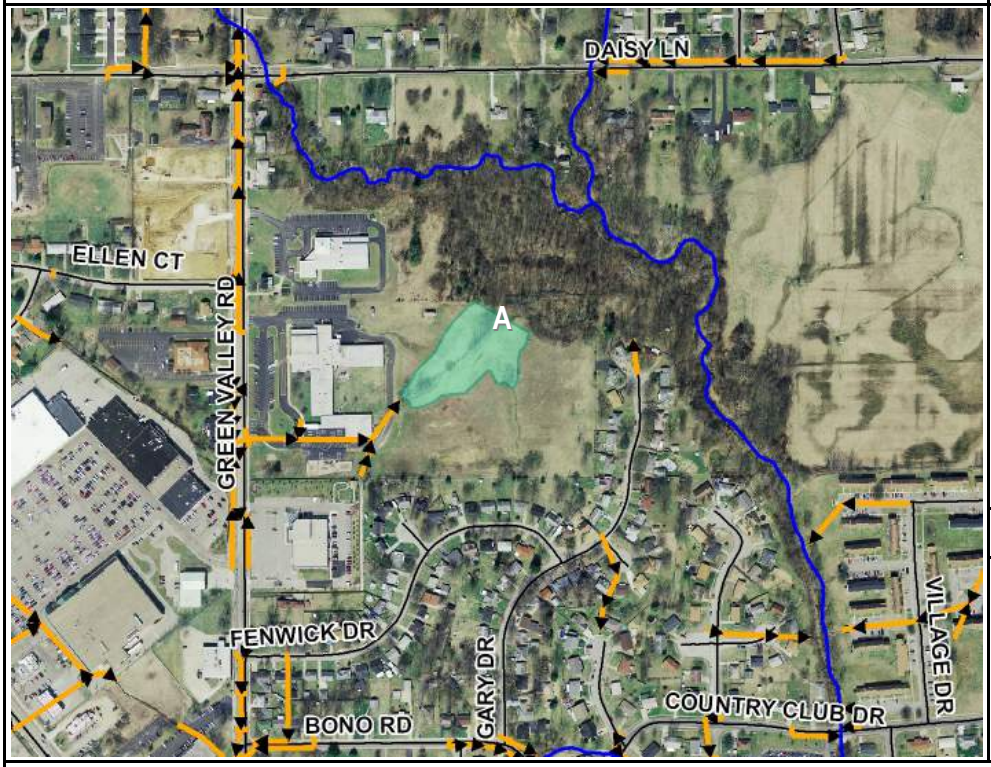
Probable Cost: $233,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

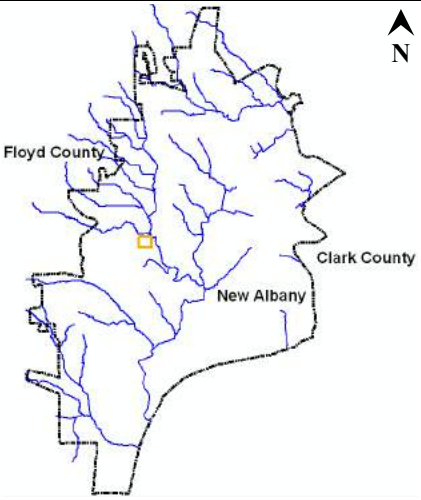
Storage Basin

## Green Valley Elementary Storage Basin Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Located on public property east of Green Valley Road on a tributary draining into Falling Run. Outfall would need dredging to define stream. City Council District 2.

**Site Picture**

Picture A – Looking southwest at site

**Basin Information**

Basin Area: 1.7 acres
Basin Volume: 3.6 ac-ft
Contributing Drainage Area: 32 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Public - School
Modeling: No

Probable Cost: $207,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

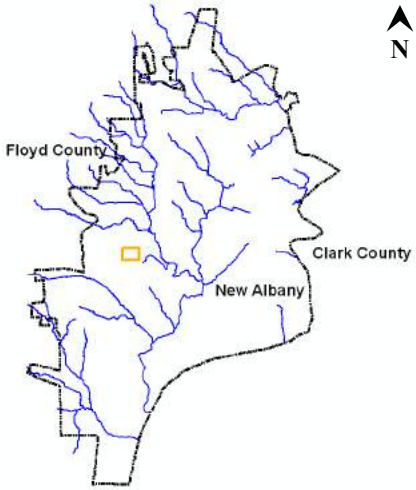
# Stormwater Master Planning
# City of New Albany

Storage Basin

## Kroger Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on public property west of Green Valley Road and upstream of a tributary draining into Falling Run. Heavy vegetation present in basin, needs to be cleared. Possibly needs restrictor plate on outlet. City Council District 2.

### Site Pictures

Picture A – Looking southeast at site

Picture B – Looking northeast at site.

### Basin Information

Basin Area: 1.0 acres
Basin Volume: 3.5 ac-ft
Contributing Drainage Area: 100 acres
Type of Basin: Existing In-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Public - New Albany
Modeled: No

Probable Cost: $20,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

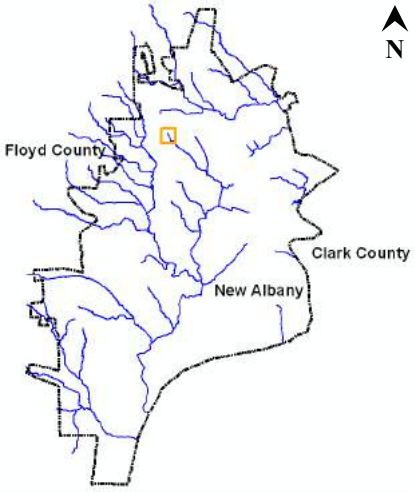
# Stormwater Master Planning
# City of New Albany

Storage Basin

## North of Christian Academy Storage Basin Fact Sheet

**Project Map**


**Key Map**




**Site Description**

Located on private property between I-265 and Christian Academy at the head-waters of Fall Run. City Council District 4.

**Site Picture**


**Basin Information**

Basin Area: 4.7 acres
Basin Volume: 11.2 ac-ft
Contributing Drainage Area: 70 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: Yes

Probable Cost: $493,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

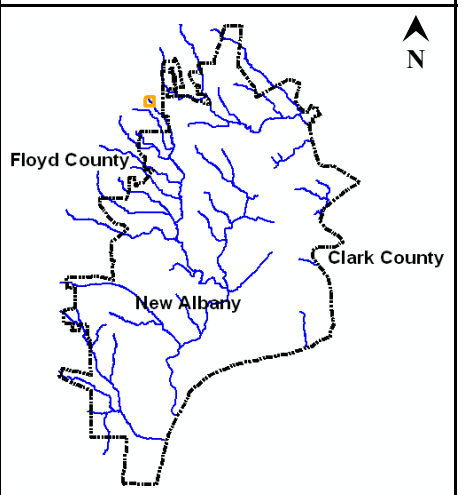
# Stormwater Master Planning
# City of New Albany

Storage Basin

## North of Meide Dr Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on private property west of Green Valley Rd and north of Meide Dr. City Council District 2.

### Site Picture


Picture A – Looking southeast at site


Picture B – Looking southest at site

### Basin Information

Basin Area: 6.1 acres
Basin Volume: 40.2 ac-ft
Contributing Drainage Area: 191 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: No

Property Owner: Private - Commercial
Modeled: Yes

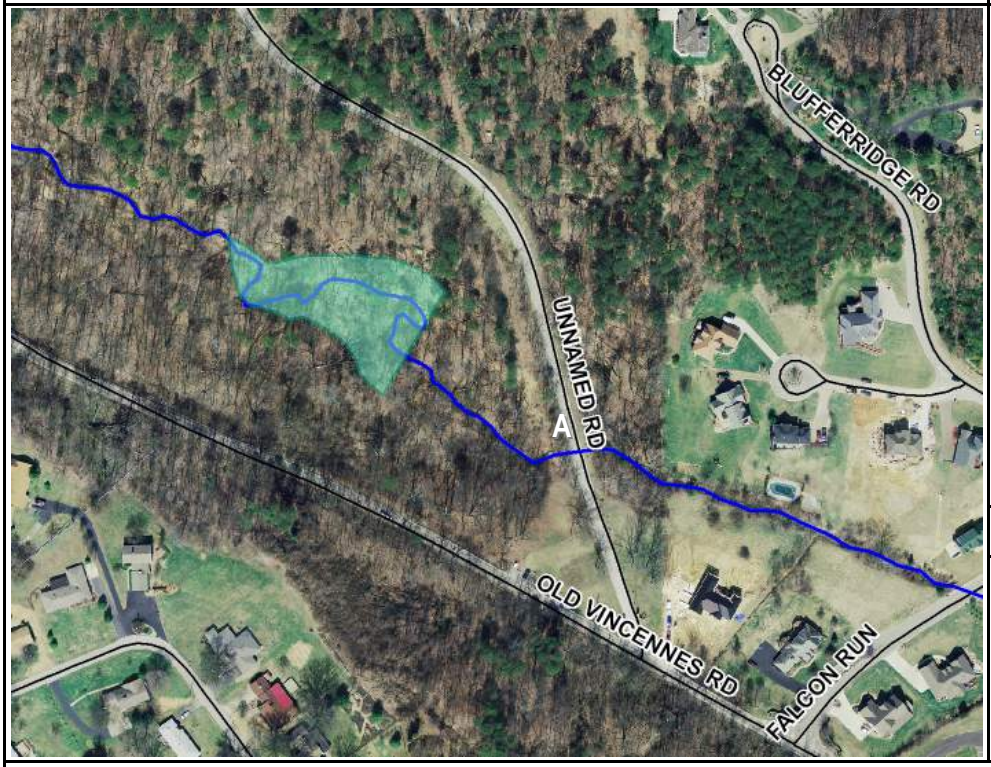
Probable Cost: $417,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

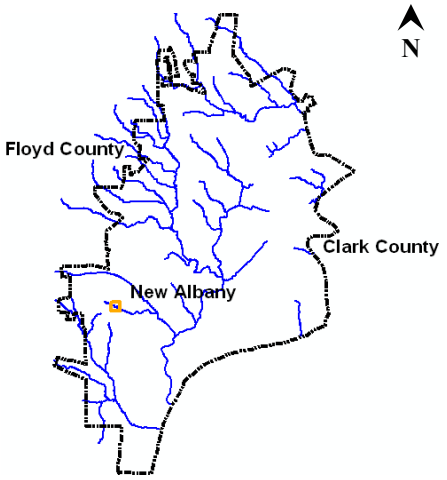
Storage Basin

## North of Old Vincennes Rd Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property on a tributary north of Old Vincennes Road near Falcon Run Drive. City Council District 2.

### Site Picture


Picture A – Looking northwest at site

### Basin Information

Basin Area: 1.6 acres
Basin Volume: 5.4 ac-ft
Contributing Drainage Area: 64 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: Yes

Property Owner: Private - Residential
Modeled: Yes

Probable Cost: $272,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

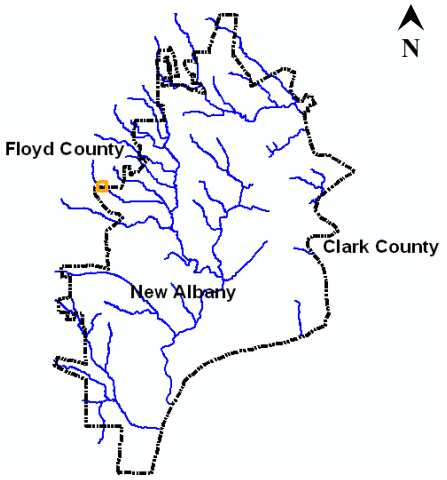
# Stormwater Master Planning
# City of New Albany

Storage Basin

## Northwest of Clearstream Ct Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on private property northwest of Clearstream Ct and north of Paoli Pike. City Council District 2.

### Site Picture


Picture A – Looking north at site


Picture A – Looking east at site

### Basin Information

Basin Area: 2.5 acres
Basin Volume: 18.7 ac-ft
Contributing Drainage Area: 115 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: Yes

Property Owner: Private - Residential
Modeled: Yes

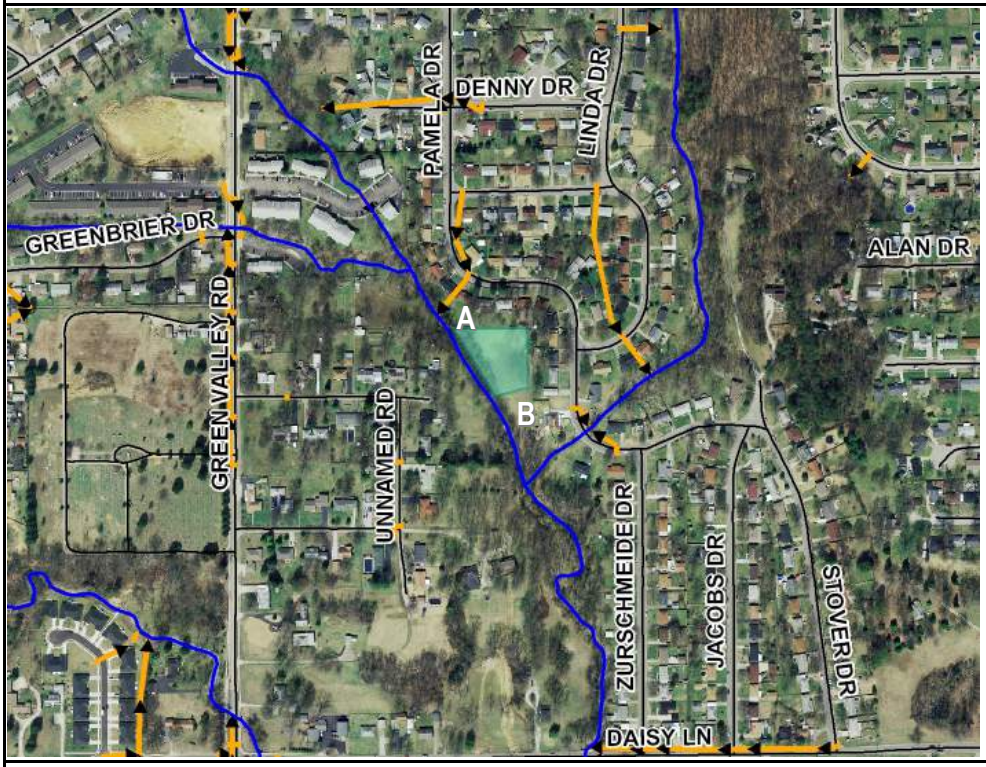
Probable Cost: $427,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

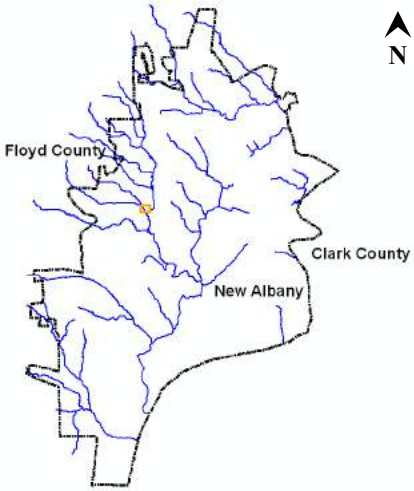
Storage Basin

## Pamela Drive Storage Basin Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Located on private property west of Pamela Drive adjacent to Green Run. Site has depression area may have been existing detention basin before. City Council District 2.

**Site Pictures**

Picture A – Looking southeast at site

Picture B – Looking northwest at site

**Basin Information**

Basin Area: 0.9 acres
Basin Volume: 3.0 ac-ft
Contributing Drainage Area: 491 acres
Type of Basin: Side Saddle (Off-Line)
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Unknown
Modeled: No

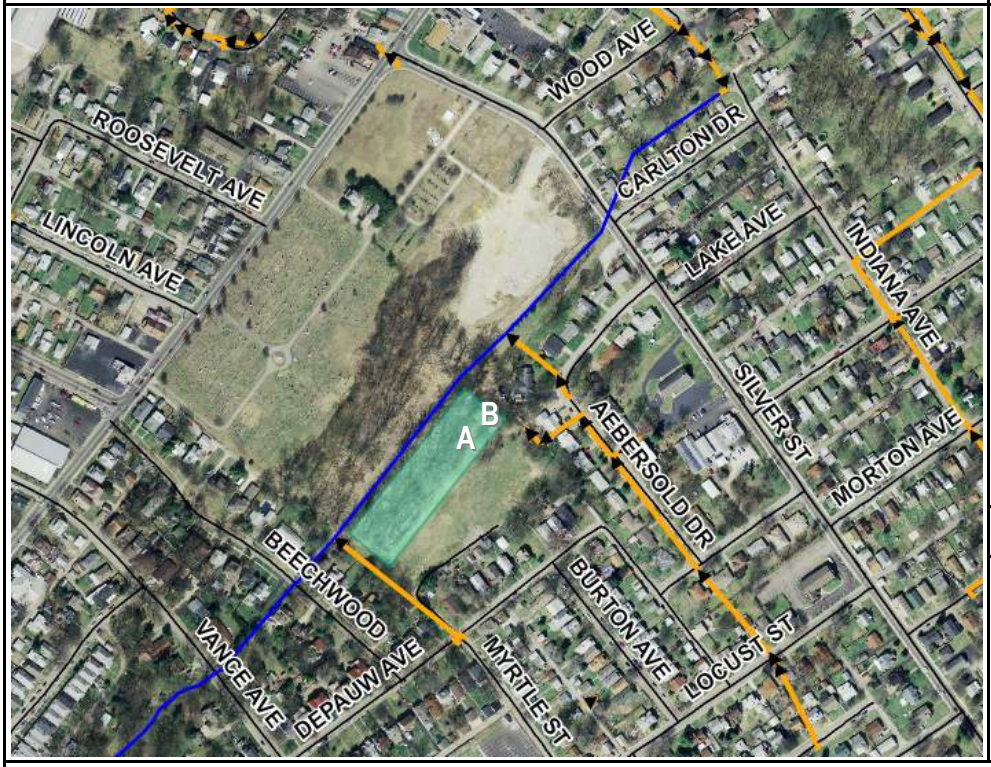
Probable Cost: $206,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

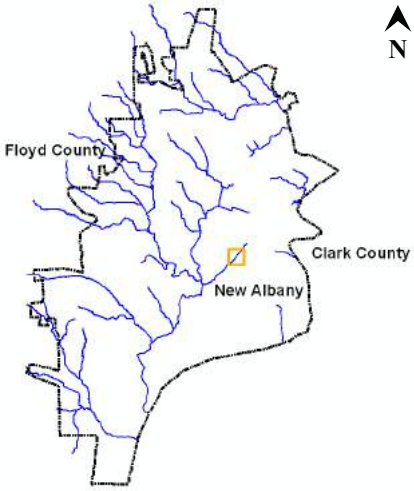
Storage Basin

## Silver Street - South Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property southwest of Silver Street adjacent to Falling Run. City Council District 4.

### Site Pictures


Picture A – Looking southwest at site


Picture B – Looking north at site.

### Basin Information

Basin Area: 1.7 acres
Basin Volume: 6.15 ac-ft
Contributing Drainage Area: 131 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Catholic Diocese
Modeled: No

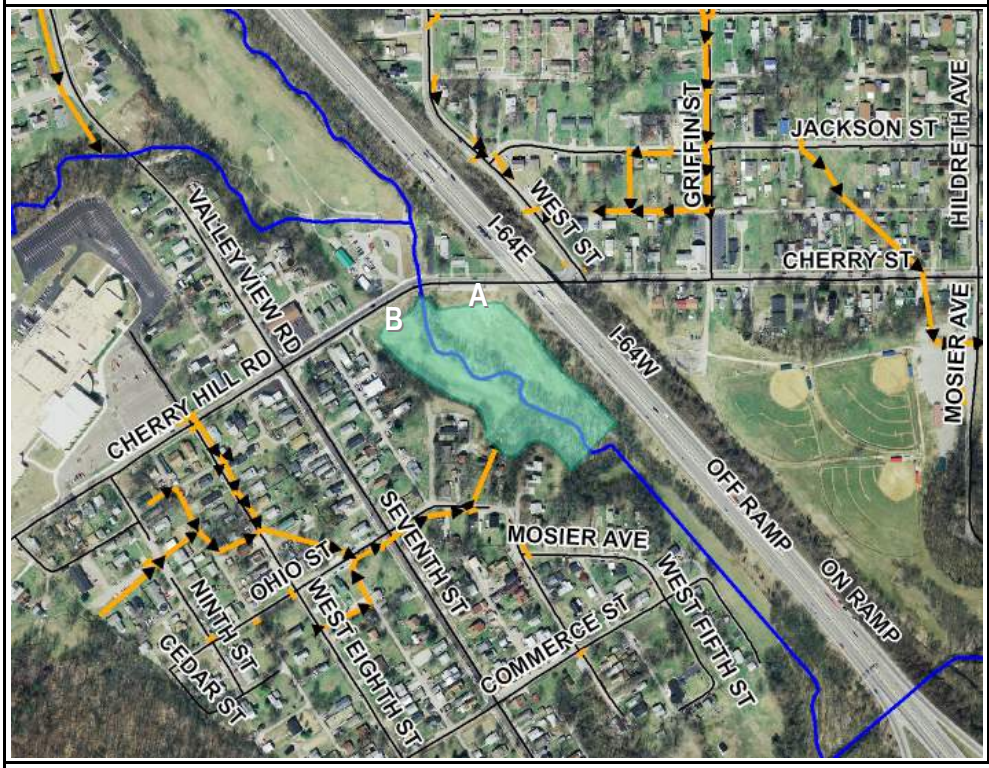
Probable Cost: $344,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

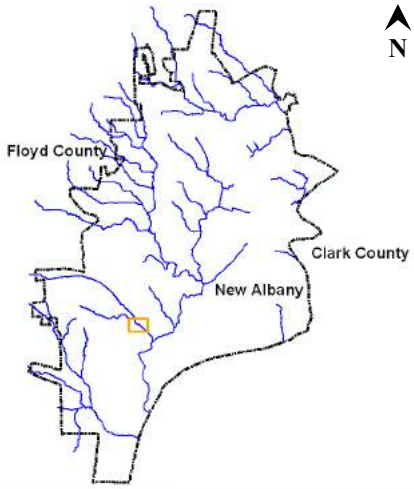
Storage Basin

## South of Cherry Valley Golf Course Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property south of Cherry Hill Road on Cherry View Creek. City Council District 1.

### Site Pictures


Picture A – Looking southeast at site (left bank)


Picture B – Looking southeast at site (right bank)

### Basin Information

Basin Area: 4.8 acres
Basin Volume: 26.9 ac-ft
Contributing Drainage Area: 1126 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Public - Unknown
Modeled: No

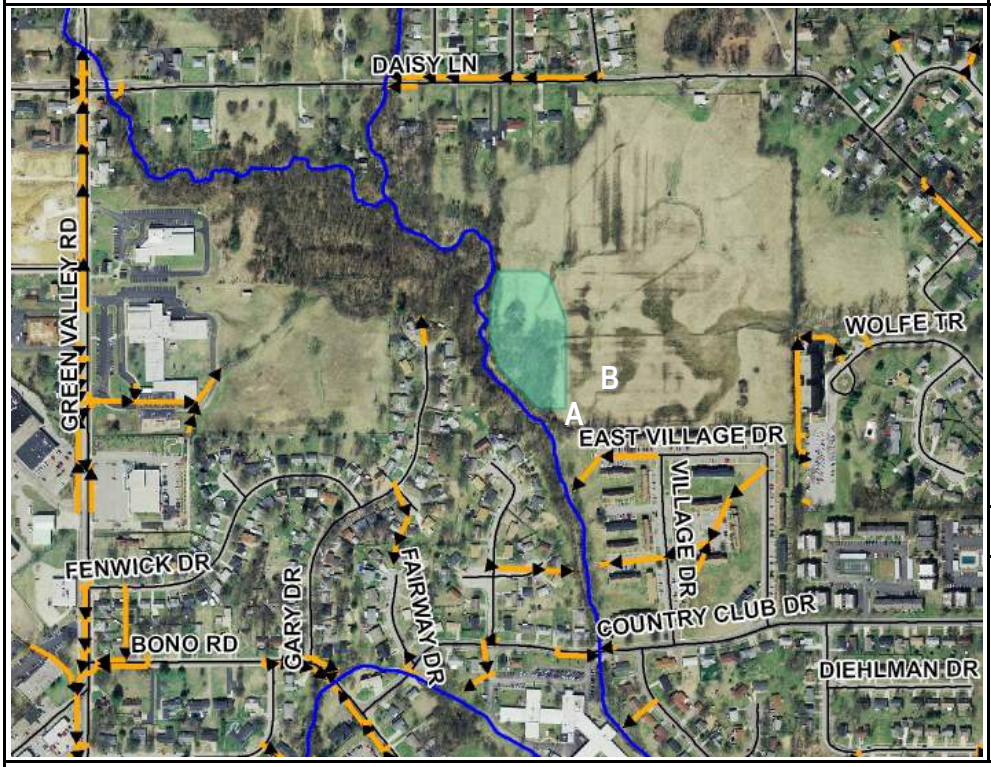
Probable Cost: $989,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

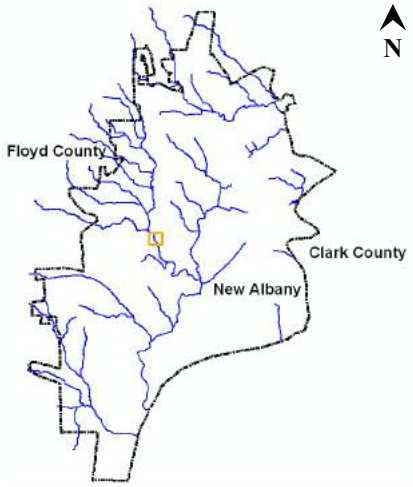
Storage Basin

## South of Daisy Lane Storage Basin Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Located on private property west of Pamela Drive adjacent to Green Run. Site has depression area and standing water. City Council District 2.

**Site Pictures**


Picture A – Looking north at site


Picture B – Looking west at site

**Basin Information**

Basin Area: 2.8 acres
Basin Volume: 10.5 ac-ft
Contributing Drainage Area: 2509 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

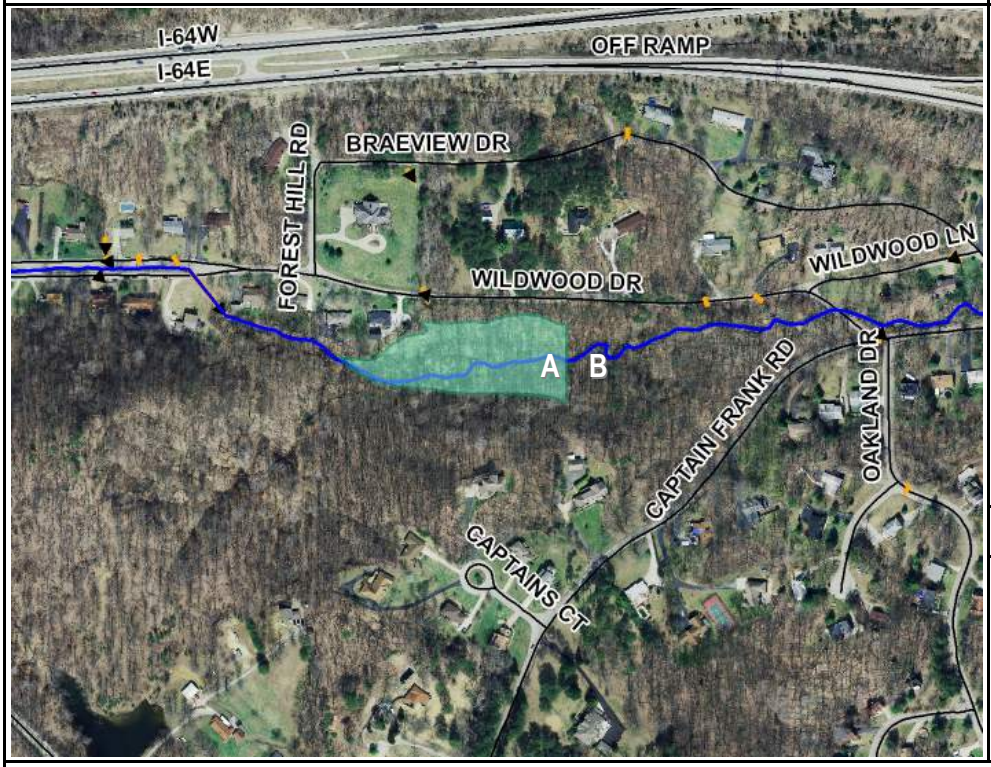
Probable Cost: $490,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

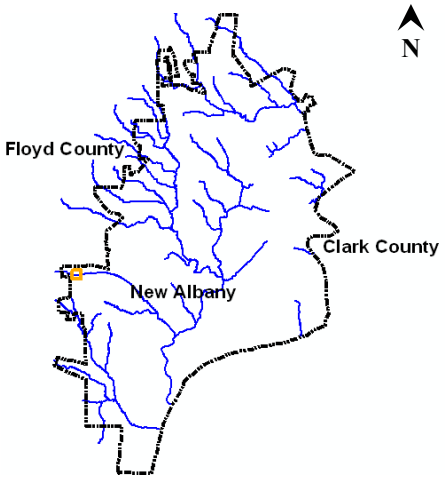
Storage Basin

## South of Wildwood Drive Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property south of Wildwood Drive. City Council District 2.

### Site Picture


Picture A – Looking west at site


Picture A – Looking east away from site

### Basin Information

Basin Area: 2.4 acres
Basin Volume: 20.3 ac-ft
Contributing Drainage Area: 164 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: Yes

Property Owner: Private - Residential
Modeled: Yes

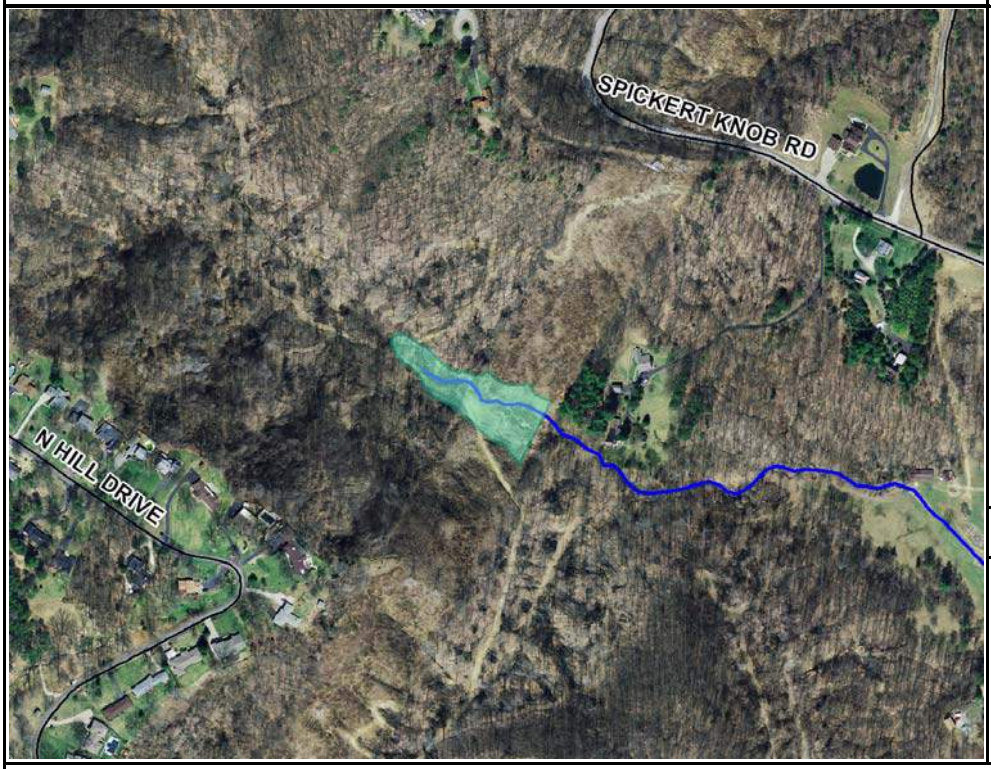
Probable Cost: $658,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

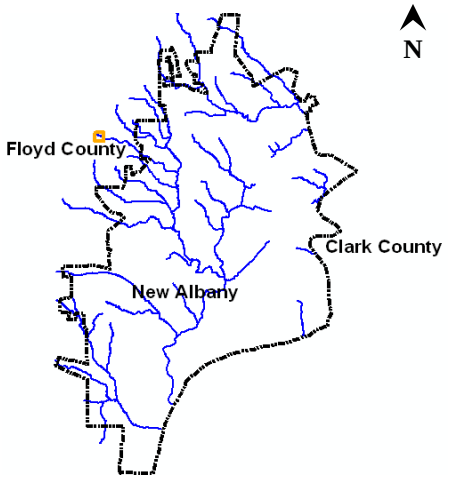
Storage Basin

## Southwest of Spickert Knob Rd Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property southwest of Spickert Knob Rd. Outside of City Council Districts.

### Site Picture

Picture A – Looking north at site

### Basin Information

Basin Area: 1.5 acres
Basin Volume: 14.4 ac-ft
Contributing Drainage Area: 95 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: No

Property Owner: Private - Residential
Modeled: Yes

Probable Cost: $470,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Appendix 5.6

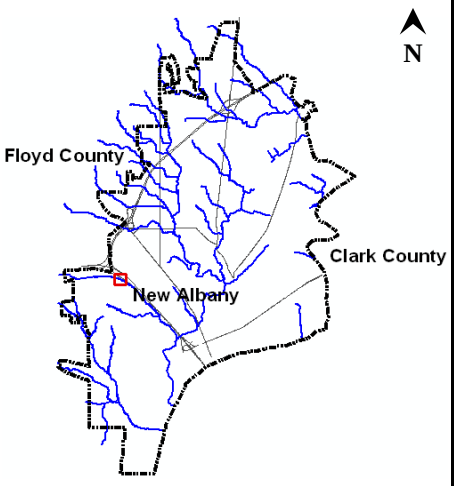
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Captain Frank Road Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Valley View Creek. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: Two 7.25' x 4.7' CMP
Proposed replacement: 12' x 6' concrete box

### Probable Cost

$229,000*

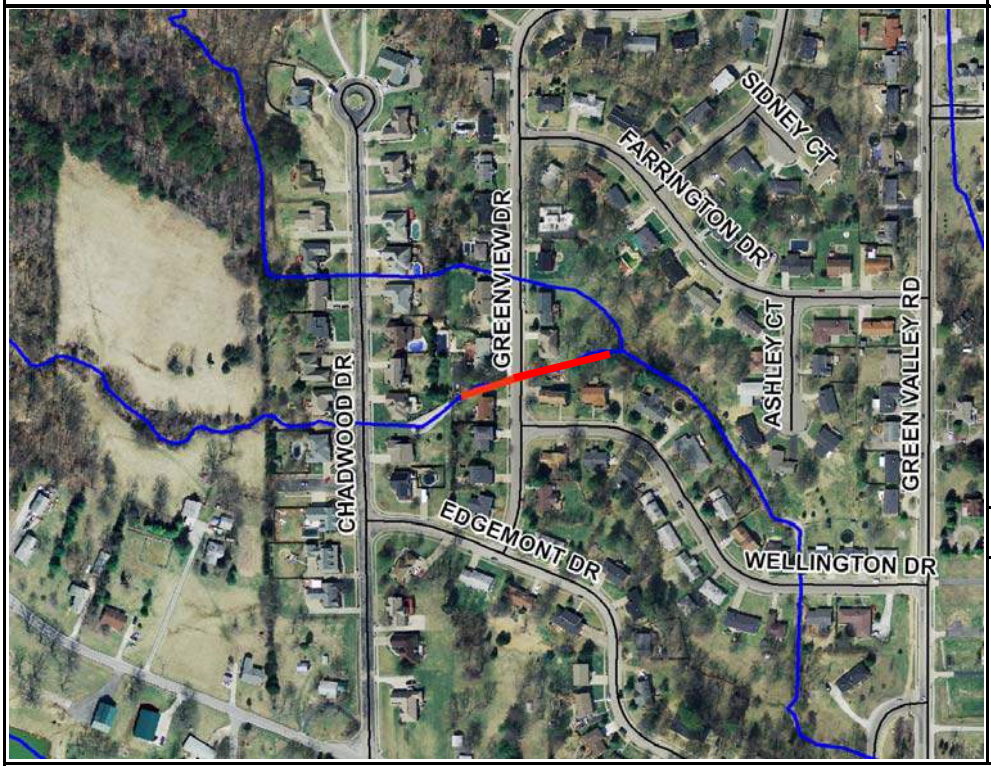
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

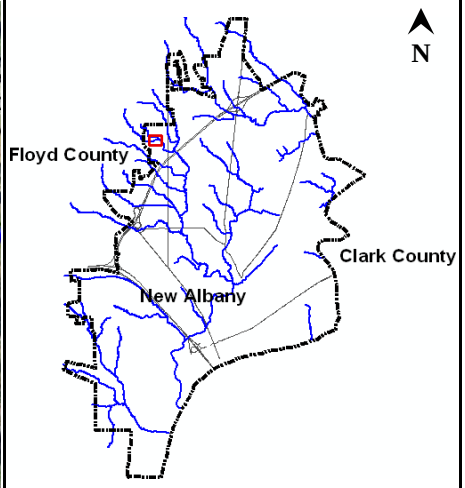
**Culvert Replacement**

## Greenview Drive - South Culvert Replacement Fact Sheet

### Project Map




### Key Map




### Site Description

Located on tributary to Falling Run. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: 48” corrugated plastic
Proposed replacement: 8’ x 4’ concrete box

### Probable Cost

$413,000*

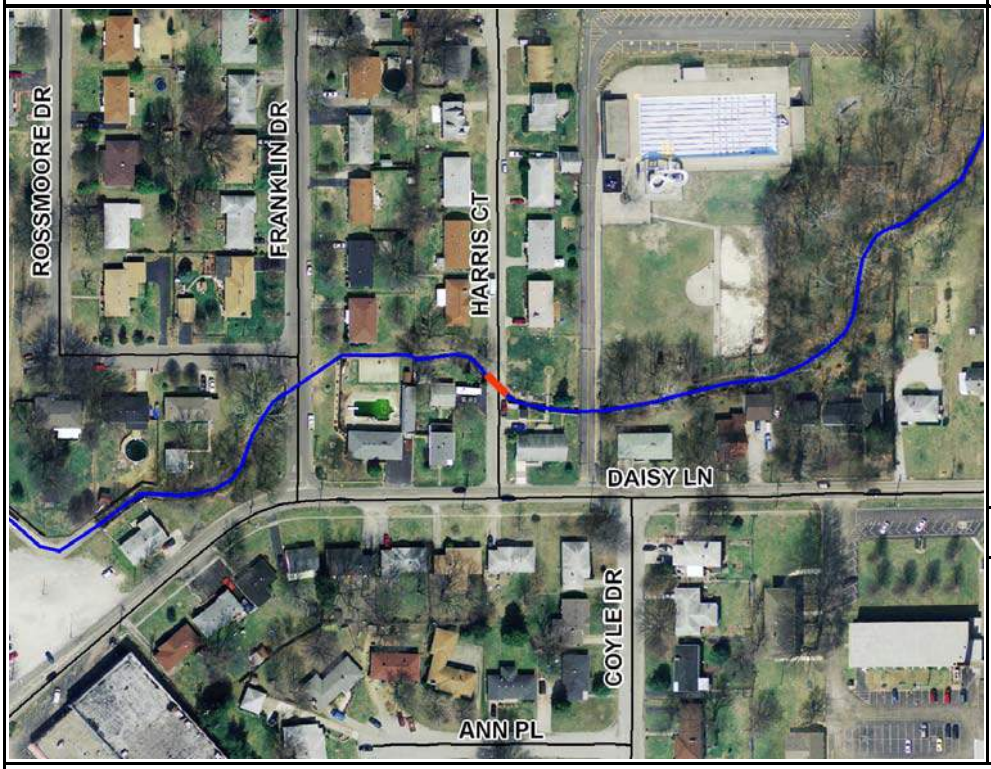
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

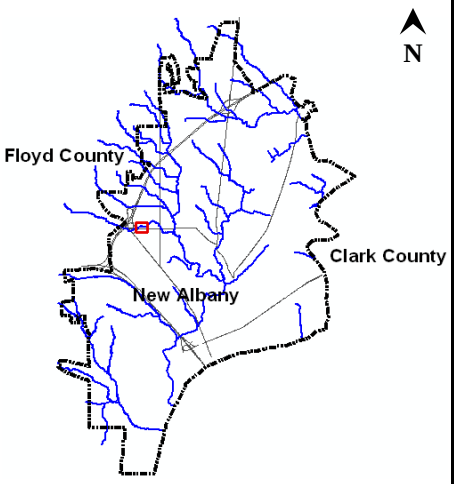
**Culvert Replacement**

## Harris Court Culvert Replacement Fact Sheet

### Project Map




### Key Map




### Site Description

Located on Trinity Run. City Council District 2.

### Site Pictures


Upstream face of culvert


Downstream face of culvert

### Culvert Information

Existing pipe: 14' x 5.25' bridge
Proposed replacement: 30' x 6' bridge

Re-grading of the stream bed needed.

### Probable Cost

$323,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

NOTE: DOWNSTREAM BRIDGE AT ENTRANCE TO WATER PARK CAUSES BACKWATER

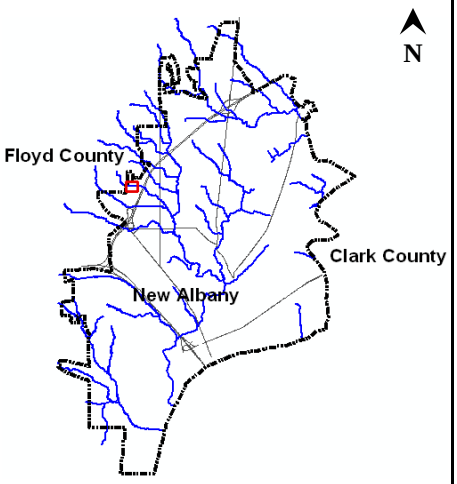
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Tingle Drive Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Green Run. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: 66” CMP
Proposed replacement: 10’ x 4’ concrete box

### Probable Cost

$122,000*

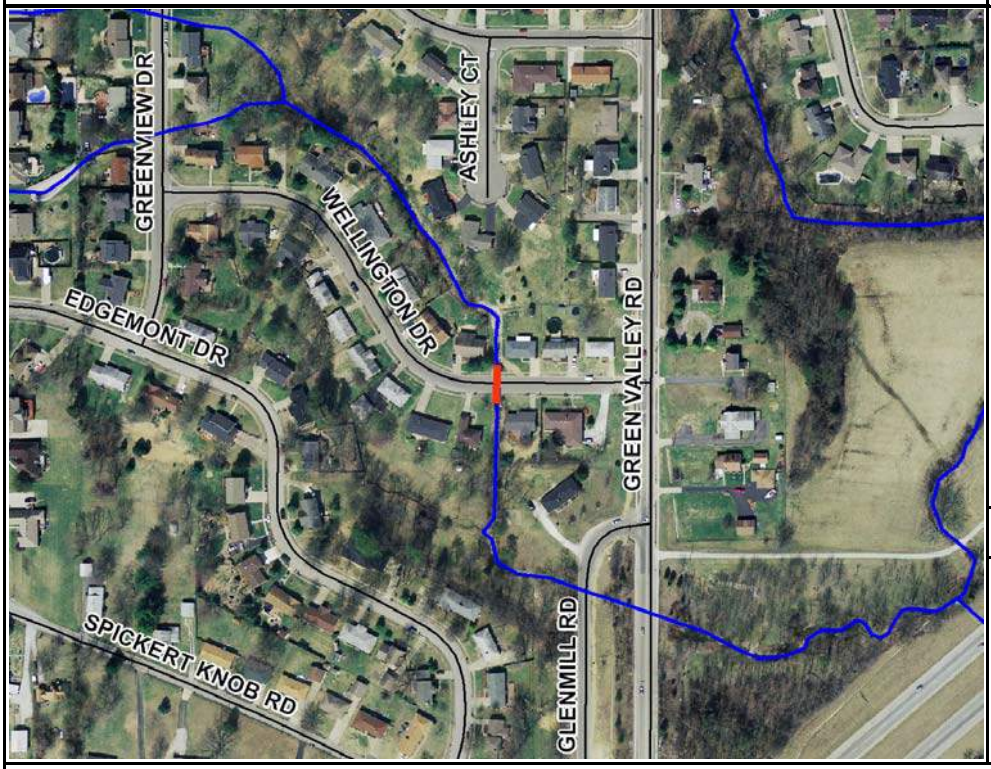
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

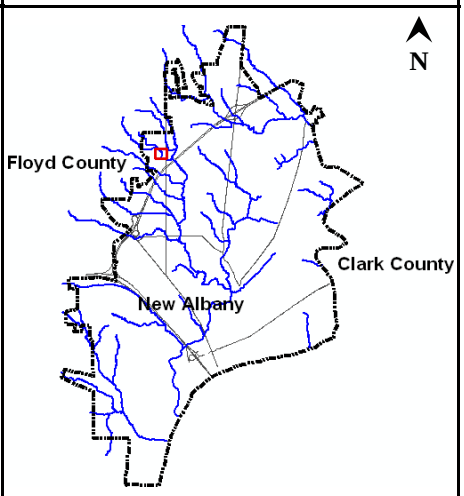
**Culvert Replacement**

## Wellington Drive Culvert Replacement Fact Sheet

### Project Map




### Key Map




### Site Description

Located on Fork Run. City Council District 2.

### Site Pictures


Upstream face of culvert


Downstream face of culvert

### Culvert Information

Existing pipe: Two 48" RCP
Proposed replacement: 8' x 4' concrete box

### Probable Cost

$127,000*

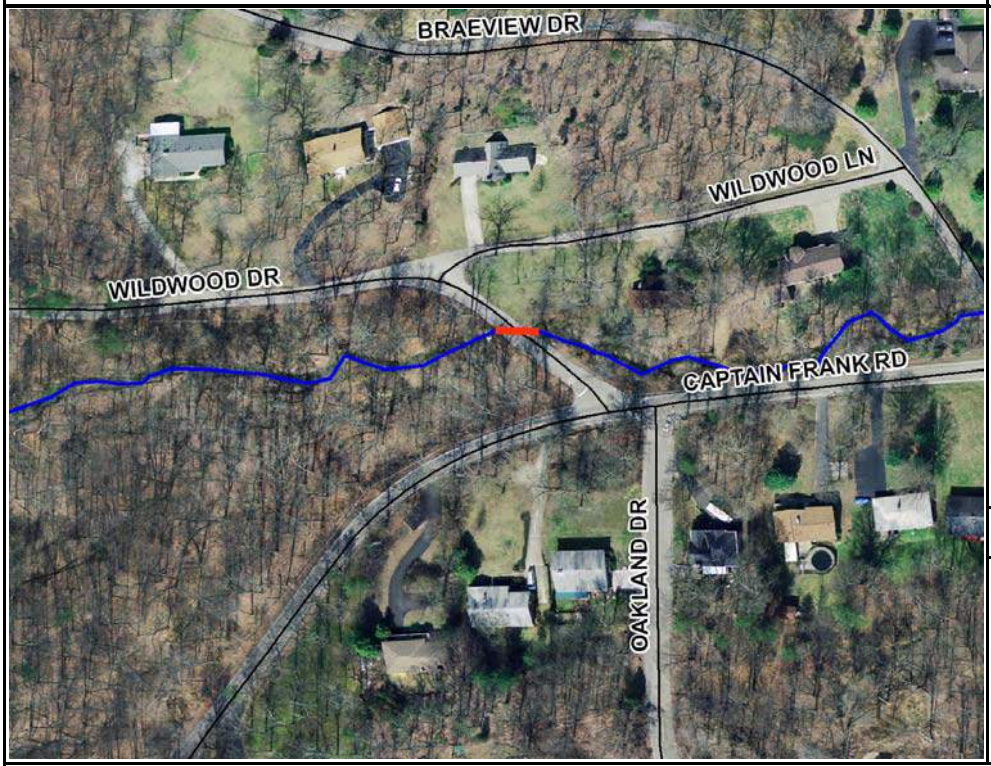
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

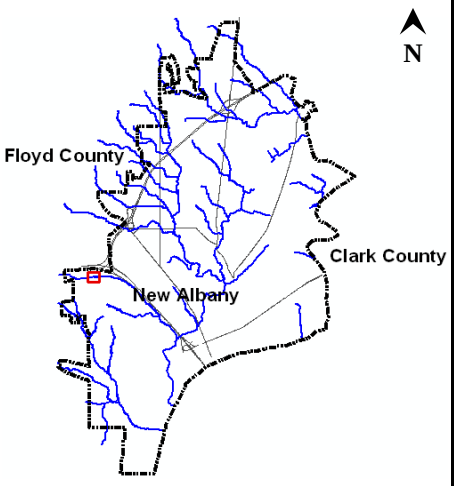
**Culvert Replacement**

## Wildwood Drive Culvert Replacement Fact Sheet

### Project Map




### Key Map




### Site Description

Located on Valley View Creek. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: 70” x 52” RCP
Proposed replacement: 6’ x 4’ concrete box

### Probable Cost

$127,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

# 6.0 Silver Creek Tributaries

Silver Creek is a large tributary to the Ohio River. After rising in Scott County, it drains 152 square miles and flows 34 miles to the Ohio River at New Albany. The portion of the Silver Creek Watershed located in New Albany is in the northern and easternmost areas of the city. It is comprised of tributaries to Silver Creek and some areas near that drain directly to Silver Creek.

New Albany's Silver Creek tributaries are shown in **Figure 6.1**, as described above, they drain the north and east ends of the city. The tributaries are: Blackiston Run; Land Run; Town Run and several un-named tributaries to Silver Creek. Important tributaries to these streams are: Slate Run (tributary to Blackiston Run) and Rail Run and Flat Run (tributaries to Slate Run). The combined area of the tributary watersheds encompasses 6.0 square miles. The watersheds draining the city extend from tributary headwaters north of the city to Silver Creek's confluence with the Ohio River in the south.

The analysis and results for the planning effort for the tributaries to Silver Creek are presented in **Section 6**. The characteristics of the tributary watersheds are presented in **Section 6.1**. This section provides discussion of watershed characteristics; their representation in SWMM models and drainage issues on the watersheds. **Section 6.2** presents the Areas of Concern that were identified on the tributaries through discussions with the stormwater board, stormwater utility personnel, and a review of maintenance requests. This section presents drainage issues in each area, results of SWMM model simulations and recommended action plans for each area based on information provided in request logs and SWMM model results.

Potential detention basin sites on the tributary watersheds are discussed in **Section 6.3** and selected roadway crossing improvements are presented in **Section 6.4**. Selection of road crossings was made by reviewing known problem areas and the need to determine the frequency of overtopping of major and critical road crossings. Priorities for improvements to road crossings are also discussed in this section.

Maintenance needs are discussed and critical areas requiring routine maintenance are identified in **Section 6.5**. The cost of local and road crossing improvements on the Falling Run Watershed are presented in **Section 6.6**. The results of the evaluations of the Silver Creek Tributaries are summarized in **Section 6.7**.

## 6.1 WATERSHED CHARACTERISTICS

The tributary watersheds are characterized by steep slopes in the upper reaches with flat slopes in the lower. The average slope of the tributary watersheds is two percent (2%). Upper reaches are relatively undeveloped compared the lower reaches which are medium to high intensity development. Based on the current land use map (See **Figure 4.5**), the Silver Creek

tributaries are roughly 50% developed. According to the soil survey (USDA, 1974), soils found in the tributary watersheds are HSG B and C, like soils in the Falling Run watershed described in **Section 5.1** above.

### 6.1.1 Sub-Basin Delineations and Soil Characteristics

Delineation of the sub-basins for the analysis of the Silver Creek tributaries is shown in **Figure 6.2**. The basins range in size from 0.04 to 238.7 acres. Primary sub-basin input parameters for the SWMM model of the Silver Creek tributaries are given in the tables in **Appendix 6.1**. Typically the smaller basins are in the areas that are highly developed and the larger are in areas with lighter development. There is one basin in the table that represents the areas that drain directly to Silver Creek. The area of this sub-basin is 4,339.9 acres. It was not included in the range of basin sizes given above for the Silver Creek tributaries.

Effective hydraulic conductivities, moisture deficits and wetting front suction values for the Green-Ampt equation were assigned to each sub-basin based on the dominant HSG in a basin, as described in **Section 4**. Land use and terrain data such as impervious areas, soil types, land slopes were developed from the GIS database. Selected inputs for each sub-basin (drainage area, average slope, representative width, Hydrologic Soil Group (HSG), and Percent Impervious Area for Existing (EC) and Fully Developed Conditions (FD)) are provided in **Appendix 6.1**. SWMM inputs for the drainage infrastructure in the sub-basins are given in **Appendix 6.2**.

### 6.1.2 Flood Control Works

Flood control works along Silver Creek include the levee that protects New Albany from Ohio River floods. Along Silver Creek, the levee extends from its mouth north to Brown Station Road. The Slate Run Pumping Station is located at the mouth of Slate Run. Its stormwater pumping capacity is 10,000 GPM or 22 cfs. The pump station is put into operation when the Ohio River stage is 61.8 feet corresponding to a river elevation of 437 feet. When floodgates are closed the pump station discharges runoff from Slate Run to Silver Creek. The East Market Street Pumping Plant serves the east end of the downtown area and discharges to Silver Creek. Its capacity is 7,600 gpm or 17 cfs. It is only of interest because it discharges to Silver Creek.

### 6.1.3 Floodplain Encroachments

Based on the current effective floodplain and floodway on Silver Creek and its tributaries within the City Limits there are 84 parcels with structures that encroach the 100-YR floodplain. A total of 36 structures encroach the floodway of Silver Creek. When the preliminary floodplain and floodway are mapped, there are still 84 properties with structures that encroach the floodplain. However, there are 54 structures in the floodway mapped in the preliminary floodplain maps.

Lewis Branch
Jay Run
CHARLESTOWN ROAD
Uphill Run
Bald Knob Creek
Crooked Run
Blackiston Run
Jacobs Creek
Flat Run
Rail Run
Slate Run near Rainbow Drive
Industrial Blvd
Slate Run
GRANT LINE ROAD
Castlewood
Land Run
Kraft Cemetery
Fork Run
Lost Knob Brook
265
Woodbourne Drive and Kaywood Drive
South of McDonald Lane
Grace Run
Old Ford Road
Green Run
Brookview Drive - McDonald Lane
Hickory Vale Drive side streets
County Run
Silver Creek
Holy Run
Miller Lane
Charlestown Road near Coes Lane
Trinity Run
Silver Street and Roanoke Avenue
Falling Run near Daisy Ln
Carlton Drive
Korb Avenue and Lyon Lane
Falling Run
Aebersold Drive
VINCENNES STREET
265
Captain Frank Road
Reno Ave - Market Street
Valley View Creek
Fall Run
State Run
13th - Vincennes Street
Silvercrest Run
Culbertson - Markert Street
Cherry Hill Road and West 9th Street
STATE STREET
Galt Street
Corydon Pike
Vincennes Run
Middle Creek

**Figure 6.1. Silver Creek Tributaries and Their Watersheds**

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

N

NHD Stream

**Area of Concern**

Falling Run

Middle Creek

Ohio River

Silver Creek

New Albany Boundary

Falling Run Watershed

Middle Creek Watershed

Ohio River Watershed

Silver Creek Watershed

Floyd County Boundary

Stantec

V:\1756\active\175658068\gis\mxd\new\Figure_6-1.mxd

Additional structures in the floodway can have serious implications for property owners in the preliminary floodway. When the floodplain map becomes effective, those property owners in the floodway who do not purchase flood insurance prior to the effective date of the revised maps will not be eligible to participate in the National Flood Insurance Program (NFIP).

## 6.2 AREAS OF CONCERN

A significant level of flooding is currently being experienced within the tributary watersheds of Silver Creek. Localized flooding occurs in some neighborhoods. Neighborhoods in the area appear to be impacted by high intensity commercial development above established subdivisions. There is little if any detention storage above residential neighborhoods to mitigate upstream commercial development. Storm sewers that may have been adequate to convey runoff from these neighborhoods appear to be overloaded by additional runoff generated by parking lots, roads, rooftops and other impervious areas in commercial areas resulting in localized structural flooding in neighborhoods. Local improvements such as detention basins and relief sewers will help reduce flooding in these neighborhoods. It is also apparent that accumulated debris around surface inlets and catchbasins contribute to local flooding.

In addition, a number of existing structures encroach the floodplains of Silver Creek and its tributaries. Flooding can only be reduced in these areas through the implementation of floodplain management measures such as regional detention basins, floodwalls or levees, or buy-outs of properties that experience chronic and frequent flooding that can not be reduced to acceptable levels using these measures.

In addition to local flooding and floodplain encroachments, channel erosion along the Silver Creek tributaries has been reported in drainage requests. Causes of bank erosion are a combination of elevated runoff rates that increase velocities and shear stresses in channels coupled with the loss of vegetation on stream banks and loss of access to floodplains.

Six Areas of Concern were identified within the Silver Creek Watershed. These are Industrial Boulevard; Slate Run near Rainbow Drive; the Ashwood Subdivision (Castlewood Drive); Kraft Cemetery; Old Ford Road; Miller Lane; and Slate Run near Rainbow Drive. Locations of the Areas of Concern are shown in **Figure 6.1**.

Flooding on the tributaries to Silver Creek is primarily local in nature with some structural flooding along the tributaries in addition to neighborhood or local flooding. The Silver Creek Tributaries constitute a small portion of the Silver Creek Watershed.

OVERVIEW

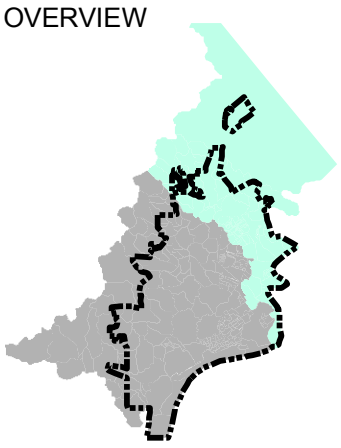


**Figure 6.2.**
**Silver Creek Watershed Subcatchments**

**Legend**

Silver Creek subcatchments

NOTE: LABEL REPRESENTS SUBCATCHMENT FID

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18

116 16 12 96 14 11 15 95 89 93 90 97 13 106 99 94 3 91 98 92 104 48 4 5 17 101 100 2 1 109 108 111 110 0 113

32 34 33 68 35 36 37 29 38 30 39 40 41 42 31 43 46 45 44 47

102 51 83 49 24 22 84 85 50 87 103 23 82 88 71 21 69 86 27 25 72 63 70 60 76 28 75 64 52 26 74 62 53 61 65 54 55 73 107 77 56 57 80 59 78 79 58 19 66 67 81

114 8 7 115 10 6 9

Watershed or regional scale flood control measures will have little impact on flood frequency or severity along Silver Creek. Eight potential storm water detention basin sites are identified in **Section 6.3**. These should be considered local flood control measures which will have the capacity to reduce flooding along their receiving streams for some distance downstream of proposed basins and in localized areas that are not related to a stream floodplain.

Each Area of Concern is shown in more detail in the figures accompanying the following descriptions of the area. Fact sheets for the Areas of Concern on the Silver Creek tributaries are provided in **Appendix 6.3**.

### 6.2.1 Industrial Boulevard

The Industrial Boulevard Area of Concern is located in north-central New Albany as shown in **Figure 6.1**. **Figure 6.3** shows the area in more detail. A drainage ditch runs under Progress Boulevard, drains to the east, flows under Park Place, and then turns south along Central Court and a side rail line to the mouth of a tributary ditch that flows from Progress Boulevard. The tributary ditch appears to have a stable rip-rap lining. From the mouth of the tributary, the main ditch flows east along the rail line then under Industrial Boulevard then to a culvert under I-265. The main ditch is a tributary to Slate Run.

Maintenance request data indicates that bank erosion is an issue throughout the reach of the main ditch. Requests indicate that the culvert under Progress Boulevard and its downstream headwall appear to be failing and contributing to road failure at the crossing. Requests also indicate that the ditch is blocked by sediment in the reach between Progress Boulevard and Park Place and is believed to contribute to structural flooding. The maintenance request upstream of Industrial Boulevard (No. 8-211) indicates that bank erosion is threatening a building foundation. During field reconnaissance it was observed that stream stabilization measures are in place for sections of the ditch although some are still unprotected.

Maintenance requests also indicate issues with standing water on Progress Boulevard; blocked drainage ditches along Progress Boulevard that may cause structural flooding; and a suspected collapsed pipe under a driveway on Progress Boulevard.

It appears that flooding, bank erosion and sedimentation issues are related to industrial park development that has increased runoff rates and volumes in the area. Recommended improvements for the area are:

- Detailed evaluation of the existing drainage infrastructure in the area utilizing a hydrologic model such as HEC-HMS and a hydraulic model such as HEC-RAS or a similar open channel model to evaluate the capacity of existing drainage ditches and culverts in the area;

- Design of drainage improvements to increase ditch and culvert capacity and to stabilize ditch banks;

PARK PLACE

Industrial Blvd

PROGESS BOULEVARD

INDUSTRIAL BOULEVARD

OLD HAUSFELDT LANE

Slate Run

MOUNT TABOR ROAD

7-238

1-0224

8-211

# Figure 6.3.
# Industrial Boulevard

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Primary Problem Area
- Structure in Flood Hazard Area
- Contour
- Structure
- NHD Stream
- Area of Concern

- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Silver Creek Watershed
- New Albany Boundary

0 100 200 400 Feet

1 inch = 200 feet

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- Use of a multi-stage ditch that will provide efficient drainage and sediment transport for small events with a wide flood prone area that will reduce bank stress and provide both flow and storage capacity in the ditch;

- Use of native vegetation where practical to stabilize the low-flow channel and flood prone benches to reduce maintenance requirements, to improve runoff quality, and reduce mitigation requirements for Section 404 and Section 401 permitting; In-stream structures should be designed to reduce bank stresses and improve stream habitat; and

- Ditches and culverts should be designed to pass the 10-YR, 24-HR and the 25-YR, 24-HR design storm, respectively.

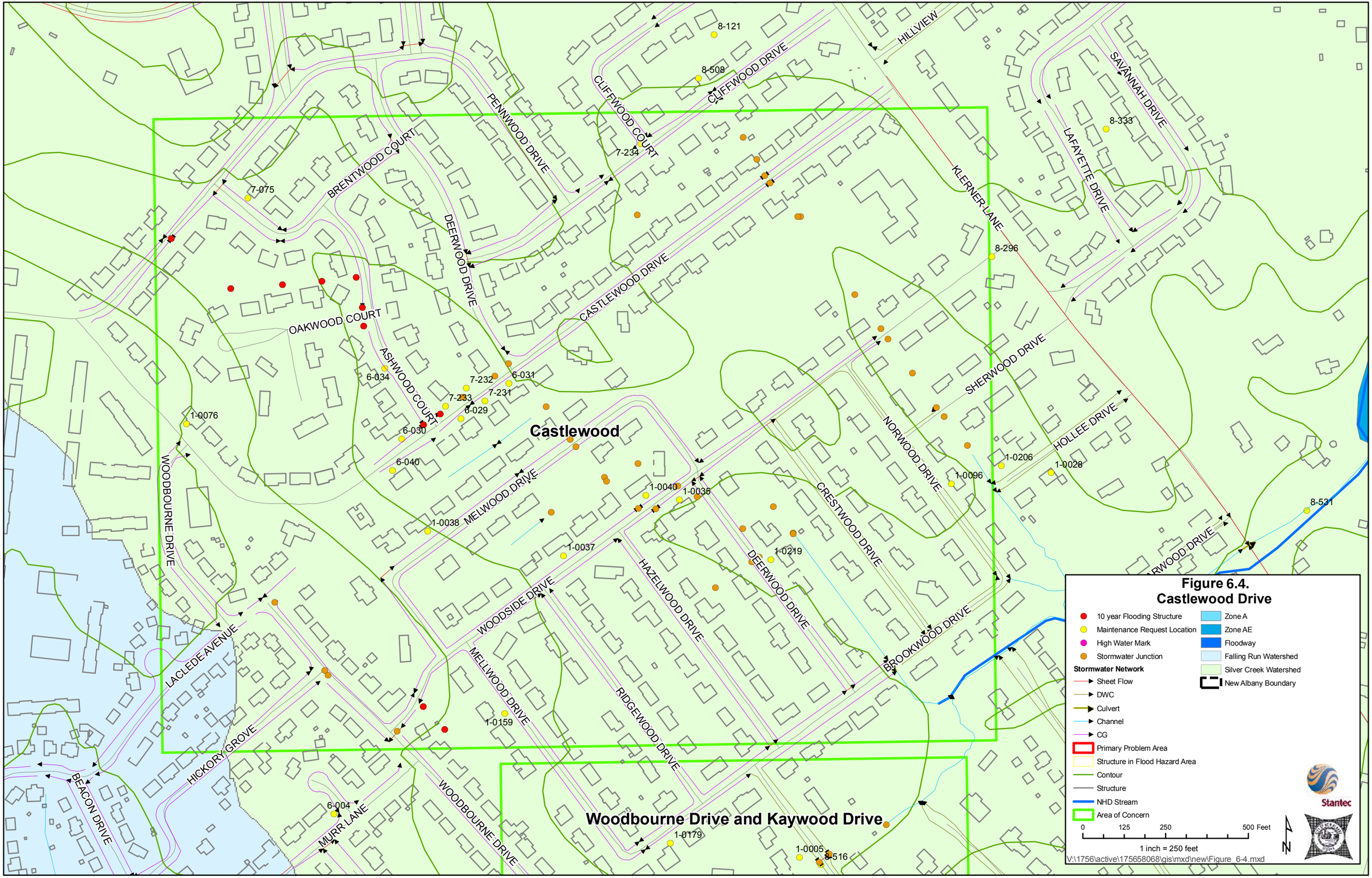
A potential stormwater detention basin site was identified south of the confluence of the main ditch and tributary ditch, north of Industrial Boulevard as shown in **Figure 6.3**. The basin should be considered as a regional basin that may be effective in reducing flooding downstream of the industrial park and further downstream on Slate Run. The basin is discussed in more detail in **Section 6.2.2** below.

### 6.2.2 Castlewood Drive

Castlewood Drive is located in the Oakwood Subdivision south of Mount Tabor Road, as shown in **Figure 6.4**. The neighborhood is drained by curbs and gutters and an existing storm sewer system. The storm sewers drain generally to the south-southeast to unnamed tributaries to Land Run. In addition to draining the subdivision, the storm sewer system receives runoff from highly developed commercial and residential areas to the north and northeast along Grant Line Road, University Woods Drive and Mount Tabor Road. Mount Tabor Elementary School is located in the northern reaches of the drainage area, north of Pennwood Drive.

Runoff from developed areas upstream of the subdivision enters the storm sewers north of Pennwood Drive, from University Woods Drive into Pennwood Drive and Castlewood Drive. Streets, properties and homes are flooded along Pennwood Drive, Ashwood Court, Castlewood Drive, and to a lesser extent on Mellwood, Woodside and Deerwood Drive.

There are numerous entries in the maintenance request log for this area. The calls document: chronic standing water in the drainage easement on Brentwood Court; numerous incidents of street, property and structural flooding on Ashwood Court; frequent flooding in the street and numerous homes on Castlewood Drive (one cites several feet of water); basement flooding in one residence (house flooding four times in two years was cited), flooding under and in a home (often), and a house surrounded by water on Castlewood Drive; two incidents of one home flooding and a single incidents of another home flooding on Woodside Drive; a home flooded four times on Mellwood Drive; and a flooded ditch with debris flooding property on Deerwood Drive.




## Figure 6.4.
## Castlewood Drive

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Primary Problem Area
- Structure in Flood Hazard Area
- Contour
- Structure
- NHD Stream
- Area of Concern

- Zone A
- Zone AE
- Floodway
- Falling Run Watershed
- Silver Creek Watershed
- New Albany Boundary

0 125 250 500 Feet

1 inch = 250 feet

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The area was a focus in the monitoring effort in **Section 3**. The flooding issues in this area are local in nature and depend upon the development of either storm sewer capacity to supplement existing flow capacity or storage capacity to reduce flow rates in the existing sewers. It was also observed that catch basin clogging by debris was contributing to flooding in the area. A design solution is under development for this area. It has found that the design and construction of a detention basin upstream of Penwood Drive on the Mount Tabor Elementary School and Mount Tabor Presbyterian Church campuses will reduce flooding in the area and raise the level of service to and above current standards. The storage capacity of the proposed basin is 5.1 acre-feet. The design also includes the construction of several additional catch basins and the upgrade of an existing 12-inch storm sewer that drains rear yards at Castlewood Drive and Ashwood Court.

Recommendations for this Area of Concern are:

- Complete design of the proposed detention basin and storm sewer upgrade;
- Construct proposed detention basin and proposed storm sewer upgrade.
- Implement a routine maintenance program to clean catch basins and ditches.
- Educate residents on the importance of keeping grass clippings, leaves and litter out of streets and catch basins.

### 6.2.3 Kraft Cemetery

Kraft Cemetery is located east of the intersection of Charlestown Road and Old Ford Road as shown in **Figure 6.5**. Ponding occurs towards the entrance of the cemetery during storm events causing some grave sites to be inundated along Old Ford Road. In this area Old Ford Road is drained by curb and gutter. A debris-filled catch basin was observed during field reconnaissance which appears to serve as the main drainage structure at the entrance of the cemetery. The solution proposed in the maintenance request log identified the need for a study to determine limits of jurisdiction, identify solution alternatives and the design and construction of storm water infrastructure to serve this area.

The action plan for this area includes:

- Implementation of a routine maintenance plan for existing drainage infrastructure.
- Completion of a study to identify drainage issues and solutions for the area.
- Development of design plans for drainage improvements in the area.
- Construction of drainage improvements.
- Development and implementation of a routine drainage plan for the improved infrastructure.

8-531
Land Run
1-0098
7-325
KLERNER LANE
OLD FORD ROAD
BYRN MAWR COURT
SLATE RUN ROAD
Kraft Cemetery
KRAFT CEMETERY
8-124
8-096
1-0085
1-0081
MARY LEE DRIVE
ELMVIEW DRIVE
Silver Creek
Grace Run
Old Ford Road

**Figure 6.5.**
**Kraft Cemetery**

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Primary Problem Area
- Structure in Flood Hazard Area
- Contour
- Structure
- NHD Stream
- Area of Concern

- Zone A
- Zone AE
- Floodway
- Silver Creek Watershed
- New Albany Boundary

0 100 200 400 Feet

1 inch = 200 feet

V:\1756\active\175658068\gis\mxd\new\Figure_6-5.mxd

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### 6.2.4 Woodbourne Drive and Kaywood Drive

The Woodbourne Drive and Kaywood Drive Area of Concern is shown in **Figure 6.6**. It lies south of the Castlewood Drive area. The area is drained by a storm sewer main comprised of 24-, 36-inch RCP with a 48-inch CMP outlet to a tributary of Land Run. Laterals range in size ranging in size from 12- to 15-inches. The review of maintenance logs found the following issues in the area: drainage issues and flooding on Harbrook Drive; development of a sinkhole near a rear yard drain on Mellwood Drive; storm drain failure on Lynnwood Drive; and stormwater bubbling to surface close to street and causing damage to driveway, also on Lynnwood Drive. SWMM results indicate storm sewer overflows in the 36-inch main between Mellwood and Woodbourne Drives and between Mellwood and Kaywood Drives.

The following action plan should be implemented in this area:

- Conduct a study including televideo inspection of existing infrastructure to determine the condition of existing sewers, determine if evidence exists of overflows on the main line, evaluate runoff rates in the area, to determine if existing capacity is adequate to meet current level of service standards, identify alternatives for providing additional capacity or storage if needed.

- Design retrofits to the system to repair damaged infrastructure identified in the study.

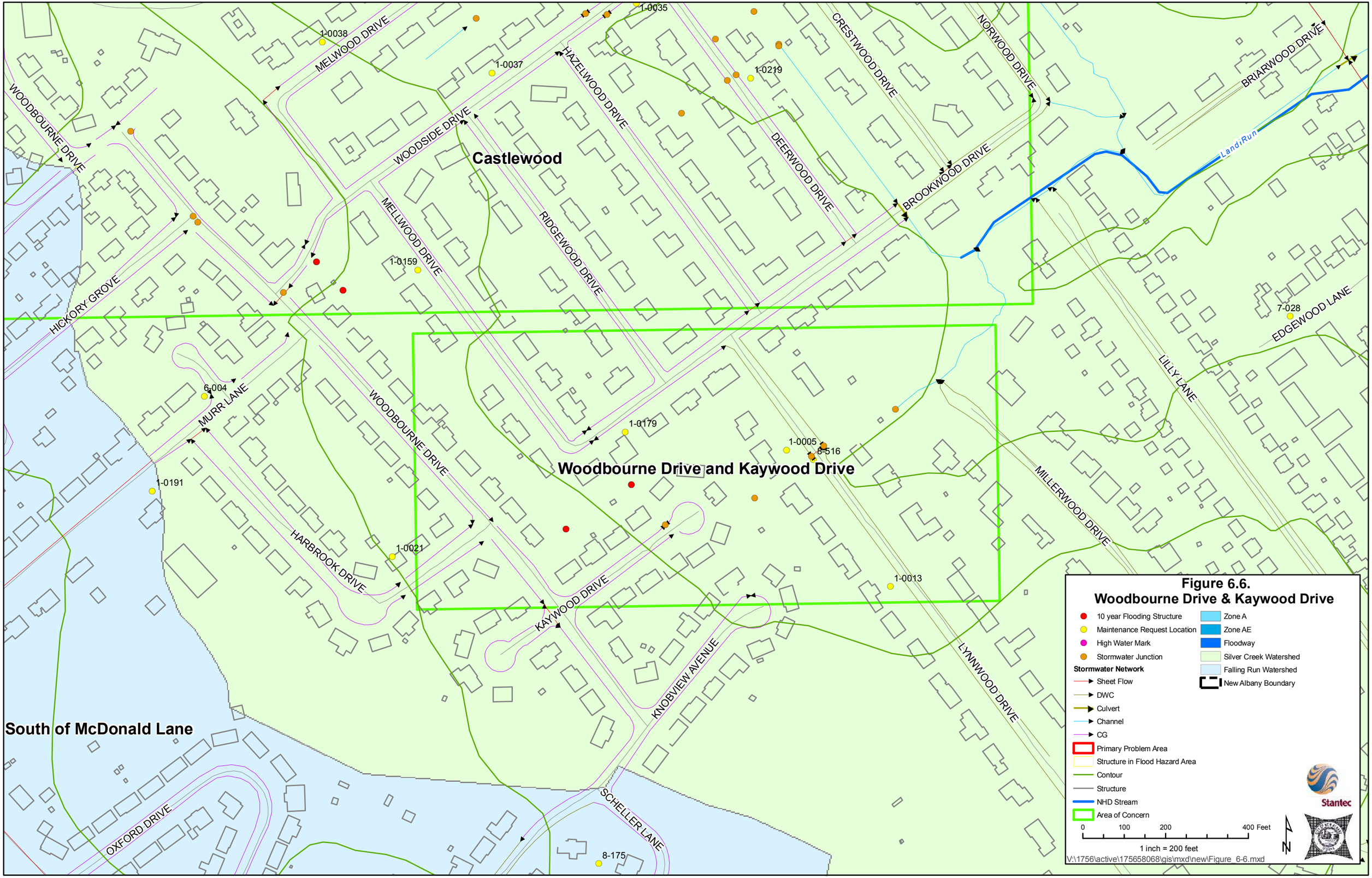
- Design and construct storm sewer and/or storage structures if the study indicates that the existing storm sewer system does not have capacity to meet the current level of service standards.

- Develop and implement a routine inspection and maintenance program for the area.

### 6.2.5 Old Ford Road

The Old Ford Road Area of Concern is shown in **Figure 6.7**. Surface runoff flows southeast through shallow ditches along Old Ford Road from Kraft cemetery to a ditch near Armstrong Bend Road. Town Run is the outlet for this area. The drainage issues in this area are local issues.

Maintenance requests in the area identify a general lack of stormwater infrastructure from Charlestown Road to Armstrong Bend with many front yards totally flooded during rain events. Flooding extends to foundations of homes and is slow to drain after storms. Many driveways and cross streets have no culverts. Field reconnaissance found a shallow but not well defined drainage ditch is some areas. Driveways with culverts had debris and sediment blocking most of the culverts. Recommendations from the request log included a study to identify drainage improvement alternatives.




## Figure 6.6.
## Woodbourne Drive & Kaywood Drive

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Primary Problem Area
- Structure in Flood Hazard Area
- Contour
- Structure
- NHD Stream
- Area of Concern
- Zone A
- Zone AE
- Floodway
- Silver Creek Watershed
- Falling Run Watershed
- New Albany Boundary

0 100 200 400 Feet

1 inch = 200 feet

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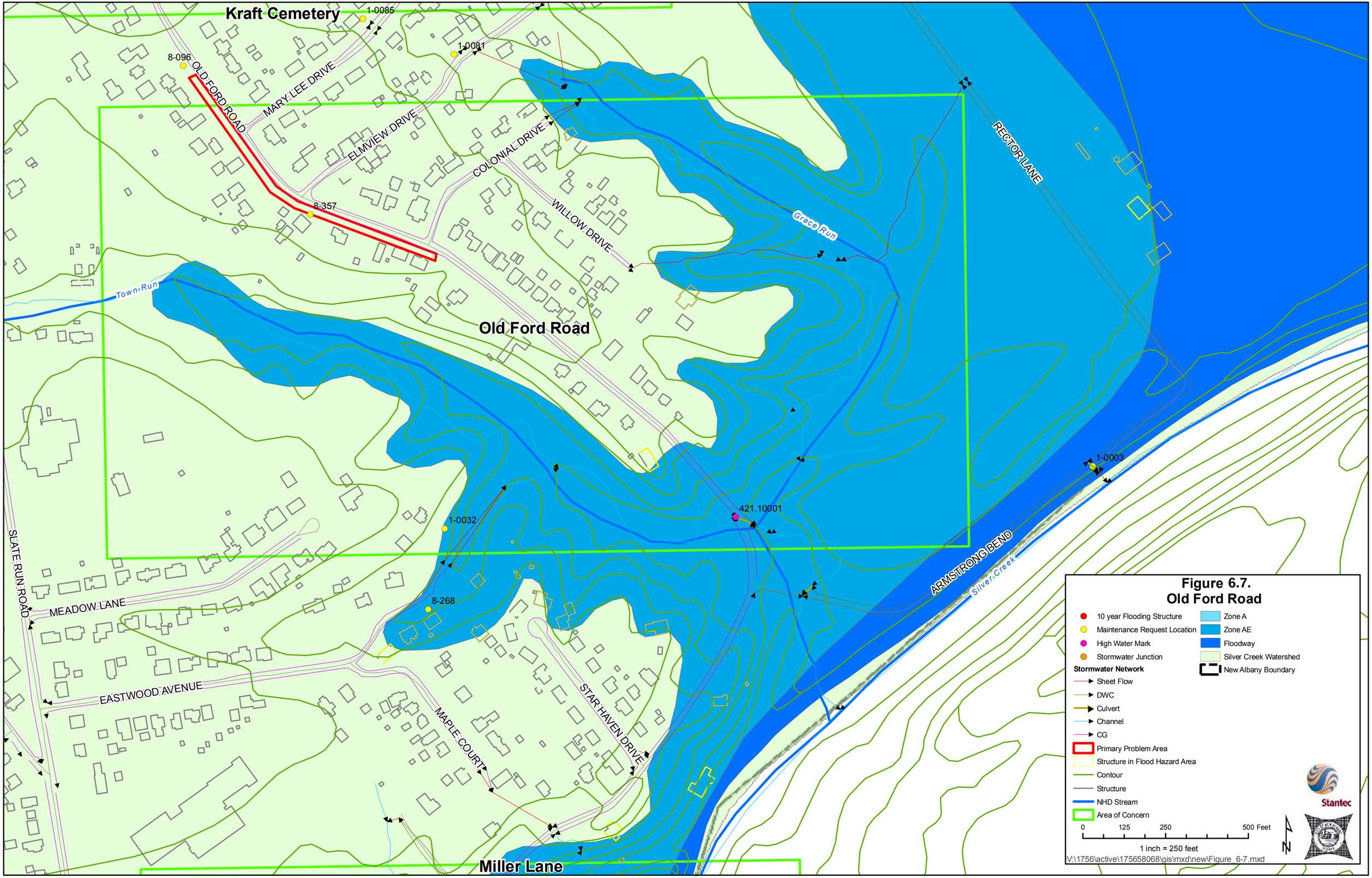
Kraft Cemetery
1-0085
1-0081
8-096
OLD FORD ROAD
MARY LEE DRIVE
ELMVIEW DRIVE
COLONIAL DRIVE
WILLOW DRIVE
RECTOR LANE
8-357
Grace Run
Town Run
Old Ford Road
1-0003
421.10001
1-0032
8-268
ARMSTRONG BEND
Silver Creek
SLATE RUN ROAD
MEADOW LANE
EASTWOOD AVENUE
MAPLE COURT
STAR HAVEN DRIVE
Miller Lane
Figure 6.7.
Old Ford Road
10 year Flooding Structure
Maintenance Request Location
High Water Mark
Stormwater Junction
Stormwater Network
Sheet Flow
DWC
Culvert
Channel
CG
Primary Problem Area
Structure in Flood Hazard Area
Contour
Structure
NHD Stream
Area of Concern
Zone A
Zone AE
Floodway
Silver Creek Watershed
New Albany Boundary
0
125
250
500 Feet
1 inch = 250 feet
V:\1756\active\175658068\gis\mxd\new\Figure_6-7.mxd
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The recommended plan of action for the Old Ford Road area is:

- Clean existing culverts and ditches to improve flow in the existing system;
- Conduct a study to identify alternatives for design;
- Design and construct drainage infrastructure for this area. The system must accommodate drainage from the Kraft Cemetery area. Options should include roadside ditches and/or roadside storm sewers with yard inlets. Additional yard inlets may be necessary to provide yard drainage to the drainage system; and
- Develop and implement a routing maintenance program for the drainage improvements.

This project should be completed either before or in conjunction with the Kraft Cemetery drainage improvement project. This area is the outlet for the Kraft Cemetery area. The improvements should extend to Town Run. The adequacy of roadside drainage south of Town Run should be evaluated and improved as necessary to provide an outlet to either Town Run at Old Ford Road or extend along Armstrong Bend Road to Town Run.

### 6.2.6 Miller Lane

Miller Lane is located off Old Ford Road near Silver Creek as shown in **Figure 6.8**. In this area surface runoff primarily flows northwest along Miller Lane and northeast along Old Ford Road towards three catchbasins located just east of their intersection. Drainage infrastructure in Miller Lane and Old Ford Road includes roadside swales, curbs and gutters and 24-inch storm sewers that outlet to the north into an unnamed tributary of Silver Creek. Old Ford Road is drained by roadside swales except near its intersection with Miller Lane.

Grace Court and Bellemeade Drive are drained by curbs and gutters that empty into catchbasins then flow through 12” laterals that feed a 15-inch storm sewer. The 15-inch line flows to the 24-inch line on Miller Lane. Curbs and Gutters along Miller Lane and Bellemeade Drive drain to 3 catchbasins at the intersection of Miller and Bellemeade. Flow from the catchbasins is discharged through 12-inch RCP to Silver Creek. Curb and gutter and a 12-inch storm sewer drain Miller Lane. Fox Run Court is drained by curb and gutter that drain to a catch basin in the cul-de-sac then to the unnamed tributary through a 12-inch RCP. Old Ford Road north of Miller Lane is drained by roadside ditches that discharge to the unnamed tributary to Sliver Creek.

Maintenance requests in the area have identified deteriorating catchbasins; tell-tale signs of pipe and/or catch basin failure such as sinkholes and voids under pavement; and significant ponding during large rain events. Field reconnaissance found that there are no existing catchbasins along Miller Lane between the existing catchbasins at the bottom of the street and Bellemeade Drive. Along Old Ford Road there is only one existing catch basin between Mill Lane and Miller Lane which appears to be installed by a homeowner. The SWMM model in this

LAIB DRIVE
SLATE RUN ROAD
VICTOR LANE
444.26999
1-0207
FOX RUN
8-497
Miller Lane
GRABLE COURT
8-387
1-0178
Silver Creek
1-0097
OLD FORD ROAD
1-0006
MILL LANE
BELLEMEADE DRIVE
1-0190
MILLER LANE
FRANCES DRIVE
6-022
6-020
7-105
7-209
MCCARTIN DRIVE
HARRIET COURT
MAY DRIVE

**Figure 6.8.**
**Miller Lane**

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Primary Problem Area
- Structure in Flood Hazard Area
- Contour
- Structure
- NHD Stream
- Area of Concern

- Zone A
- Zone AE
- Floodway
- Silver Creek Watershed
- New Albany Boundary

0 100 200 400 Feet

1 inch = 200 feet

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area indicates that a 10-YR, 24HR design storm overtops the catchbasins in the lower end of Miller Lane and at Old Ford Road and Mill Lane.

The recommended action plan for the area includes:

- Recommended improvements include the following:
- Implement a routine inspection and maintenance plan for the area;
- Expand the SWMM model to include the 15- and 12-inch storm sewers that drain Grable Court and Bellemeade Drive and flow in the street and gutters to existing catchbasins to determine if upgrading of these laterals and the main lines in Old Ford Road and Miller Court is required;
- Conduct televidio inspection of the existing drainage infrastructure to identify the location and extend of catch basin and pipe failures and or deterioration;
- Repair failed pipe and catchbasins identified in the televidio inspection. Upgrade pipe sizes as repairs are made based on SWMM model and/or Tier 1 tool results;
- Install additional catchbasins in Old Ford Road and Miller Lane as part of system upgrades; and
- If necessary, design and construct upgrades to the storm sewer system based on the results of the more detailed SWMM analysis.

### 6.2.7 Slate Run near Rainbow Drive

The bridge at Rainbow Drive crosses Blackiston Run just north of the mouth of Slate Run as shown in **Figure 6.9**. Maintenance requests indicate that there is significant erosion near the confluence. During field reconnaissance it was observed that the northern banks of Slate Run have eroded significantly leaving only a few feet between the top of the bank and Rainbow Drive. The erosion continues downstream on Blackiston Run.

The Rainbow Drive Bridge and Slate Run's confluence with Blackiston Run are located in the lower reach of a hard bend in Slate Run. Shear stresses on the outside bend are very high to extreme in this area. Measures that protect the outside bend and/or reduce shear stresses on it are appropriate for this reach of the stream. While vegetation of the banks can provide bank protection, stresses on the bank are likely too high for vegetation alone. The stresses also appear to be too high for riprap protection of the bank. A solution that effectively armors the bank while providing the water quality and aquatic habitat value of vegetation should be developed in this area. Vegetative growth along the bank would also compliment and help maintain the aesthetics of the Rainbow Drive corridor in this vicinity. Proposed bank protection

Blackiston Run
ST JOE ROAD
MUIRFIELD DRIVE
LAURENS CIRCLE
TAMMY COURT
1-0222
BROOK SIDE LANE
RAINBOW DRIVE
LOLA DELL COURT
MARY DELL COURT
1-0080
7-114
DALE BROOK DRIVE
PINE CREEK CIRCLE
1-0078
MONTY DRIVE
Slate Run
-076

**Slate Run near Rainbow Drive**

**Figure 6.9.**
**Slate Run near Rainbow Drive**

- 10 year Flooding Structure
- Maintenance Request Location
- High Water Mark
- Stormwater Junction

**Stormwater Network**

- Sheet Flow
- DWC
- Culvert
- Channel
- CG
- Primary Problem Area
- Structure in Flood Hazard Area
- Contour
- Structure
- NHD Stream
- Area of Concern
- Zone A
- Zone AE
- Floodway
- Silver Creek Watershed
- New Albany Boundary

0 125 250 500 Feet

1 inch = 250 feet

V:\1756\active\175658068\gis\mxd\new\Figure_6-9.mxd

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needs to be extended to the downstream headwalls of the Rainbow Drive Bridge to maintain the integrity of the bridge.

#### 6.2.7.1 Road Improvements on Rainbow Drive

Planned road improvements on Rainbow Drive and include replacement of the culvert on an un-named tributary to Slate Run. Design of the proposed bridge or culvert for Rainbow drive should be evaluated for its ability to reduce flood hazards on Slate Run and the un-named tributary. Measures to stabilize stream banks and reduce erosion should be incorporated into the bridge or culvert design.

The following options should be considered for protecting the stream bank, the road embankment and bridge:

- Design and construction of a plantable segmented retaining wall (SRW) using open concrete modules with openings in which live stakes and/or seedlings can be planted;
- Design and construction of live cribs utilizing timber members; or
- Design and construction of live cribs using concrete members.

Each of these designs should include recovery of road embankment width by offsetting the structures from the existing road bed and backfilling the void between the road and embankment. The extent of road bed recovery will likely be limited by both rises in base flood elevations and Section 404 and Section 401 permit requirements. Construction of stormwater detention basins upstream of the area on Slate Run and to a lesser degree on Blackiston Run will also help reduce flow velocities in the stream and shear stresses on its banks.

Potential storage basins upstream of the problem area are located at Industrial Boulevard, Indiana University Southwest, north of Mt. Tabor Road, north of Reas Lane, Park East-Reas Lane and south of Hausfeldt Lane. Fact sheets regarding these basins are located in **Appendix 6.4** and are discussed in more detail in **Section 6.3** below. Stream stabilization could involve installation of either rip-rap or gabion baskets near Rainbow Drive along Slate Run. Either one of these alternatives should limit the effects of erosion along Rainbow Drive.

## 6.3 POTENTIAL STORAGE BASIN SITES

Eight potential detention basin sites were identified in the watersheds of the Silver Creek Tributaries. One is the Castlewood Drive basin currently under design in the Ashwood Subdivision. Potential basin locations are shown in **Figure 6.1** and are listed in **Table 6.1** below. **Table 6.1** shows the basin locations, their receiving streams; surface area; and storage volume potential. Factors were considered such as availability of the basin, location of the basin within city limits, the benefits it would have to the problem areas, and whether or not the property is privately or publicly owned. Details for each of the potential storage basins can be found on the fact sheets in **Appendix 6.4**.

The mapped floodplain in the Silver Creek Tributaries is based on level routing of backwater from Silver Creek for the 100-YR event in the FIS study (FEMA, 2009). No detailed studies were conducted on the tributaries for the FIS. Given the size of the drainage basin above New Albany, flood control measures implemented on the tributaries in New Albany will have little impact on flood elevations on the main stem of Silver Creek and for some distance up its tributaries. It is expected that these basins will provide the most benefit on a local scale, similar to the benefits of the proposed Castlewood Drive Basin. These basins should be justified and prioritized based on their expected local benefits and costs.

**Table 6.1. - Silver Creek Proposed Storage Basins.**

| Basin Location | Stream | Area (acres) | Volume (acre-feet) |
|---|---|---|---|
| Industrial Boulevard | Unnamed Tributary to Slate Run | 0.7 | 2.3 |
| Indiana University Southwest | Unnamed Tributary to Blackiston Run | 0.3 | 1.5 |
| North of Mount Tabor Road | Slate Run | 1.3 | 4.6 |
| North of Reas Lane* | Slate Run | 2.4 | 4.8 |
| Park East - Reas Lane | Slate Run | 0.4 | 1.4 |
| South of Hausfeldt Lane | Slate Run | 0.5 | 1.5 |
| South of Old Ford Road | Town Run | 0.1 | 0.5 |
| Castlewood Drive* | Unnamed Tributary to Slate Run | 1.6 | 5.2 |
| ** Indicates basin was modeled within XPSWMM* | | | |

Seven potential basin sites were identified in the watersheds of the Silver Creek Tributaries. Areas of concern that benefit from the proposed storage basins include the “Industrial Boulevard” (and limited areas downstream) and “Slate Run near Rainbow Drive” areas of concern. Details for each of the potential storage basins can be found on the fact sheets in **Appendix 6.4.** Existing topographic data was available to model only one of the seven basins in detail, the basin north of Reas Lane. Proposed storage basin sites that were not modeled in SWMM are summarized in **Table 6.2**. The basin north of Reas Lane is summarized in **Table 6.3**. The site for the “North of Reas Lane” basin is on Slate Run.

**Table 6.2. Silver Creek Proposed Storage Basins – Not Modeled.**

| Basin Location | Tributary | Basin Area (acres) | Potential Basin Volume (acre-ft) | Drainage Area (acres) |
|---|---|---|---|---|
| Industrial Boulevard - South | Tributary to Slate Run | 0.7 | 2.3 | 80 |
| Indiana University Southeast | Rail Run | 0.3 | 1.5 | 18 |
| North of Mount Tabor Rd | Slate Run | 1.3 | 4.6 | 1200 |
| Park East - Reas Lane | Slate Run | 0.4 | 1.4 | 202 |
| South of Hausfeldt Lane | Slate Run | 0.5 | 1.5 | 776 |
| South of Old Ford Road | Town Run | 0.1 | 1.3 | 92 |

**Table 6.3. Proposed Basin Sites on Silver Creek Tributaries – Modeled.**

| Basin Location | Surface Area (acres) | Drainage Area (acres) | 25yr Volume (ac-ft) | Peak Inflow (cfs) | Peak Outflow (cfs) | % Reduction |
|---|---|---|---|---|---|---|
| North of Reas Lane | 2.4 | 73 | 4.8 | 265 | 13 | 95 |
| Castlewood Drive | 1.6 | 24 | 5.2 | 90 | 3 | 97 |

The Stormwater Board of the City of New Albany has jurisdiction over only a small portion of the Silver Creek Watershed. Options for flood control on Silver Creek are limited to property protection measures such as floodwalls and levees and perhaps extension of the Ohio River floodwall and construction of a flood pumping station at the mouth of Silver Creek. Projects that benefit the Silver Creek main stem would require multi-jurisdictional cooperation between, at a minimum: the City of New Albany, Floyd County and Clark County.

## 6.4 ROAD CROSSING IMPROVEMENTS

Culverts at selected road crossings were modeled using the 25-YR, 24-HR storm event for existing conditions. Culverts that were undersized were replaced with a larger concrete box culvert to attenuate the 25-YR, 24-HR storm event. Fact sheets provided in **Appendix 6.5** provide more detailed information regarding each culvert replacement. **Table 6.4** provides a summary of culverts and during which rainfall event the roadway is overtopped. The culverts shown in the table below represent some of the most critical and problematic culverts in the Silver Creek watersheds. Other culverts may become critical or problematic as they age and/or their sub-basins become more developed.

**Table 6.4. Tributaries of Silver Creek culvert performance during rainfall events.**

| Location | Location in Sub-Basin | Overtopping for Existing Conditions | | | |
|---|---|---|---|---|---|
| | | 100-YR, 24-HR | 25-YR, 24-HR | 10-YR, 24-HR | 2-YR, 24-HR |
| Earnings Way^ on Flat Run | high | Yes | Yes | No | No |
| Tammy Court^ on Tributary of Slate Run | high | Yes | Yes | No | No |
| Rainbow Drive on Blackiston Run | low | Yes | No | No | No |
| Armstrong Bend on Grace Run | middle | No | No | No | No |
| Old Ford Road - North on Town Run | low | No | No | No | No |
| Slate Run Road - South on Tributary of Silver Creek | high | No | No | No | No |
| Old Ford Road - South on Tributary of Silver Creek | low | No | No | No | No |
| Southern Drive[1] on Rail Run | middle | Yes | Yes | Yes | No |
| Hausfeldt Lane[1] on Rail Run | low | Yes | Yes | Yes | No |
| Prestwick Square Drive[1] on Tributary of Slate Run | middle | Yes | Yes | Yes | Yes |
| Brook Side Lane[1] on Tributary of Slate Run | middle | Yes | Yes | Yes | No |
| Slate Run Road - North[1] on Town Run | low | Yes | Yes | Yes | No |
| Bald Knob Road[1] on Blackiston Run | middle | Yes | No | No | No |

[1] *Culvert not in good condition.*

^ *Roadway was modeled as being overtopped for the 25-YR, 24-HR event due to the conservative approach used for drainage basins but was not considered as a replacement because minimal flow was modeled over the roadway and/or the location of the culvert inside the watershed.*

As in **Section 5.4**, priorities for culvert improvements or replacement can be assigned based on the frequencies of overtopping as follows:

- **Priority 1:** Culverts that are overtopped for the 2-YR, 24-HR design storm or smaller (shown in red in **Table 6.4**);
- **Priority 2:** Culverts that overtop for the 10-YR, 24-HR storm or smaller (shown in orange in **Table 6.4**); and
- **Priority 3:** Culverts that are overtopped by the 25-YR, 24-HR storm or smaller Shown in yellow in **Table 6.4**).

Using the frequency-based priorities above, the following are priorities for improvements to the culverts shown in **Table 6.4**:

**Priority 1:**

Preswick Sqaure Drive on a Tributary to Slate Run

**Priority 2:**

Southern Drive on Rail Run

Hausfeldt Lane on Rail Run

Brook Side Lane on Tributary of Slate Run

Slate Run Road, North of Town Run

**Priority 3:**

Earnings Way on Flat Run

Tammy Court on Tributary of Slate Run

In addition to frequency of flooding, the condition of existing culverts also needs to be considered. As indicated in **Table 6.4**, the culverts on Prestwick Square; Southern Drive; Hausfeldt Lane; Brook Side Lane; Slate Run Drive – North; and Bald Knob Road all were found to be in less than good condition. A study of the condition of high priority culverts should be completed to assess the condition of culverts, determine alternatives for repair, improvement and/or replacement of the culverts and to set priorities based on the condition of the culverts and the frequency of overtopping. Priority 2 culverts that are most compromised should be repaired or replaced first.

While it is not overtopped, the Bald Knob Road crossing on Blackiston Run may need to be considered as a priority due to its condition. An engineering evaluation of the condition of the structure should be completed to determine if it should be a high priority for repair, improvement or replacement.

### 6.4.1 Road Crossing Improvements

Culverts that require improvements based on their condition were evaluated based on their performance during simulations for a 25-YR, 24-HR storm. Culverts that were undersized were replaced in the SWMM model with a larger concrete box culvert to pass the 25-YR, 24-HR storm event. **Appendix 6.5** provides more detailed information regarding each culvert replacement in the model. **Table 6.5** provides a summary of the dimensions of the existing culverts and proposed culverts that were evaluated using the SWMM models. If culverts are not replaced, the improvements should provide equivalent capacity compared to the culvert sizes shown in **Table 6.5**.

**Table 6.5. Silver Creek Proposed Culvert Replacements.**

| Location | Existing Culvert | Proposed Culvert |
|---|---|---|
| Bald Knob Road on Blackiston Run | 6.5-ft x 4.5-ft Box | 10-ft x 4-ft Box |
| Brookside Lane on Tributary of Slate Run | 54-in RCP | 8-ft x 4-ft Box |
| Hausfeldt Lane on Rail Run | 6.8-ft x 5.3-ft CMP | 10-ft x 4-ft Box |
| Prestwick Square Drive on tributary to Slate Run | 48-in HDPE | 8-ft x 4-ft Box |
| Slate Run Road on Town Run | 48-in RCP | 6-ft x 4-ft Box |
| Southern Drive on Rail Run | 54-in x 36-in CMP | 8-ft x 4-ft Box |

These size estimates should be used for planning purposes only. Culvert sizes should be verified in the design studies. Culvert sizing should consider a culvert's ability to pass both storm flows and expected sediment loads. Improvements may include repair of the existing culverts with additional openings to provide flow capacity equivalent to the proposed culverts in **Table 6.5.**

## 6.5 MAINTENANCE ISSUES

Routine maintenance of the stormwater drainage infrastructure serving the Silver Creek Tributary watershed should be a major priority. A routine maintenance schedule should be developed for those mentioned in **Section 6.2** as well as areas that historically contribute to local flooding. Clearing clogged headwalls, ditches and catchbasins will maintain system capacity and will reduce the frequency and magnitude of local flooding in neighborhoods. **Table 6.6** shows areas in which routine monthly maintenance schedules need to be developed and implemented and identifies infrastructure on which the maintenance plans need to focus.

**Table 6.6 – Routine Maintenance Locations for the Silver Creek Tributaries.**

| Location | Headwall/Ditch Cleaning | Catchbasin Cleaning |
|---|---|---|
| Indiana Avenue near Morton and Mclean Avenue | | X |
| Klerner Lane near Mount Tabor Road | X | |
| Liab Drive | X | X |
| Oakwood Subdivision (Castlewood Drive) | X | X |

Maintenance programs should be developed and implemented immediately to maintain the capacity and increase the longevity of existing drainage assets on the Silver Creek Tributaries.

## 6.6 PROJECT COSTS

Opinions of Cost were developed for each capital improvement project identified in **Section 6** for the Silver Creek Tributaries. Improvements in the areas of concern are local improvements that will provide relief in the areas served by existing infrastructure and will provide some relief immediately downstream. These are smaller in scale and include storm sewer improvements, catch basin and inlet upgrades; drainage ditches; local detention basins and other improvements that reduce flooding hazards in local stormwater drainage systems and along upper reaches of the tributaries to Silver Creek.

Flooding along the main stem of Silver Creek is requires a large-scale watershed approach to the problem and requires cooperation between multiple jurisdictions. In general, alternatives include construction of floodwalls and levees to protect properties; development of a large-scale flood control project such as extending the Ohio River levee across the mouth of Silver Creek and constructing a flood pumping station. Buy-outs of properties with repetitive losses with support from FEMA may also be an alternative. Opinions of cost were not developed for these alternatives. The Corps of Engineers should be approached to evaluate options for Silver Creek flood control projects, to determine if a flood control project is feasible and if so, what the federal interest is in the project.

Opinions of Cost for capital improvement projects for the Silver Creek Tributaries are presented in two of the three categories identified in **Section 5**: Local Improvements and Road Crossing Improvements. **Table 6.7** presents a summary of probable costs for local improvements for the areas of concern on tributaries to Silver Creek. The total probable cost for these projects is $2,310,000.

**Table 6.7. Opinion of Probable Cost for Silver Creek Tributary Capital Improvements-Local Improvements.**

| Area of Concern | Probable Cost |
|---|---|
| Industrial Boulevard | $948,000 |
| Kraft Cemetery | $116,000 |
| Woodbourne Drive and Kaywood Drive | $171,000 |
| Old Ford Road | $722,000 |
| Miller Lane | $147,000 |
| Slate Run near Rainbow Drive | $206,000 |
| **Total** | **$2,310,000** |

**Table 6.8** presents a summary of probable costs for local detention basin projects on Silver Creek Tributaries. Construction of these basins would primarily provide local benefits with negligible benefits on properties in the Silver Creek floodplain. These basins will reduce runoff is local areas and along tributaries that are outlets for local drainage systems. Probable costs for the basin sites identified along the Silver Creek Tributaries are shown in **Table 6.8**. The total cost of detention basins identified the tributaries is $1,728,000.

**Table 6.8. Opinions of Cost for Local Detention Basin Capital Improvements on Silver Creek Tributaries.**

| Basin Location | Probable Cost |
|---|---|
| Industrial Boulevard | $171,000 |
| Indiana University Southwest | $144,000 |
| North of Mount Tabor Road | $279,000 |
| North of Reas Lane | $400,000 |
| Park East - Reas Lane | $149,000 |
| South of Hausfeldt Lane | $137,000 |
| South of Old Ford Road | $148,000 |
| Castlewood Drive | $300,000 |
| Total | $1,728,000 |

Probable costs for improvements at high priority road crossings are summarized in **Table 6.9** for crossings on the Silver Creek Tributaries. High priority crossings are Priority 1 culverts and Priority 2 culverts that were found in less than good condition. The total cost of these improvements is $907,000 as shown in the table.

**Table 6.9. Probable Costs of High Priority Road Crossing Improvements on Silver Creek Tributaries.**

| Location | Probable Cost |
|---|---|
| Bald Knob Road on Blackiston Run | $102,000 |
| Brookside Lane on Tributary of Slate Run | $88,000 |
| Hausfeldt Lane on Rail Run | $232,000 |
| Prestwick Square Drive on tributary to Slate Run | $172,000 |
| Slate Run Road on Town Run | $191,000 |
| Southern Drive on Rail Run | $122,000 |
| Total | $907,000 |

The combined probable costs for local improvements and high-priority road crossing improvements is $4,945,000 for the tributaries of Silver Creek. In terms of cost, this is 21% of the capital improvement needs in the City of New Albany.

# Appendix 6.1

Table 6.1 Silver Creek watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 0^ | 27.38 | 0 | 0 | | | | | 0 | 0 |
| 1^ | 85.87 | 0 | 0 | | | | | 0 | 0 |
| 2 | 104.14 | 0.011 | 6387 | C | 0.1 | 0.14 | 8.6 | 34 | 41 |
| 3^ | 179.74 | 0 | 0 | | | | | 0 | 0 |
| 4^ | 22.17 | 0 | 0 | | | | | 0 | 0 |
| 5^ | 81.04 | 0 | 0 | | | | | 0 | 0 |
| 6 | 5.47 | 0.018 | 919 | C | 0.1 | 0.14 | 8.6 | 36 | 38 |
| 7 | 3.61 | 0.018 | 1300 | C | 0.1 | 0.14 | 8.6 | 35 | 38 |
| 8 | 2.17 | 0.018 | 928 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 9 | 6.58 | 0.018 | 1988 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 10 | 1.06 | 0.018 | 707 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 11 | 238.68 | 0.05 | 5783 | C | 0.1 | 0.14 | 8.6 | 20 | 43 |
| 12 | 150.43 | 0.075 | 6487 | C | 0.1 | 0.14 | 8.6 | 0 | 41 |
| 13 | 118.42 | 0.05 | 10514 | C | 0.1 | 0.14 | 8.6 | 10 | 52 |
| 14 | 101.74 | 0.113 | 4355 | B/C | 0.15 | 0.155 | 7.6 | 3 | 39 |
| 15 | 80.56 | 0.089 | 5233 | B/C | 0.15 | 0.155 | 7.6 | 0 | 38 |
| 16 | 146.90 | 0.133 | 5466 | B | 0.2 | 0.17 | 6.6 | 0 | 38 |
| 17 | 100.75 | 0.012 | 4923 | C | 0.1 | 0.14 | 8.6 | 11 | 37 |
| 18^ | 4339.90 | 0 | 0 | | | | | 0 | 0 |
| 19 | 16.84 | 0.025 | 800 | C | 0.1 | 0.14 | 8.6 | 15 | 38 |
| 20 | 24.22 | 0.015 | 1785 | C | 0.1 | 0.14 | 8.6 | 27 | 57 |
| 21 | 0.83 | 0.015 | 120 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 22 | 1.68 | 0.015 | 1816 | C | 0.1 | 0.14 | 8.6 | 39 | 39 |
| 23 | 7.16 | 0.015 | 1865 | C | 0.1 | 0.14 | 8.6 | 39 | 39 |
| 24 | 3.47 | 0.015 | 1188 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 25 | 3.32 | 0.015 | 80 | C | 0.1 | 0.14 | 8.6 | 40 | 40 |
| 26 | 7.31 | 0.015 | 250 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 27 | 14.98 | 0.015 | 3482 | C | 0.1 | 0.14 | 8.6 | 52 | 52 |
| 28 | 0.60 | 0.015 | 379 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 29 | 0.15 | 0.01 | 192 | C | 0.1 | 0.14 | 8.6 | 42 | 42 |
| 30 | 0.38 | 0.01 | 288 | C | 0.1 | 0.14 | 8.6 | 49 | 50 |
| 31 | 0.96 | 0.047 | 670 | C | 0.1 | 0.14 | 8.6 | 73 | 73 |
| 32 | 0.10 | 0.01 | 197 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 33 | 0.47 | 0.01 | 452 | C | 0.1 | 0.14 | 8.6 | 41 | 41 |
| 34 | 0.40 | 0.01 | 597 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 35 | 0.24 | 0.01 | 277 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 36 | 0.22 | 0.01 | 190 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 37 | 0.18 | 0.01 | 199 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 38 | 0.21 | 0.01 | 242 | C | 0.1 | 0.14 | 8.6 | 63 | 63 |
| 39 | 0.35 | 0.01 | 131 | C | 0.1 | 0.14 | 8.6 | 46 | 49 |
| 40 | 0.44 | 0.047 | 153 | C | 0.1 | 0.14 | 8.6 | 32 | 39 |
| 41 | 0.56 | 0.047 | 133 | C | 0.1 | 0.14 | 8.6 | 57 | 58 |
| 42 | 0.65 | 0.047 | 208 | C | 0.1 | 0.14 | 8.6 | 62 | 62 |
| 43 | 0.32 | 0.047 | 251 | C | 0.1 | 0.14 | 8.6 | 80 | 80 |
| 44 | 0.04 | 0.047 | 98 | C | 0.1 | 0.14 | 8.6 | 85 | 85 |
| 45 | 0.08 | 0.047 | 220 | C | 0.1 | 0.14 | 8.6 | 74 | 74 |
| 46 | 0.04 | 0.047 | 171 | C | 0.1 | 0.14 | 8.6 | 85 | 85 |
| 47 | 3.06 | 0.017 | 1040 | C | 0.1 | 0.14 | 8.6 | 51 | 61 |
| 48 | 105.06 | 0.018 | 6169 | C | 0.1 | 0.14 | 8.6 | 32 | 44 |
| 49 | 11.39 | 0.015 | 1690 | C | 0.1 | 0.14 | 8.6 | 37 | 39 |
| 50 | 5.13 | 0.015 | 111 | C | 0.1 | 0.14 | 8.6 | 40 | 40 |
| 51 | 2.00 | 0.015 | 171 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 52 | 13.62 | 0.015 | 1079 | C | 0.1 | 0.14 | 8.6 | 34 | 38 |
| 53 | 2.54 | 0.015 | 711 | C | 0.1 | 0.14 | 8.6 | 40 | 40 |
| 54 | 1.46 | 0.015 | 429 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |

Table 6.1 Silver Creek watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 55 | 2.86 | 0.015 | 909 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 56 | 0.58 | 0.015 | 672 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 57 | 0.68 | 0.015 | 508 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 58 | 18.15 | 0.015 | 2188 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 59 | 5.14 | 0.015 | 1473 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 60 | 0.59 | 0.015 | 259 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 61 | 1.94 | 0.015 | 173 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 62 | 0.80 | 0.015 | 131 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 63 | 1.87 | 0.015 | 471 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 64 | 0.70 | 0.015 | 80 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 65 | 3.05 | 0.015 | 854 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 66 | 8.26 | 0.015 | 492 | C | 0.1 | 0.14 | 8.6 | 34 | 38 |
| 67 | 2.15 | 0.015 | 868 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 68 | 0.33 | 0.01 | 173 | C | 0.1 | 0.14 | 8.6 | 60 | 60 |
| 69 | 0.46 | 0.015 | 94 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 70 | 0.35 | 0.015 | 93 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 71 | 1.71 | 0.015 | 269 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 72 | 0.71 | 0.015 | 159 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 73 | 8.98 | 0.015 | 1223 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 74 | 0.44 | 0.015 | 192 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 75 | 0.75 | 0.015 | 328 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 76 | 0.20 | 0.015 | 121 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 77 | 2.03 | 0.015 | 536 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 78 | 2.68 | 0.015 | 986 | C | 0.1 | 0.14 | 8.6 | 36 | 38 |
| 79 | 2.45 | 0.019 | 141 | C | 0.1 | 0.14 | 8.6 | 31 | 38 |
| 80 | 0.45 | 0.015 | 145 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 81 | 12.22 | 0.019 | 265 | C | 0.1 | 0.14 | 8.6 | 17 | 38 |
| 82 | 8.04 | 0.015 | 629 | C | 0.1 | 0.14 | 8.6 | 30 | 38 |
| 83 | 2.22 | 0.015 | 179 | C | 0.1 | 0.14 | 8.6 | 31 | 38 |
| 84 | 1.22 | 0.015 | 119 | C | 0.1 | 0.14 | 8.6 | 33 | 38 |
| 85 | 1.43 | 0.015 | 149 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 86 | 2.11 | 0.015 | 266 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 87 | 0.88 | 0.015 | 65 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 88 | 1.01 | 0.015 | 159 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 89 | 188.43 | 0.017 | 10616 | C | 0.1 | 0.14 | 8.6 | 4 | 46 |
| 90 | 116.63 | 0.02 | 6093 | C | 0.1 | 0.14 | 8.6 | 28 | 45 |
| 91 | 38.42 | 0.033 | 2844 | C | 0.1 | 0.14 | 8.6 | 28 | 44 |
| 92 | 169.79 | 0.018 | 9724 | C | 0.1 | 0.14 | 8.6 | 36 | 43 |
| 93 | 96.56 | 0.04 | 4350 | C | 0.1 | 0.14 | 8.6 | 0 | 53 |
| 94 | 46.42 | 0.014 | 5410 | C | 0.1 | 0.14 | 8.6 | 5 | 50 |
| 95 | 139.80 | 0.087 | 4353 | C | 0.1 | 0.14 | 8.6 | 8 | 48 |
| 96 | 88.32 | 0.128 | 4320 | B/C | 0.15 | 0.155 | 7.6 | 0 | 38 |
| 97 | 126.76 | 0.033 | 2331 | C | 0.1 | 0.14 | 8.6 | 2 | 44 |
| 98 | 86.43 | 0.014 | 3956 | C | 0.1 | 0.14 | 8.6 | 35 | 61 |
| 99 | 50.53 | 0.012 | 2785 | C | 0.1 | 0.14 | 8.6 | 48 | 65 |
| 100 | 78.54 | 0.023 | 5570 | C | 0.1 | 0.14 | 8.6 | 27 | 41 |
| 101 | 64.50 | 0.016 | 2789 | C | 0.1 | 0.14 | 8.6 | 32 | 46 |
| 102 | 0.84 | 0.015 | 351 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 103 | 2.95 | 0.015 | 715 | C | 0.1 | 0.14 | 8.6 | 38 | 38 |
| 104 | 58.31 | 0.031 | 2556 | C | 0.1 | 0.14 | 8.6 | 36 | 55 |
| 105 | 10.16 | 0.06 | 1841 | C | 0.1 | 0.14 | 8.6 | 15 | 56 |
| 106 | 59.55 | 0.041 | 5584 | C | 0.1 | 0.14 | 8.6 | 0 | 39 |
| 107 | 10.88 | 0.018 | 913 | C | 0.1 | 0.14 | 8.6 | 29 | 39 |
| 108 | 76.65 | 0.015 | 6580 | C | 0.1 | 0.14 | 8.6 | 10 | 58 |
| 109 | 83.85 | 0.019 | 3119 | C | 0.1 | 0.14 | 8.6 | 5 | 45 |

Table 6.1 Silver Creek watershed Sub-basin Parameters 

| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 110^ | 22.63 | 0 | 0 | | | | | 0 | 0 |
| 111 | 51.43 | 0.019 | 3532 | C | 0.1 | 0.14 | 8.6 | 0 | 43 |
| 112 | 10.40 | 0.067 | 1594 | B/C | 0.15 | 0.155 | 7.6 | 19 | 42 |
| 113^ | 94.62 | 0 | 0 | | | | | 0 | 0 |
| 114 | 0.14 | 0.018 | 370 | C | 0.1 | 0.14 | 8.6 | 35 | 38 |
| 115 | 3.58 | 0.018 | 1390 | C | 0.1 | 0.14 | 8.6 | 35 | 40 |
| 116 | 73.21 | 0.15 | 5645 | B/C | 0.15 | 0.155 | 7.6 | 0 | 38 |

^Sub-basin not modeled in XPSWMM. Area drains directly to Silver Creek.
*The sub-subasin slope reflects the average along the pathway of overland flow to inlet locations.
**Irregularly shaped subcatchments with drainage channels off-centre can be handled by computing a skew factor:

Sk = (A2 - A1) / A
W = (2 - Sk) * L

*where*

Sk = skew factor
A1 = area to one side of the channel
A2 = area to other side of the channel
A = total area
W = subcatchment width
L = length of main drainage channel

OVERVIEW

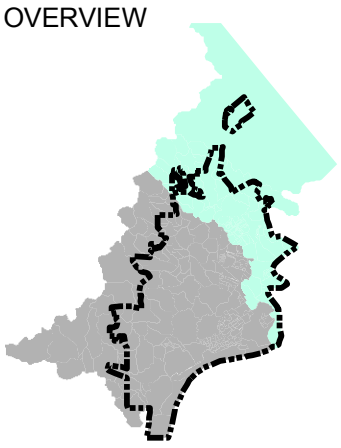

**Figure 6-2**
**Silver Creek Watershed Subcatchments**

**Legend**

Silver Creek subcatchments

N

Stantec

NOTE: LABEL REPRESENTS SUBCATCHMENT FID

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# Appendix 6.2

**Appendix 6.2. XPSWMM Input Parameters For Drainage Infrastructures for Silver Creek Watershed In Areas Of Concern**



| Castlewood | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 2 | 2.5 | 0.013 | RCP | Circular | 60 |
| 3 | 3 | 0.013 | RCP | Circular | 126 |
| 4 | 3 | 0.014 | VCP | Circular | 55 |
| 5 | 3 | 0.014 | VCP | Circular | 28 |
| 6 | 3 | 0.022 | CMP | Circular | 131 |
| 7 | 3 | 0.022 | CMP | Circular | 287 |
| 8 | 2.5 | 0.013 | RCP | Circular | 234 |
| 9 | 4 | 0.02 | ADS | Circular | 99 |
| 10 | 3 | 0.013 | RCP | Circular | 299 |
| 12 | 3 | 0.013 | RCP | Circular | 37 |
| 13 | 3 | 0.013 | RCP | Circular | 112 |
| 14 | 2.5 | 0.013 | RCP | Circular | 93 |
| 15 | 2.5 | 0.013 | RCP | Circular | 55 |
| 16 | 2.5 | 0.013 | RCP | Circular | 350 |
| 17 | 2.5 | 0.013 | RCP | Circular | 85 |
| 18 | 3 | 0.013 | RCP | Circular | 172 |
| 19 | 2.5 | 0.013 | RCP | Circular | 116 |
| 20 | 3 | 0.013 | RCP | Circular | 52 |
| 21 | 2.5 | 0.013 | RCP | Circular | 192 |
| 22 | 4 | 0.02 | ADS | Circular | 109 |
| 23 | 3 | 0.013 | RCP | Circular | 126 |
| 24 | 3 | 0.013 | RCP | Circular | 14 |
| 25 | 4 | 0.02 | ADS | Circular | 143 |
| 41 | 3 | 0.013 | RCP | Circular | 9 |
| 42 | 2.5 | 0.013 | RCP | Circular | 156 |
| 43 | 2.5 | 0.013 | RCP | Circular | 120 |
| 44 | 2.5 | 0.013 | RCP | Circular | 104 |
| 45 | 2.5 | 0.013 | RCP | Circular | 56 |
| 46 | 3 | 0.013 | RCP | Circular | 122 |
| 47 | 3 | 0.013 | RCP | Circular | 29 |
| 48 | 3 | 0.013 | RCP | Circular | 126 |
| 49 | 4 | 0.02 | ADS | Circular | 67 |
| 50 | 4 | 0.02 | ADS | Circular | 167 |
| 51 | 4 | 0.02 | ADS | Circular | 114 |
| 52 | 3 | 0.013 | RCP | Circular | 136 |
| 53 | 3 | 0.013 | RCP | Circular | 26 |
| 54 | 3 | 0.013 | RCP | Circular | 124 |
| 55 | 3 | 0.014 | VCP | Circular | 397 |
| 56 | 3 | 0.014 | VCP | Circular | 79 |
| 57 | 3 | 0.013 | RCP | Circular | 131 |
| 58 | 3 | 0.013 | RCP | Circular | 38 |
| 59 | 3 | 0.013 | RCP | Circular | 126 |

**Appendix 6.3. XPSWMM Input Parameters For Drainage Infrastructures for Silver Creek Watershed In Areas Of Concern.**



| Miller Lane | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 26 | 1.75 | 0.013 | RCP | Circular | 93 |
| 27 | 1.75 | 0.013 | RCP | Circular | 301 |
| 28 | 1.75 | 0.013 | RCP | Circular | 79 |
| 29 | 1.75 | 0.013 | RCP | Circular | 37 |
| 30 | 1.75 | 0.013 | RCP | Circular | 656 |
| 64 | 1.75 | 0.013 | RCP | Circular | 141 |

In Potential Areas Of Concern

| Woodbourne Drive and Kaywood Drive | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 1 | 2 | 0.013 | RCP | Circular | 109 |
| 11 | 2 | 0.013 | RCP | Circular | 256 |
| 60 | 2 | 0.013 | RCP | Circular | 17 |
| 61 | 2 | 0.013 | RCP | Circular | 268 |
| 62 | 2 | 0.02 | ADS | Circular | 94 |
| 63 | 2 | 0.02 | ADS | Circular | 790 |
| 65 | 4 | 0.022 | CMP | Circular | 39 |
| 68 | 4 | 0.022 | CMP | Circular | 170 |
| 69 | 4 | 0.022 | CMP | Circular | 194 |
| 72 | 3 | 0.022 | CMP | Circular | 191 |
| 73 | 3 | 0.022 | CMP | Circular | 127 |
| 74 | 3 | 0.022 | CMP | Circular | 225 |

| Korb Avenue and Lyon Lane | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 66 | 4 | 0.013 | RCP | Circular | 56 |
| 67 | 4 | 0.022 | CMP | Circular | 4 |
| 70 | 4 | 0.02 | ADS | Circular | 718 |
| 71 | 4 | 0.02 | ADS | Circular | 259 |

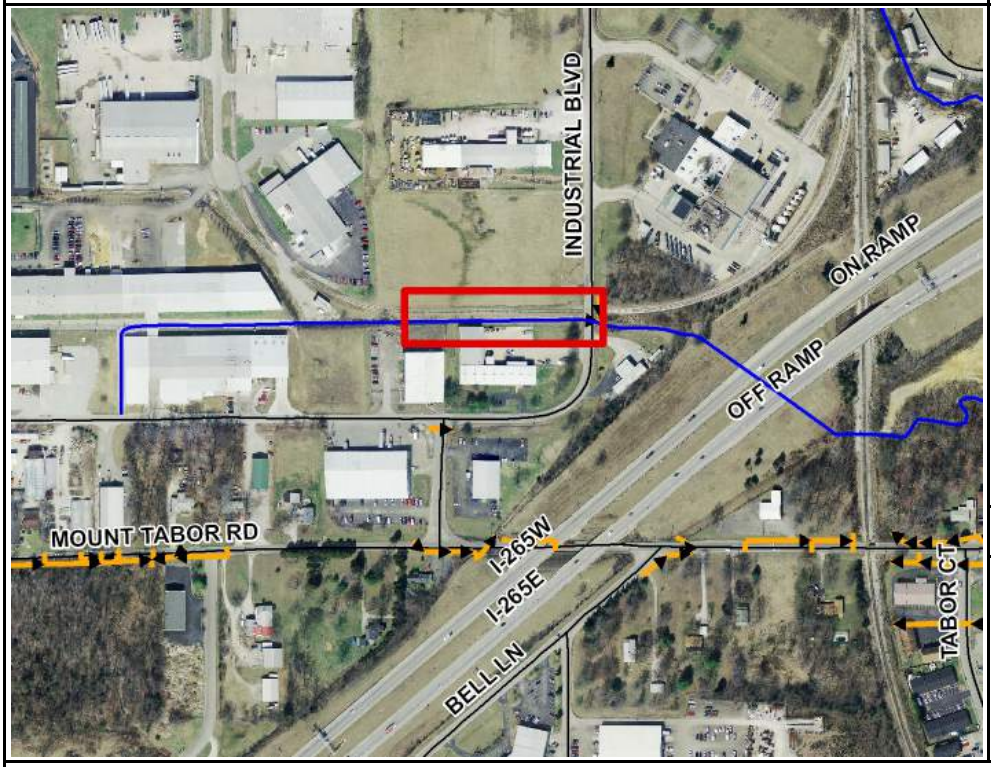
# Appendix 6.3

# Stormwater Master Planning
# City of New Albany

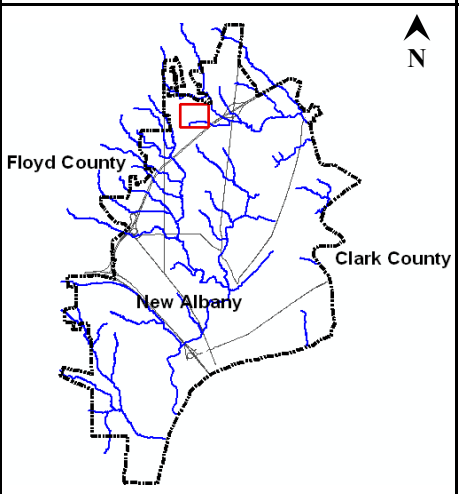
Capital Improvement

## Industrial Boulevard Fact Sheet

### Project Map




### Key Map




### Site Description

A drainage ditch drains to the east through the commercial park located on Industrial Boulevard. The drainage area is mostly impervious. City Council District 2.

### Site Pictures

### Current Concerns

Drainage request data indicates roadway flooding, culvert deterioration, first floor flooding, sedimentation in ditches and that erosion occurs throughout a drainage ditch during large storm events.

### Scope of Work

- Enhance 3,500 linear feet of ditch using two-stage ditch design to stabilize banks and promote sediment transport.
- Construct 900 linear feet of storm sewers to drain roadways
- Install 18 catchbasins

**Cost $948,000**

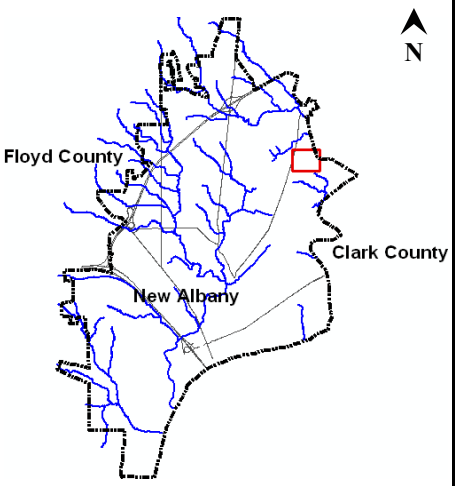
# Stormwater Master Planning
# City of New Albany

Capital Improvement

## Kraft Cemetery Fact Sheet

### Project Map


### Key Map




### Site Description

Kraft Cemetery is located east of the intersection of Charlestown Road and Old Ford Road. Surface runoff drains to a series of catchbasins within the cemetery. City Council District 5.

### Site Pictures


### Current Concerns

Ponding occurs towards the entrance of the cemetery during storm events causing some grave sites to be inundated. A debris-filled catchbasin was observed during field reconnaissance which appears to serve as the main drainage structure at the entrance of the cemetery. Drainage infrastructure is not adequate.

### Scope of Work

- Construction of storm sewers
- Installation of catch basins
- Develop and implement maintenance plan

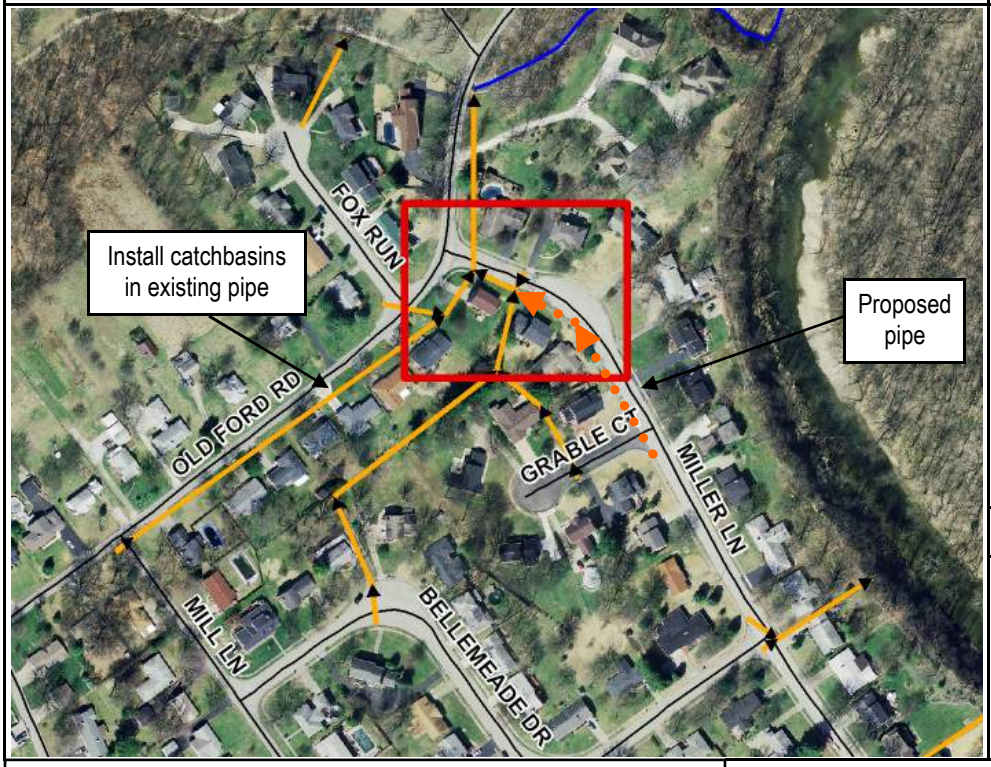
**Cost $116,000**

# Stormwater Master Planning
# City of New Albany

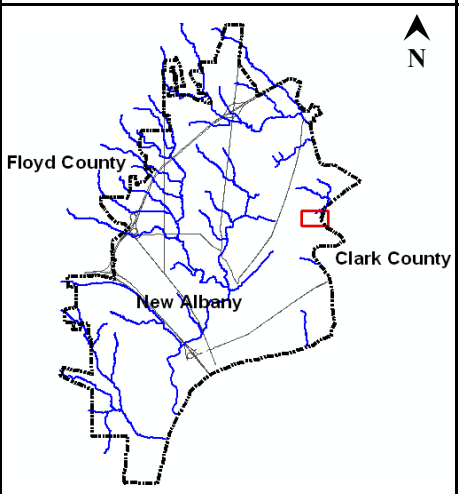
Capital Improvement

## Miller Lane Fact Sheet

### Project Map




### Key Map




### Site Description

Surface runoff flows northwest along Miller Lane and northeast along Old Ford Road towards three catchbasins located inside the red highlighted area. City Council District 5.

### Current Concerns

Residents indicate catchbasin deterioration and ponding during large rain events occur. During field reconnaissance it was observed that no catchbasins exist along Miller Ln between the three catchbasins at the bottom of the street and Bellemeade Dr. Along Old Ford Rd only one catchbasin exists between Mill Ln and Miller Ln which appears to be installed by the homeowner.

### Site Picture

Looking southwest down Old Ford Road

### Recommended Improvements

- Installation of a stormwater system along Old Ford Road and Miller Lane.
- Replace pipes along Miller Lane that drain to Silver Creek
- Routine maintenance plan of stormwater infrastructure

### Scope of Work

- Right-of-way requirements
- Construct 700 linear feet of storm sewer
- Construct 12 catchbasins

### Cost

$147,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

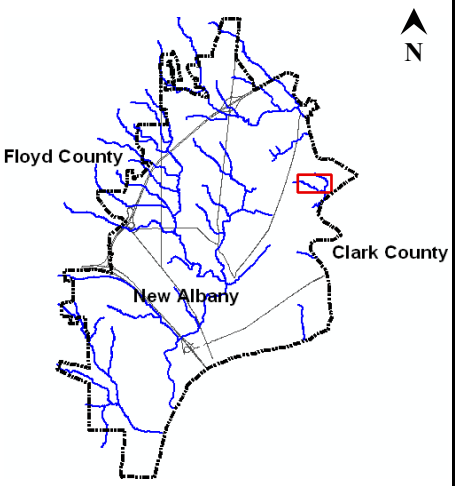
# Stormwater Master Planning
# City of New Albany

Capital Improvement

## Old Ford Road Fact Sheet

### Project Map


### Key Map




### Site Description

Surface runoff flows southeast through shallow ditches along Old Ford Road from Graceland cemetery to a ditch near Armstrong Boulevard.
City Council District 5.

### Site Pictures



### Current Concerns

Flooding occurs on Old Ford Road due to debris and sediment covering pipe and ditch. Stormwater infrastructure is not adequate.

### Scope of Work

- Construct 3,200 linear feet of storm sewers
- Install 50 catchbasins/yard inlets
- Replace 1 culvert

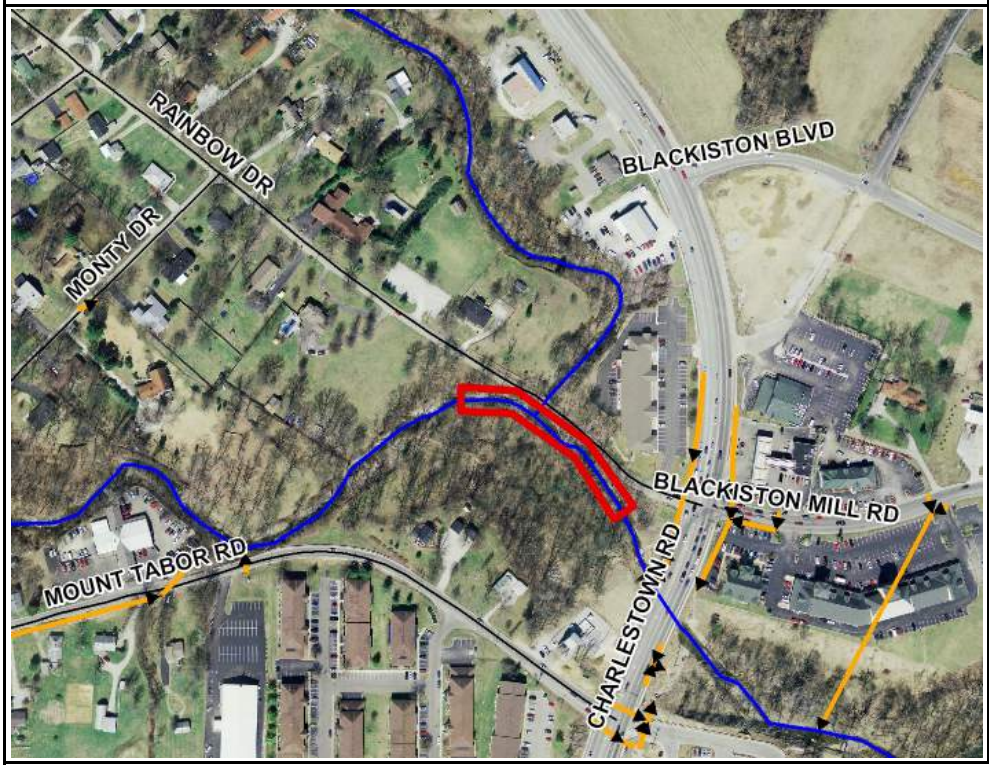
**Cost $722,000**

# Stormwater Master Planning
# City of New Albany

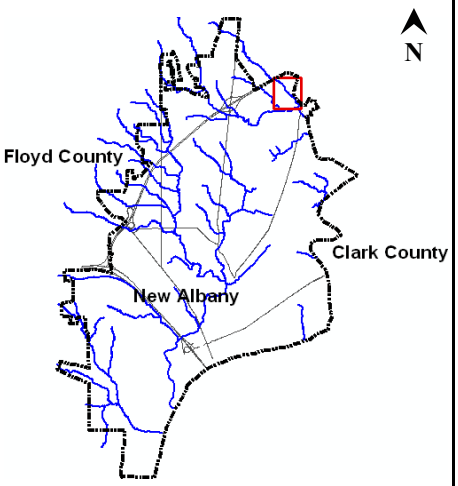
Capital Improvement

## Slate Run near Rainbow Drive Fact Sheet

### Project Map




### Key Map




### Site Description

Slate Run makes a sharp bend and flows adjacent to Rainbow Drive until it's confluence with another tributary. City Council District 6.

### Site Pictures



### Current Concerns

During field reconnaissance it was observed that the banks of Slate Run, adjacent to Rainbow Drive, have eroded leaving only a few feet between the bank and the edge of pavement. Tree root systems are visible and could result in significant bank failure.

### Scope of Work

- Construct 4,800 square feet of plantable segmented retaining wall
- Install 6 catchbasins
- Construct 60 linear feet of storm sewer outlets to creek

**Cost $206,000**

# Appendix 6.4

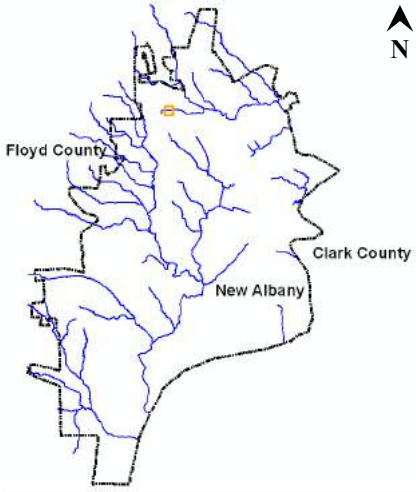
# Stormwater Master Planning
# City of New Albany

Storage Basin

## Industrial Blvd Storage Basin Fact Sheet

**Project Map**


**Key Map**




**Site Description**

Located on private property north of Industrial Blvd adjacent toTabor Run. City Council District 2.

**Site Picture**


**Basin Information**

Basin Area: 0.7 acres
Basin Volume: 2.3 ac-ft
Contributing Drainage Area: 80 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

Probable Cost: $171,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

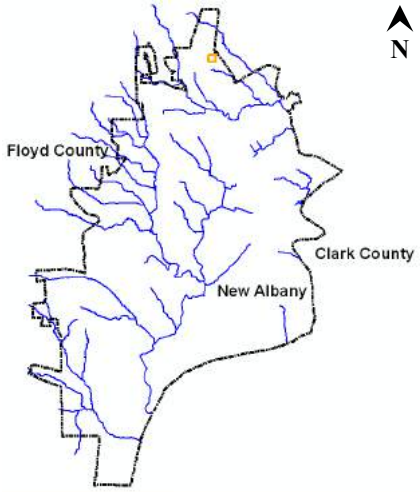
# Stormwater Master Planning
# City of New Albany

Storage Basin

## Indiana University Southeast Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on private property west of Grant Line Road on a tributary that drains into Blackiston Run. City Council District 2.

### Site Pictures


Picture A – Looking east at site


Picture B – Looking west at site

### Basin Information

Basin Area: 0.3 acres
Basin Volume: 1.5 ac-ft
Contributing Drainage Area: 18 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - University
Modeled: No

Probable Cost: $144,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

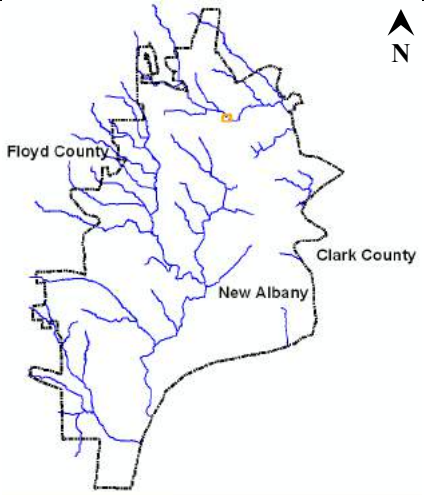
# Stormwater Master Planning
# City of New Albany

Storage Basin

## North of Mt Tabor Road Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on private property north of Mt Tabor Road adjacent to Slate Run. Standing water observed on site. City Council District 6.

### Site Pictures


Picture A – Looking southeast at site


Picture B – Looking southeast at site

### Basin Information

Basin Area: 1.3 acres
Basin Volume: 4.6 ac-ft
Contributing Drainage Area: 1200 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

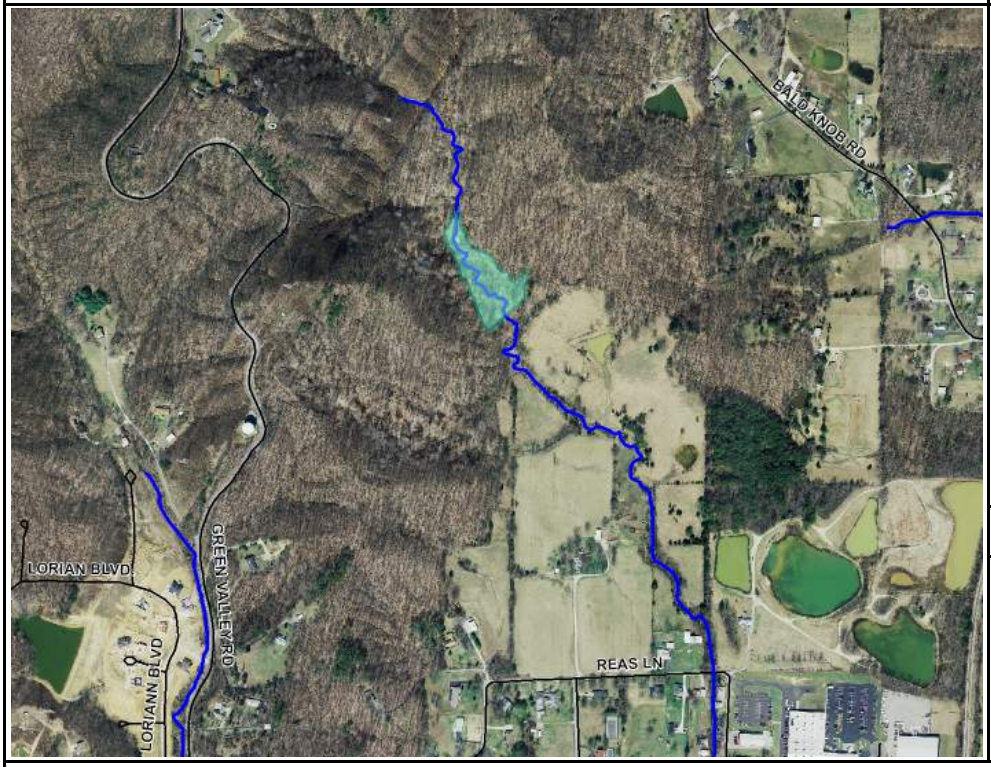
Probable Cost: $279,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

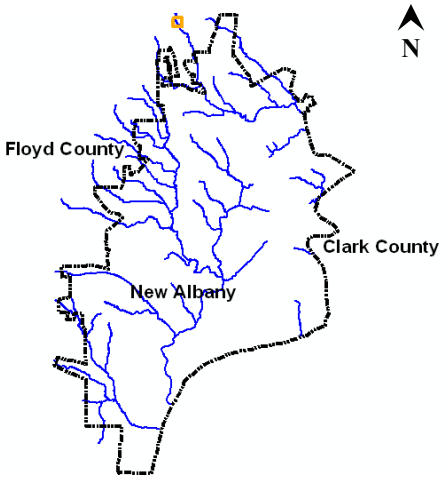
Storage Basin

## North of Reas Lane Storage Basin Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Located on private property north of Reas Lane. Outside of City Council Boundary.

**Site Picture**

Picture A – Looking north at site

**Basin Information**

Basin Area: 2.4 acres
Basin Volume: 17.2 ac-ft
Contributing Drainage Area: 73 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: No

Property Owner: Private - Residential
Modeled: Yes

Probable Cost: $400,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

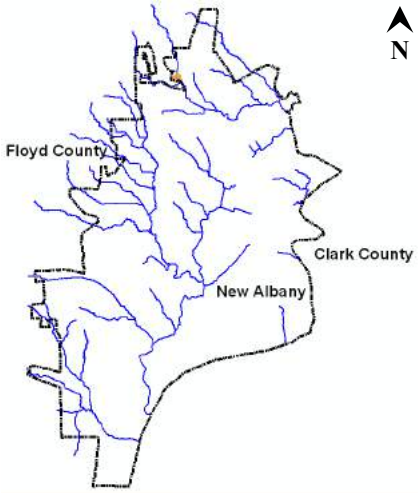
# Stormwater Master Planning
# City of New Albany

Storage Basin

## Park East - Reas Lane Storage Basin Fact Sheet

**Project Map**


**Key Map**




**Site Description**

Located on private property east of Reas Lane north of Slate Run. City Council District 2.

**Site Pictures**

Picture A – Looking south at site

Picture B – Looking southeast at site

**Basin Information**

Basin Area: 0.4 acres
Basin Volume: 1.4 ac-ft
Contributing Drainage Area: 202 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

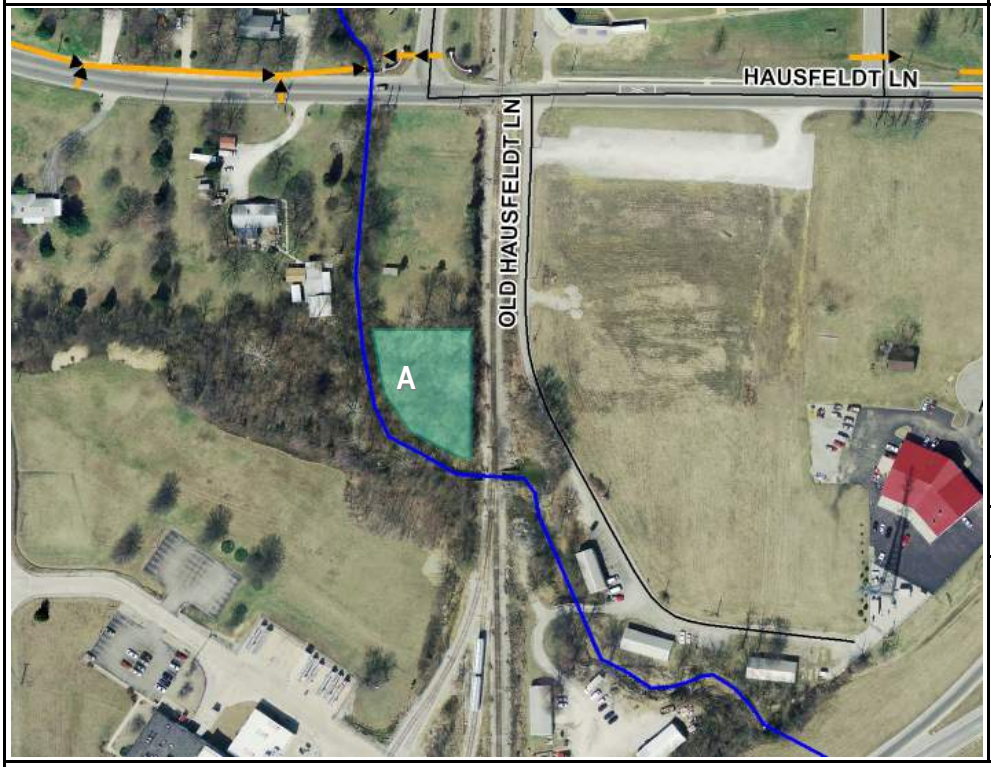
Probable Cost: $149,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

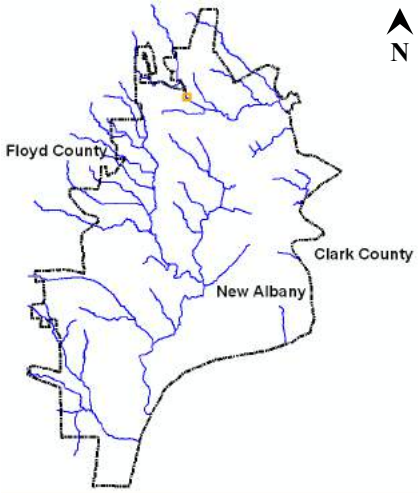
Storage Basin

## South of Hausfeldt Lane Storage Basin Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Located on private property south of Hausfeldt Lane adjacent to Slate Run. City Council District 2.

**Site Picture**


**Basin Information**

Basin Area: 0.5 acres
Basin Volume: 1.5 ac-ft
Contributing Drainage Area: 776 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

Probable Cost: $137,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

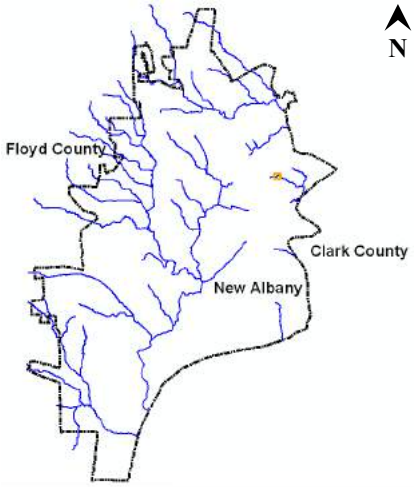
# Stormwater Master Planning
# City of New Albany

Storage Basin

## South of Old Ford Road Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on private property south of Old Ford Road at the headwaters of Town Run. City Council District 5.

### Site Pictures


Picture A – Looking southwest at site


Picture B – Looking northeast at site

### Basin Information

Basin Area: 0.5 acres
Basin Volume: 1.3 ac-ft
Contributing Drainage Area: 92 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit:: Yes

Property Owner: Private - Utility
Modeled: No

Probable Cost: $148,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Appendix 6.5

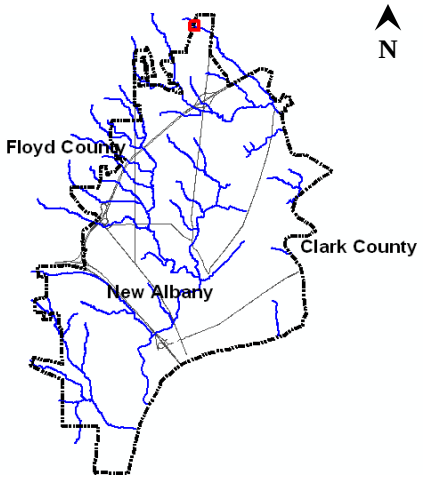
# Stormwater Master Planning
# City of New Albany

Culvert Replacement

## Bald Knob Road Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Blackiston Run. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: 6.5' x 4.5' concrete box
Proposed replacement: 10' x 4' concrete box

### Probable Cost

$102,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

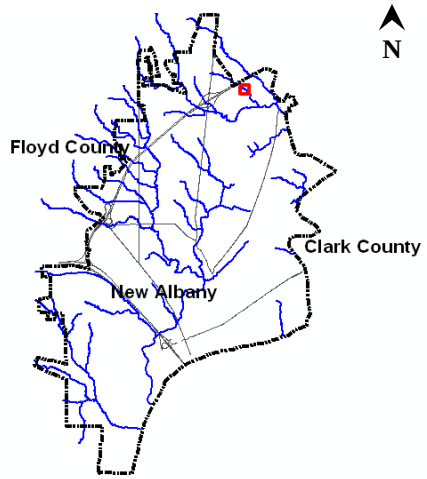
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Brookside Lane Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on a tributary of Slate Run. City Council District 6.

### Site Pictures



### Culvert Information

Existing pipe: 54” RCP
Proposed replacement: 8’ x 4’ concrete box

### Probable Cost

$88,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

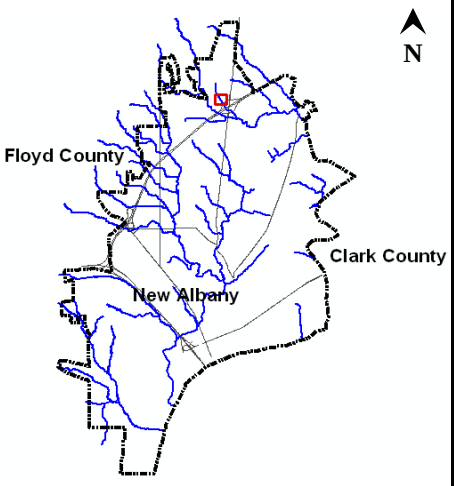
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Hausfeldt Lane Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Rail Run. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: 6.75’ x 5.25’ CMP
Proposed replacement: 10’ x 4’ concrete box

### Probable Cost

$232,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

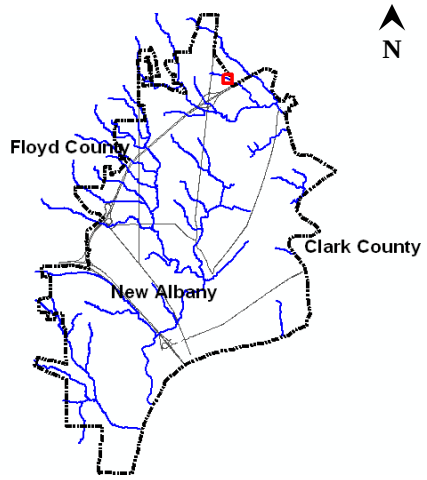
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Prestwick Square Drive Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on a tributary of Slate Run. City Council District 6.

### Site Pictures



### Culvert Information

Existing pipe: 48” corrugated plastic
Proposed replacement: 8’ x 4’ concrete box

### Probable Cost

$172,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

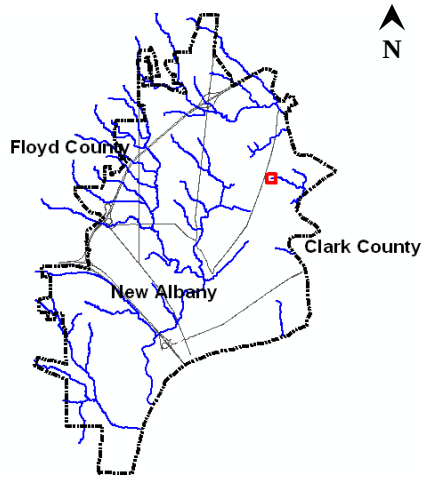
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Slate Run Road - North Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Town Run. City Council District 5.

### Site Pictures


Upstream face of culvert


Downstream face of culvert

### Culvert Information

Existing pipe: Enters at a 24” RCP that drains to a junction box, exits the junction box thru a 48” RCP

Proposed replacement: 6’ x 4’ concrete box

### Probable Cost

$191,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

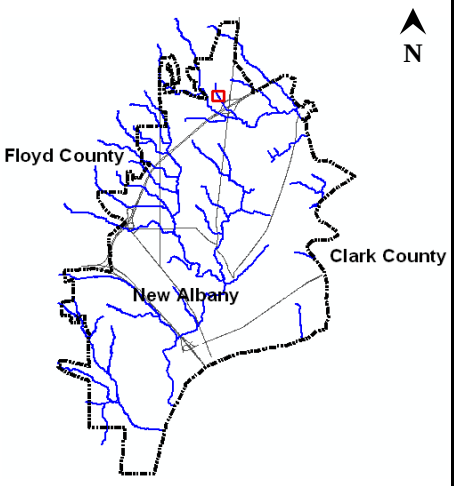
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Southern Drive Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Rail Run. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: Two 54” x 36” CMP
Proposed replacement: 8’ x 4’ concrete box

### Probable Cost

$122,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

# 7.0 Middle Creek

The Middle Creek Watershed is located in the western portion of the City of New Albany and encompasses an area of 4.9 square miles. It extends from headwaters west of the city to its confluence with the Ohio River as shown in **Figure 7.1**. It is the steepest of the watersheds in the City of New Albany. This section provides descriptions of the characteristics of the Middle Creek watershed including hydrologic and hydraulic inputs for the SWMM model developed for the watershed (**Section 7.1**); description of an area of concern in the watershed that identifies an action plan for the area (**Section 7.2**); an evaluation of selected road culverts (**Section 7.3**); identification of maintenance issues (**Section 7.4**); and the identification of potential stormwater detention basin sites (**Section 7.5**).

Drainage issues are both local and watershed-scale in nature on Middle Creek. Local issues primarily include the maintenance of existing infrastructure and the need for drainage improvements in some areas. Watershed-scale issues are structural flooding due to encroachments on the Middle Creek and Vincennes Run floodplains.

## 7.1 WATERSHED CHARACTERISTICS

#### 7.1.1.1 Sub-Basin Delineations and Soil Characteristics

As shown in **Figure 7.2**, the watershed was divided into sub-basins ranging from 8 to 344 acres for the purpose of developing the SWMM model for the watershed. According to the Soil Conservation Service (1974), soils in HSG B, C and D are present on the watershed. The watershed is characterized by steep undeveloped slopes from the upper to the lower reaches. The average slope of the watershed is 8%. According to the current land use the Middle Creek watershed is 10% developed with most of the undeveloped land located outside of the city boundaries. The hydrologic parameters for each subbasin in this watershed can be found in **Appendix 7.1**.

### 7.1.2 Flood Control Works

There are no existing flood control works on Middle Creek.

### 7.1.3 Floodplain Encroachments

There are 89 parcels with footprints that encroach the current effective Middle Creek floodplain. No floodway is shown on the current effective floodplain map. There are 83 parcels with encroachments on the preliminary floodplain maps based on the draft FIS (FEMA, 2009) for Floyd County and Incorporated Areas. In addition, there are a total of 14 structure encroachments on the preliminary floodway.

## 7.2 AREAS OF CONCERN

Primary drainage issues in the Middle Creek watershed are structures in the Middle Creek and Vincennes Run floodplains; storm drainage along Corydon Pike and maintenance of existing infrastructure in subdivisions and neighborhoods. In addition to floodplain encroachments, cause of flooding appears to be related to sediment deposition and debris accumulation in ditches, culverts and inlets. One area of concern was identified within the Middle Creek Watershed based on maintenance request logs, and input from the board and utility personnel.

### 7.2.1 Corydon Pike

In this area, Corydon Pike runs along Middle Creek above the mouth of Vincennes Run and crosses Vincennes Run. Several structures are located in the floodplains of Middle Creek and Vincennes Run. Drainage infrastructure in Corydon Pike consists of sheet flow with some roadside ditches with culverts. Maintenance requests identify flooding on Corydon Pike including several different properties along the road; general flooding and drainage issues; sediment blockages in culverts and ditches; culvert failures; and debris blockages. Maintenance log entries cite the need for a study in the area.

The recommended plan of action for this area is:

- Development and implementation of a routine maintenance program for the area that includes cleaning of existing drainage ditches, culverts and drainage inlets. Maintenance should include the removal of debris and sediment from culverts, bridges and drainageways.

- Conduct a study to evaluate the capacity and condition of the existing drainage infrastructure and develop alternatives for improving drainage in the area.

- Develop drainage improvement plans and construct improvements.

- Expand maintenance program to include drainage improvements.

The fact sheet for this area of concern is provided in **Appendix 7.2**.

## 7.3 ROAD CROSSING IMPROVEMENTS

Culverts were selected for analysis based on input from the board, utility personnel and maintenance request logs. Selected culverts were modeled for a 25-YR, 24-HR storm event for existing conditions. Culverts that were undersized were replaced in the SWMM model with larger concrete box culverts that can pass the 25-YR, 24-HR storm event without overtopping roadways. Fact sheets within **Appendix 7.3** provide more detailed information regarding each culvert replacement. **Table 7.1** provides a summary of culverts and during which rainfall event the roadway is overtopped. The culverts shown in the table below do not represent all the culverts located in the Middle Creek watershed.

**Table 7.1. Middle Creek Watershed culvert performance during rainfall events.**

| Location | Location in Sub-Basin | Overtopping for existing conditions | | | |
|---|---|---|---|---|---|
| | | 100-YR, 24-HR | 25-YR, 24-HR | 10-YR, 24-HR | 2-YR, 24-HR |
| Eagles Lane^ on Vincennes Run | high | Yes | Yes | No | No |
| Corydon Pike on Vincennes Run | high | No | No | No | No |
| William Lane^ on Middle Creek | high | Yes | Yes | No | No |
| Broeker Lane* on Tributary of Middle Creek | low | Yes | Yes | No | No |
| Busch Place - West[1] on Vincennes Run | middle | Yes | Yes | Yes | No |
| Busch Place - East[1] on Corydon Run | low | Yes | Yes | Yes | Yes |

[1] *Culvert not in good condition.*
^ *Roadway was modeled as being overtopped for the 25-YR, 24-HR event due to the conservative approach used for drainage basins but was not considered as a replacement because minimal flow was modeled over the roadway and/or the location of the culvert inside the watershed.*
* *Roadway was modeled as being overtopped for the 25-YR, 24-HR event but was not considered as a replacement because possible locations of storage basins upstream would reduce the flow at the culvert.*

As in **Sections 5.4 and 6.4**, priorities for culvert improvements or replacement based on over topping frequency are:

- **Priority 1:** Culverts that are overtopped for the 2-YR, 24-HR design storm or smaller (shown in red in **Table 7.1**);
- **Priority 2:** Culverts that overtop for the 10-YR, 24-HR storm or smaller (shown in orange in **Table 7.1**); and
- **Priority 3:** Culverts that are overtopped by the 25-YR, 24-HR storm or smaller Shown in yellow in **Table 7.1**).

Using these frequency-based priorities, priorities for improvements to the culverts in **Table 7.1** are:

**Priority 1:**

Busch Place – East on Corydon Run

**Priority 2:**

Busch Place – West on Vincennes Run

**Priority 3:**

Eagles Lane on Vincennes Run

William Lane on Middle Creek

Broeker Lane on Tributary of Middle Creek

The structural integrity of existing culverts, as well as hydraulic capacity, needs to be considered in setting priorities for improvements. In **Table 7.1**, both the Busch Place – East and Busch Place – West culverts also were not found in good condition. It may be prudent to give Busch Place – West higher priority, depending on the relative condition of the culverts. An engineering assessment of the condition of both culverts should be made and its findings considered in setting priority and developing designs for these culverts.

There was no evidence of deteriorated conditions observed on the Priority 3 culverts. Their priority should be based on hydraulic capacity unless other conditions warrant their being a higher priority. A conservative approach was used in evaluating the runoff from sub-basins draining to the culverts. A more detailed analysis should be made of these culverts before proceeding to the design phase for improvements.

## 7.4 MAINTENANCE ISSUES

Routine maintenance of the Middle Creek stormwater system should be a major priority. A monthly maintenance schedule should be developed for those mentioned in **Section 6.2** as well as areas that historically require routine maintenance within the Middle Creek Watershed.

## 7.5 PROPOSED STORAGE BASINS

Within the Middle Creek Watershed four sites have been identified as being potential storage basins. A list of the potential basins not modeled and modeled are in **Tables 7.2** and **7.3** respectively. Details for each of the potential storage basins can be found on the fact sheets in **Appendix 7.4**.

**Table 7.2 - Middle Creek Proposed Storage Basins – Not Modeled.**

| Basin Location | Basin Area (acres) | Potential Basin Volume (acre-ft) | Drainage Area (acres) |
|---|---|---|---|
| Busch Place-East | 1.0 | 1.3 | 160 |
| Busch Place-West | 5.2 | 28.7 | 491 |
| South of Old Vincennes Road | 1.1 | 3.8 | 266 |

**Table 7.3 - Middle Creek Proposed Storage Basins - Modeled.**

| Basin Location | Surface Area (acres) | Drainage Area (acres) | 25yr Volume (ac-ft) | Peak Inflow (cfs) | Peak Outflow (cfs) | Percent Flow Reduction |
|---|---|---|---|---|---|---|
| West of Broeker Lane | 1.7 | 60 | 6.9 | 222 | 15 | 93% |

## 7.6 PROJECT COSTS

Opinions of Cost were developed the capital improvement projects identified in **Section 8** for the Middle Creek Watershed. Corydon Pike is the only local improvement project identified on the watershed. Four potential sites for stormwater detention basins were identified that are watershed-scale improvements. Two road crossing improvements were also identified.

The cost opinion for the Corydon Pike area is $741,000.

**Table 7.4** is the summary of probable costs for Watershed-Scale Improvements on the Middle Creek Watershed. Watershed-Scale Improvements are the construction of stormwater detention basins that are expected to reduce the frequency and severity of flooding along Middle Creek. The total of the cost opinions for basin improvements is $1,620,000.

**Table 7.4. Opinions of Cost for Watershed-Scale Capital Improvements (Detention Basins).**

| Basin Location | Probable Cost |
|---|---|
| Busch Place-East | $145,000 |
| Busch Place-West | $1,386,000 |
| South of Old Vincennes Road | $229,000 |
| West of Broeker Lane | $389,000 |
| Total | $2,149,000 |

Probable costs for improvements at high priority road crossings are summarized in **Table 7.5** for crossings on Middle Creek and its tributaries. High priority crossings are Priority 1 culverts and Priority 2 culverts that are not in good condition. The total cost of these improvements is $501,000 as shown in the table.

**Table 7.5. Probable Costs of High Priority Road Crossing Improvements on Middle Creek.**

| Location | Probable Cost |
|---|---|
| Busch Place – West on Vincennes Run | $254,000 |
| Busch Place – East on Corydon Run | $247,000 |
| Total | $501,000 |

The breakdown of cost opinions for local improvements; watershed-scale improvements and road crossing improvements is:

**Local Improvements:** $741,000

**Watershed-Scale Improvements:** $2,149,000

**Road Crossing Improvements:** $501,000

The total of the cost opinions for drainage improvements on Middle Creek is $3,391,000. This is 15% of the cost of recommended drainage improvements in the City of New Albany.

## 7.7 SUMMARY

The Middle Creek Watershed is the steepest and least developed of the watersheds that drain the City of New Albany and covers 4.9 square miles. .

One Area of Concern ("Corydon Pike") was identified in the Middle Creek Watershed based on input from the board and utility personnel. Four detention basin sites were identified for watershed-scale improvements that may reduce flood frequency and severity along reaches of the Middle Creek floodplain. Two high-priority road crossing improvements were also identified on Busch Place - East and Busch Place - West.

The probable costs of capital improvements have been placed in three categories: local improvements; watershed-scale improvements and road crossing improvements. The total of the opinions of cost for the watershed is $3,391,000, 15% of the cost of improvements identified in the City of New Albany.

# Appendix 7.1

Table 7.1 Middle Creek watershed Sub-basin Parameters 

| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 228.36 | 0.04 | 4210 | B/C | 0.15 | 0.155 | 7.6 | 0 | 36 |
| 1 | 179.65 | 0.13 | 3820 | B/C | 0.15 | 0.155 | 7.6 | 0 | 39 |
| 2 | 104.91 | 0.11 | 5910 | B/C | 0.15 | 0.155 | 7.6 | 0 | 39 |
| 3 | 159.48 | 0.1 | 9075 | B/C | 0.15 | 0.155 | 7.6 | 0 | 39 |
| 4 | 164.23 | 0.1 | 3300 | B | 0.2 | 0.17 | 6.6 | 5 | 37 |
| 5 | 222.11 | 0.1 | 7750 | B/C | 0.15 | 0.155 | 7.6 | 6 | 38 |
| 6 | 137.13 | 0.04 | 6300 | B/C | 0.15 | 0.155 | 7.6 | 8 | 39 |
| 7 | 63.78 | 0.2 | 4625 | B | 0.2 | 0.17 | 6.6 | 0 | 38 |
| 8 | 254.60 | 0.07 | 7050 | B | 0.2 | 0.17 | 6.6 | 3 | 38 |
| 9 | 214.52 | 0.105 | 7800 | B/C | 0.15 | 0.155 | 7.6 | 0 | 39 |
| 10 | 21.83 | 0.03 | 750 | C | 0.1 | 0.14 | 8.6 | 0 | 38 |
| 11 | 13.31 | 0.01 | 1615 | B | 0.2 | 0.17 | 6.6 | 0 | 37 |
| 12 | 151.83 | 0.07 | 6480 | B | 0.2 | 0.17 | 6.6 | 0 | 38 |
| 13 | 182.39 | 0.05 | 10885 | B | 0.2 | 0.17 | 6.6 | 0 | 38 |
| 14 | 334.16 | 0.07 | 13800 | B | 0.2 | 0.17 | 6.6 | 0 | 39 |
| 15 | 69.38 | 0.07 | 2190 | B | 0.2 | 0.17 | 6.6 | 0 | 38 |
| 16 | 229.51 | 0.07 | 6570 | B | 0.2 | 0.17 | 6.6 | 0 | 39 |
| 17 | 344.17 | 0.08 | 10242 | B | 0.2 | 0.17 | 6.6 | 0 | 39 |
| 18 | 7.98 | 0.04 | 1022 | B | 0.2 | 0.17 | 6.6 | 0 | 38 |
| 19 | 48.20 | 0.15 | 3510 | B | 0.2 | 0.17 | 6.6 | 2 | 38 |

*The sub-subasin slope reflects the average along the pathway of overland flow to inlet locations.

**Irregularly shaped subcatchments with drainage channels off-centre can be handled by computing a skew factor:

Sk = (A2 - A1) / A

W = (2 - Sk) * L

*where*

Sk = skew factor

A1 = area to one side of the channel

A2 = area to other side of the channel

A = total area

W = subcatchment width

L = length of main drainage channel

# Appendix 7.2

## Appendix 7.2 XPSWMM Input Parameters For Drainage Infrastructures for Middle Creek Watershed

No drainage infrastructure was modeled in XPSWMM for the Middle Creek Watershed

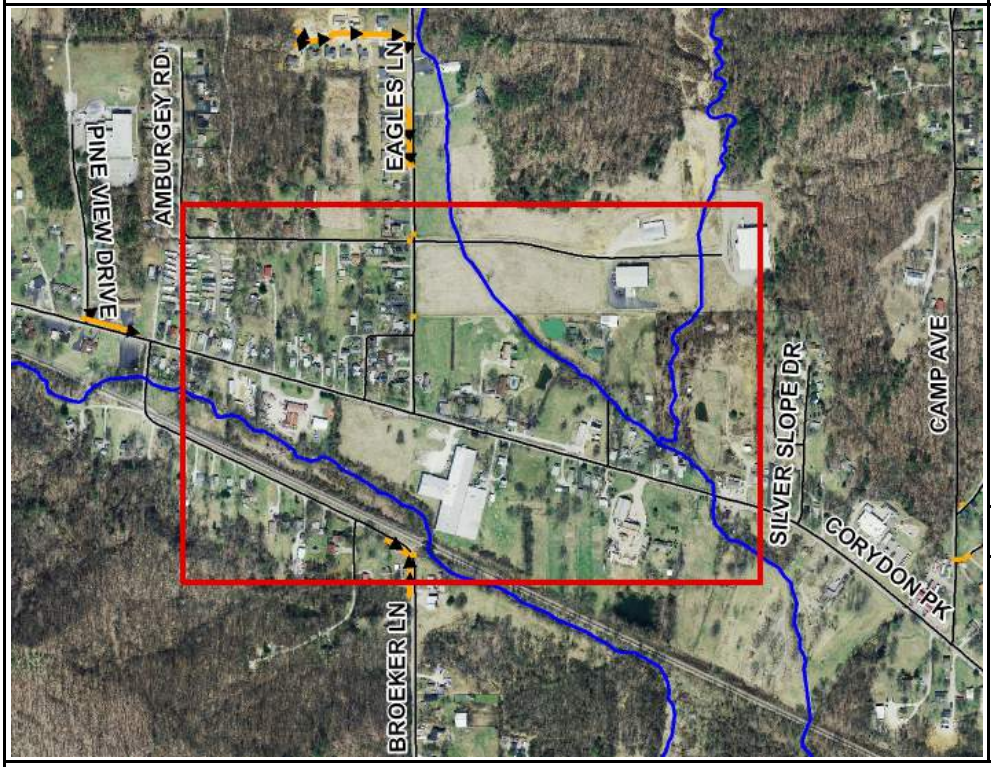
# Appendix 7.3

# Stormwater Master Planning
# City of New Albany

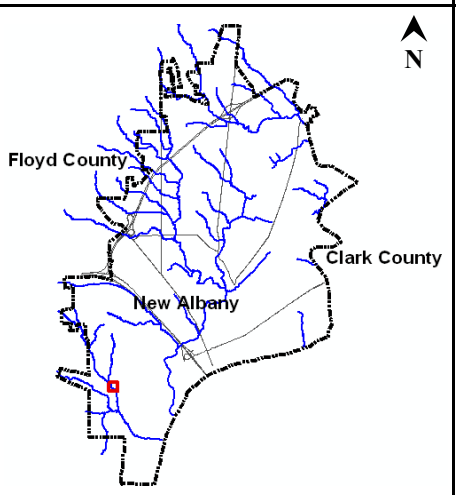
Capital Improvement

## Corydon Pike Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Corydon Pike stormwater system consists of sheet flow with some ditch with culvert.
City Council District 1 and 2.

**Site Pictures**

**Current Concerns**

Complaints in the area indicate flooding at several different properties along Corydon Pike due to deteriorating pipes. Most complaints indicate either pipe failure or blockage. Drainage infrastructure is inadequate.

**Scope of Work**

- Construct 4,750 linear feet of storm sewer
- Install 40 catchbasins

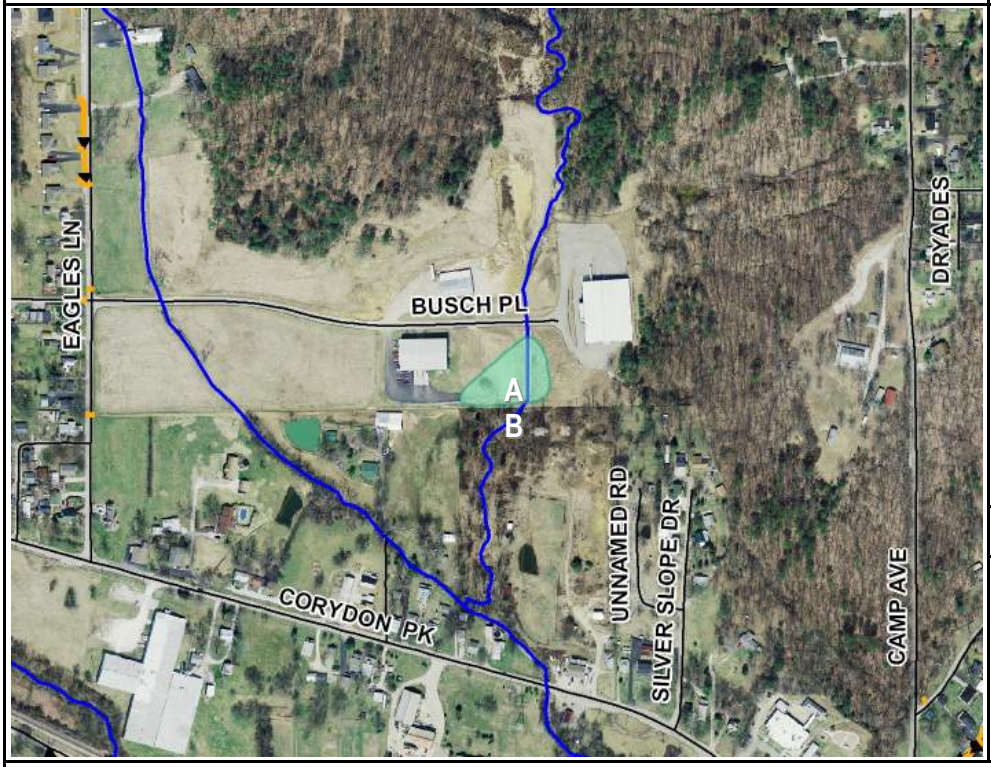
**Cost $741,000**

# Stormwater Master Planning
# City of New Albany

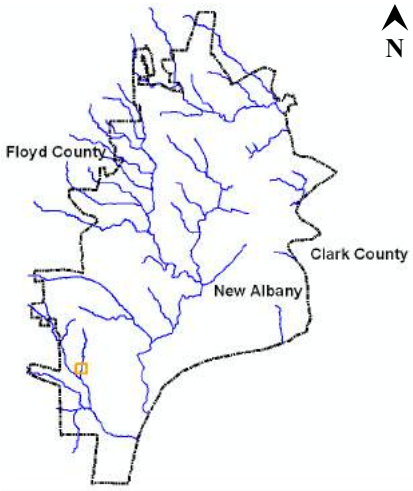
Storage Basin

## Busch Place East Storage Basin Fact Sheet

**Project Map**




**Key Map**




**Site Description**

Located on private property south of Busch Place adjacent to Corydon Run. Bank on outlet structure has serious Erosion. City Council District 2.

**Site Pictures**


Picture A – Looking north at site


Picture B – Looking at outlet structure

**Basin Information**

Basin Area: 1.0 acres
Basin Volume: 1.3 ac-ft
Contributing Drainage Area: 160
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

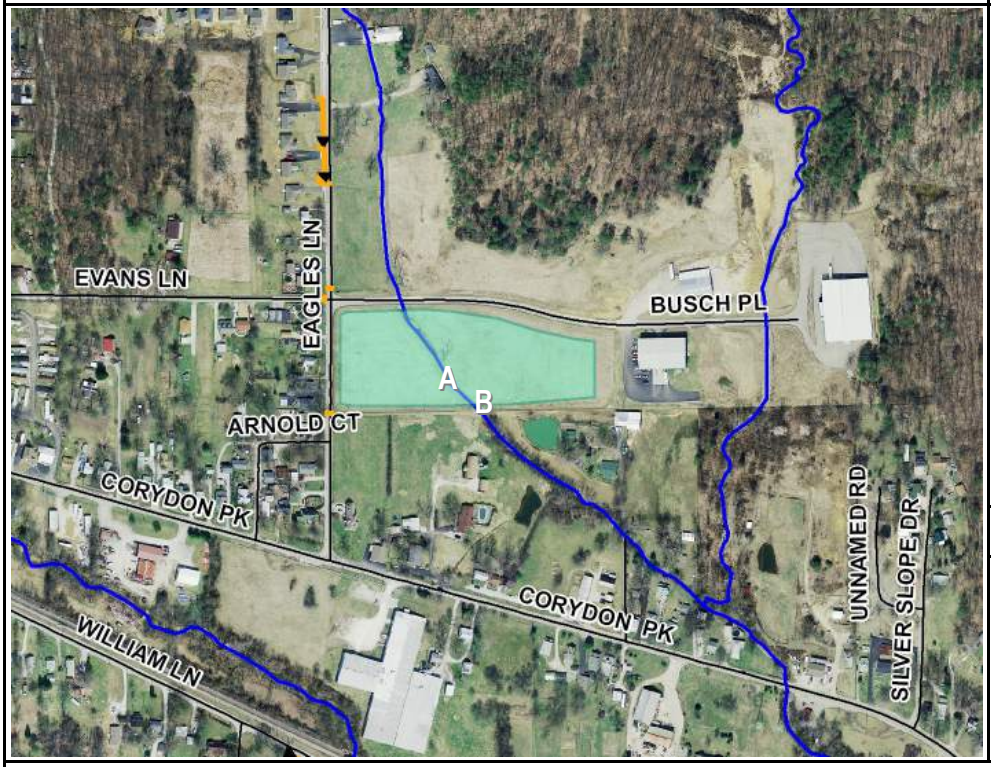
Probable Cost: $145,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

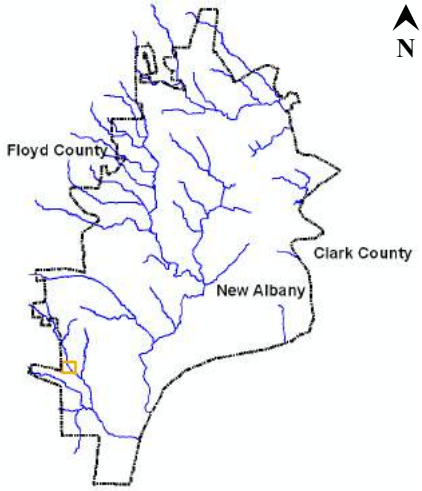
Storage Basin

## Busch Place West Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property south of Busch Place adjacent to Vincennes Run. Possibly an existing storage basin. City Council District 2.

### Site Pictures


Picture A – Looking north at site


Picture B – Looking south at outlets

### Basin Information

Basin Area: 5.2 acres
Basin Volume: 28.7 ac-ft
Contributing Drainage Area: 491 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: Yes

Property Owner: Private - Commercial
Modeled: No

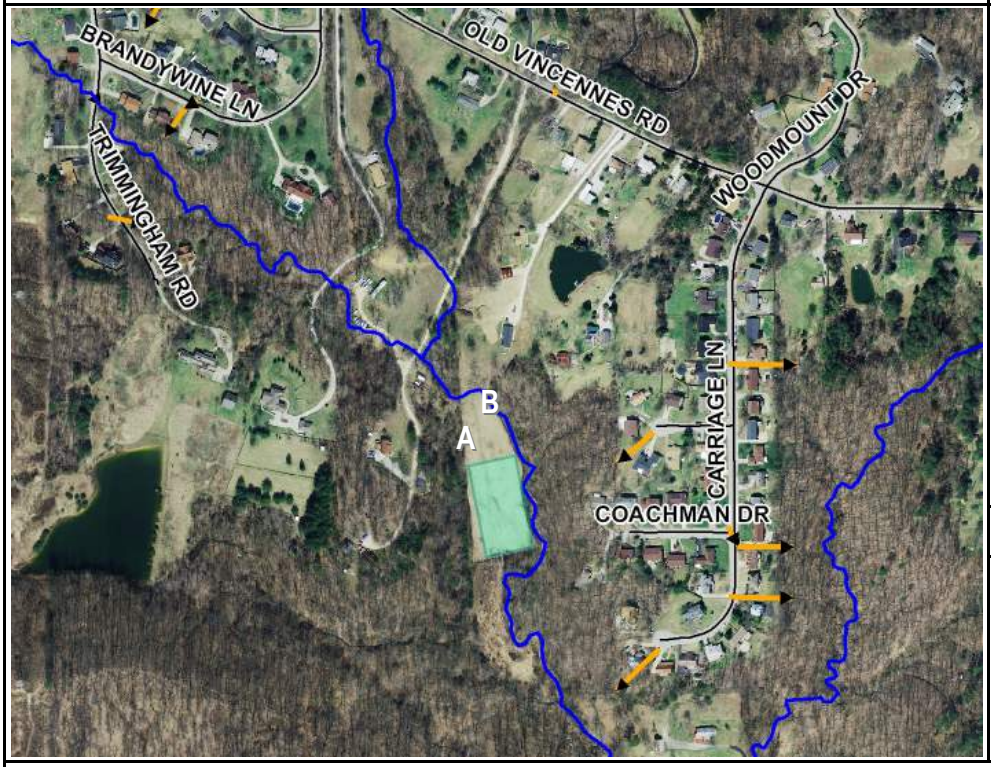
Probable Cost: $1,386,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

# Stormwater Master Planning
# City of New Albany

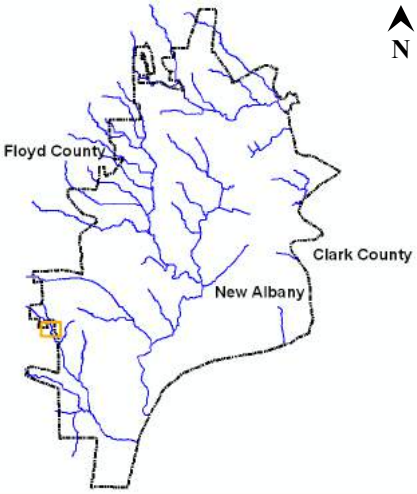
Storage Basin

## South of Old Vincennes Road Storage Basin Fact Sheet

### Project Map




### Key Map




### Site Description

Located on private property south of Old Vincennes Road adjacent to Vincennes Run. Outside of City Council Districts.

### Site Pictures


Picture A – Looking south along fence line.


Picture B – Looking south downstream.

### Basin Information

Basin Area: 1.1 acres
Basin Volume: 3.8 ac-ft
Contributing Drainage Area: 266 acres
Type of Basin: Off-line
Property Available: Yes
Property Within City Limit: No

Property Owner: Private– Residential
Modeled: No

Probable Cost: $229,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

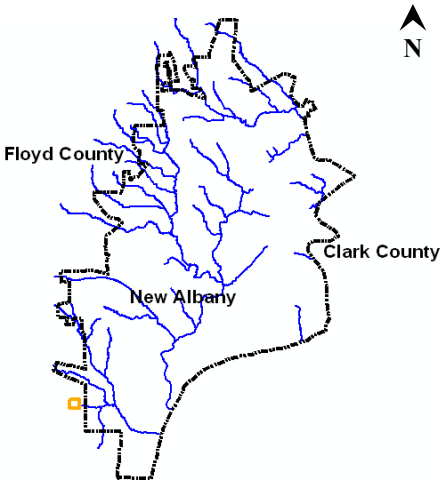
# Stormwater Master Planning
# City of New Albany

Storage Basin

## West of Broeker Lane Storage Basin Fact Sheet

### Project Map


### Key Map




### Site Description

Located on private property west of Broeker Lane. Outside of City Council Districts.

### Site Picture


Picture A – Looking west toward site

### Basin Information

Basin Area: 1.7 acres
Basin Volume: 12.0 ac-ft
Contributing Drainage Area: 60 acres
Type of Basin: Off-line
Property Available:
Property Within City Limit: No

Property Owner: Private - Residential
Modeled: Yes

Probable Cost: $389,000*
*Cost includes construction cost plus 25% Engineering and Contingency only.

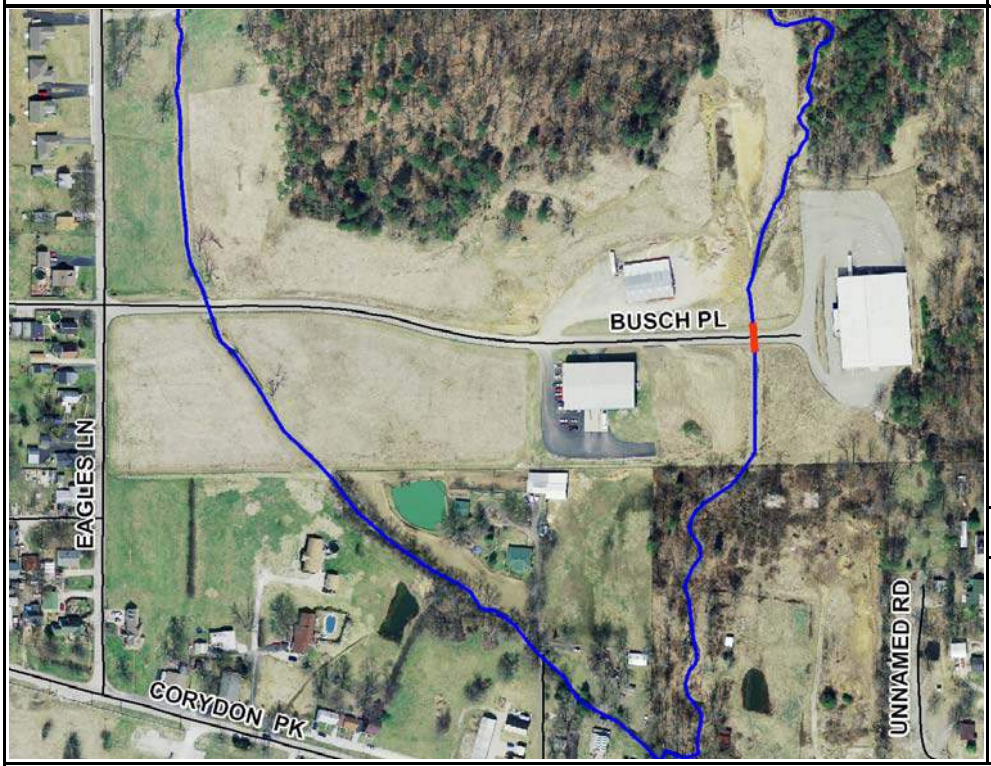
# Appendix 7.4

# Stormwater Master Planning
# City of New Albany

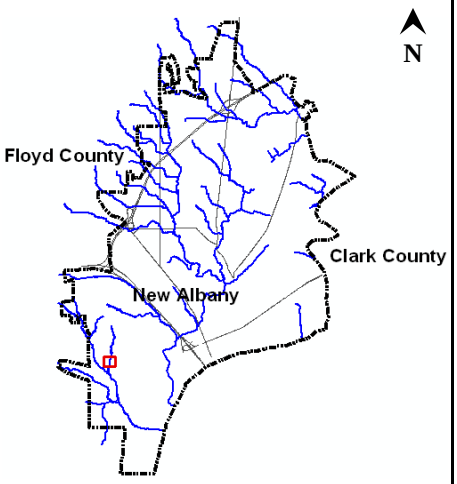
Culvert Replacement

## Busch Place - East Culvert Replacement Fact Sheet

### Project Map




### Key Map




### Site Description

Located on Corydon Run. City Council District 2.

### Site Pictures



### Culvert Information

Existing pipe: 48" RCP
Proposed replacement: 12' x 4' concrete box

### Probable Cost

$247,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

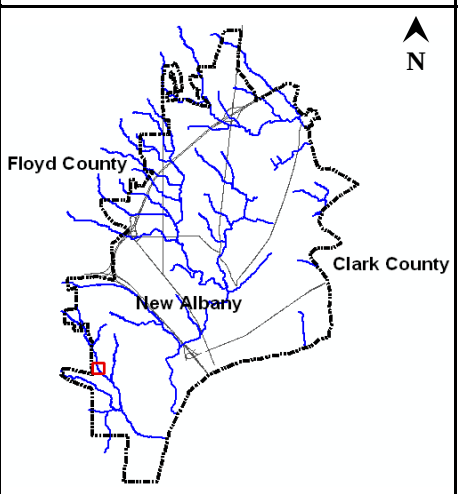
# Stormwater Master Planning
# City of New Albany

**Culvert Replacement**

## Busch Place - West Culvert Replacement Fact Sheet

### Project Map


### Key Map




### Site Description

Located on Vincennes Run. City Council District 2.

### Site Pictures


Upstream face of culvert


Downstream face of culvert

### Culvert Information

Existing pipe: Two 48" RCP
Proposed replacement: Two 12' x 4' concrete box

### Probable Cost

$254,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

# 8.0 Ohio River

All streams draining the City of New Albany are ultimately tributary to the Ohio River. Approximately 1.6 square miles of the downtown area drain directly to the Ohio River. The extent of the Ohio River watershed in New Albany is shown in **Figure 8.1**. The city is protected from Ohio River floods by a floodwall that extends from Silver Creek along the river to Middle Creek and six flood pumping stations.

Analysis and results for the evaluation of the Ohio River Watershed are provided in **Section 8. Section 8.1** describes the watershed characteristics and their representation in the SWMM model for the watershed. This section provides discussion of watershed characteristics; their Descriptions of the Areas of Concern are provided in **Section 8.2**. The areas were identified through discussions with the board and utility personnel and review of maintenance request logs. It describes drainage issues in the areas, presents SWMM simulation results and provides recommended plans of action each area. Action plans are based on information provided in request logs and SWMM model results.

Routine maintenance needs that were identified in the watershed are provided in **Section 8.3** while **Section 8.4** provides cost opinions for local improvements in the watershed. The evaluation of the Ohio River Watershed is summarized in **Section 8.5**.

## 8.1 WATERSHED CHARACTERISTICS

The watershed is characterized by flat slopes with high-intensity development to the east and less developed land to the west. The average slope for the watershed is 1%. Current land use (See **Figure 4.5**) on the Ohio River watershed is 96% developed with most of the undeveloped land located on the unprotected side of the floodwall.

### 8.1.1 Soil Characteristics and Sub-Basin Delineation

The soil survey (USDA, 1974) shows that soils in the Ohio River Watershed are HSG C. **Figure 8.2** shows the sub-basins or subcatchments used to represent the hydrology of areas of concern in the watershed. The sub-basin areas range in size. Effective hydraulic conductivities, moisture deficits and wetting front suction values for the Green-Ampt equation were assigned to each sub-basin based on HSG B, as described in **Section 4**.

Land use and terrain data such as impervious areas, soil types, land slopes were developed using the GIS database. Hydrologic Inputs for the sub-basins (drainage area, average slope, representative width, Hydrologic Soil Group (HSG), and Percent Impervious Area for Existing (EC) and Fully Developed Conditions (FD)) are provided in **Appendix 8.1**. SWMM inputs for the drainage infrastructure in the sub-basins are given in **Appendix 8.2**.

### 8.1.1.1 Flood Control Works

Flood control works in the Ohio River drainage area include the Ohio River levee and three flood pumping plants: Chambers Street; East 10th Street; and East 3rd Street. The pumping stations are essentially the only drainage relief in this area for properties protected by the levee when the Ohio River is at flood stage and the flood control works are in operation. The capacity of the pumping stations are provided in **Table 8.1**.

**Table 8.1. Flood Pumping Station Capacities and Operation Stages.**

| Pumping Plant | Location | Capacity | Ohio River Stage to Start Operation | Ohio River Water Flood Elevation |
|---|---|---|---|---|
| Chambers Street | Landward Toe of Levee at Foot of Chambers Street | 16,000 gpm (36 cfs) | 55.0 ft | 428.9 ft |
| East 10th Street | Foot of East 10th Street | 21,750 gpm (48 cfs) | 61.2 ft | 434.8 ft |
| East 3rd Street | Landward of Levee between 3rd and 4th Street | 4350 gpm (10 cfs) | 57.7 ft | 431.3 ft |

### 8.1.1.2 Floodplain Encroachments

Along the Ohio River, the floodway encompasses the entire floodplain within the City Limits. There are a total of 43 parcels with structures that encroach the floodplain/floodway for both the current effective and preliminary floodplain maps. There are a total of 99 structures that encroach the floodway on the current effective floodplain map and 103 structures that encroach the preliminary floodway.

## 8.2 AREAS OF CONCERN

There is significant flooding of stormwater drainage infrastructure in the Ohio River Watershed in New Albany, including storms where the river is at normal pool. Deteriorated infrastructure and lack of infrastructure in some areas are the primary causes of drainage system flooding. Two areas of concern, Galt Street and the Reno Avenue – Market Street areas were identified and evaluated in this study. Descriptions of these areas of concern, their drainage-related issues and proposed solutions are provided in the following paragraphs. Fact sheets for the Areas of Concern are provided in **Appendix 8.3**.

### 8.2.1 Galt Street

Stormwater flows in curb and gutter along streets in the Galt Street Area as shown in **Figure 8.1**. The storm sewer on Galt Street drains portions of East Main Street to 16th Street in the west and along Dewey Street to 18th Street in the east. The Galt Street storm sewer is a 24-inch RCP that empties to an outlet structure along the Ohio River Floodwall system to the south of Galt Street.

Maintenance requests indicate street flooding issues with water not able to reach catchbasins, catchbasins that do not appear to have an outlet; automobile flooding; the need to close streets; deteriorating catchbasins, including unsafe washouts around existing basins and rusted pipe that has deteriorated. SWMM model results indicate that the system has capacity to move the stormwater it receives if all sewers are clear. It appears that failing infrastructure may be the cause of flooding issues in this area.

The plan of action for this area should include:

- Televideo inspection of the existing storm sewers, catch basins and junctions in the area along with visual inspections of curbs, gutters and inlets to determine the size, extent, and condition of the existing stormwater infrastructure.

- Develop a repair, retrofit or replacement plan for the storm sewer system in this area based on field findings.

- Implement repair, retrofit and/or replacement construction program for the area of concern based on plans using appropriate level of engineering to prepare.

- Development and implementation of a routine maintenance plan for the area.

### 8.2.2 Reno Avenue – Market Street

The stormwater system near Reno Avenue and Market Street is “curb and gutter”, with a limited number of catch basins and separate storm sewers. It is shown in **Figure 8.4**. The storm sewers flow to a culvert that flows southwest underneath Bicknell Park. Maintenance requests in the area are related to flooding during storms. Reports by property owners indicate flooding is caused by inadequate storm drainage that is limited by the capacity of the storm sewer system in streets and rear yards. There are only a limited number of catch basins on Reno Avenue while there are no catch basins on Market Street. No drainage infrastructure exists in rear yards. Both street and rear yard flooding causes structural damages in the area. The streets are on a flat grade which cause water to pond in the streets and contributes to the severity of flooding.

The proposed project will provide the following improvements:

- Increase storm sewer capacity to meet or exceed level of service standards.
- Provide improved drainage outlet by rerouting outfall to existing storm drainage infrastructure on Silver Street and up Woodrow Avenue.
- Install drainage pipe and yard inlets to provide drainage relief in rear yards.
- Provide adequate inlet capacity with proper placement and sizing of catch basins and yard inlets.
- Provide access points for routine cleaning of catch basins.
- Milling and removal of existing pavement to recover gutter capacity.
- Replace and/or refurbish curbs and gutters to improve flow to catch basin inlets and provide effective street drainage.
- Repair sidewalks, streets and other infrastructure damaged by storm sewer failures.
- Repave streets in the area following the completion of drainage improvements.
- Develop and implement a routine maintenance program for the area.

## 8.3 MAINTENANCE ISSUES

Routine maintenance of the Ohio River stormwater system should be a major priority. A monthly maintenance schedule should be developed for those mentioned in **Section 8.2** as well as areas that historically require routine maintenance within the Ohio River Watershed.

## 8.4 OPINIONS OF COST

The cost opinions for local improvements in the “Galt Street” and “Reno Avenue – Market Street” areas are shown in **Table 8.2.**

**Table 8.2. Opinion of Probable Cost for Ohio River Capital Improvements - Local Improvements.**

| Area of Concern | Probable Cost |
|---|---|
| Galt Street | $809,000 |
| Reno Avenue – Market Street | $847,000 |
| Total | $1,656,000 |

The total cost of improvements in the Ohio River Watershed is $1,367,000.

## 8.5 SUMMARY

The drainage infrastructure in the Ohio River Watershed represents some of the older storm sewers in the city. The primary concerns in the watershed are effective drainage to existing infrastructure. The “Galt Street” area is served by storm sewers that have a limited number of inlets and is showing signs of storm sewer and catch basin failures. The “Reno Avenue – Market Street” area has inadequate drainage infrastructure. There are no storm sewers in Market Street with only minimal infrastructure in the area.

Local improvements include inspections to evaluate the condition of existing systems; storm sewer and catch basin repairs; storm sewer improvements to increase capacity; catch basin improvements; and repairs and improvements to curb and gutter systems.

The probable cost of improvements in the watershed is $1,656,000. This represents seven percent (7%) of the recommended stormwater drainage improvements in the City of New Albany.

# Appendix 8.1

Table 8.1 Ohio River Watershed Sub-basin Parameters



| Sub-basin Number | Area (acres) | Slope* (ft/ft) | Width** (ft) | HSG | Hydraulic Conductivity (in/hr) | Moisture Deficit (in/in) | Wetting Front Suction (in) | EC percent impervious | FD percent impervious |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 17.47 | 0.01 | 200 | C | 0.1 | 0.14 | 8.6 | 64 | 64 |
| 1 | 3.15 | 0.01 | 260 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 2 | 4.59 | 0.015 | 1500 | C | 0.1 | 0.14 | 8.6 | 65 | 65 |
| 3 | 5.61 | 0.011 | 510 | C | 0.1 | 0.14 | 8.6 | 63 | 63 |
| 4 | 3.49 | 0.005 | 420 | C | 0.1 | 0.14 | 8.6 | 63 | 63 |
| 5 | 5.98 | 0.01 | 1050 | C | 0.1 | 0.14 | 8.6 | 59 | 59 |
| 6 | 11.81 | 0.015 | 1585 | C | 0.1 | 0.14 | 8.6 | 65 | 67 |
| 7^ | 139.82 | 0 | 0 | | | | | 0 | 0 |
| 8 | 272.76 | 0.0125 | 9625 | C | 0.1 | 0.14 | 8.6 | 57 | 63 |
| 10^ | 283.18 | 0 | 0 | | | | | 0 | 0 |
| 11^ | 105.71 | 0 | 0 | | | | | 0 | 0 |

^Sub-basin not modeled in XPSWMM. Area drains directly to Ohio River.

*The sub-subasin slope reflects the average along the pathway of overland flow to inlet locations.

**Irregularly shaped subcatchments with drainage channels off-centre can be handled by computing a skew factor:

Sk = (A2 - A1) / A

W = (2 - Sk) * L

*where*

Sk = skew factor

A1 = area to one side of the channel

A2 = area to other side of the channel

A = total area

W = subcatchment width

L = length of main drainage channel

# Appendix 8.2

**Appendix 8.2. XPSWMM Input Parameters For Drainage Infrastructures for Ohio River Watershed. In Areas Of Concern.**



| Reno Avenue - Market Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 1 | 2 | 0.013 | RCP | Circular | 159 |
| 2 | 2 | 0.013 | RCP | Circular | 180 |
| 3 | 2 | 0.013 | RCP | Circular | 39 |
| 4 | 2 | 0.014 | VCP | Circular | 421 |
| 5 | 2 | 0.013 | RCP | Circular | 22 |
| 8 | 1.5 | 0.014 | VCP | Circular | 432 |
| 9 | 1.5 | 0.014 | VCP | Circular | 79 |
| 10 | 1.5 | 0.014 | VCP | Circular | 17 |
| 11 | 1.5 | 0.014 | VCP | Circular | 13 |
| 12 | 2 | 0.013 | RCP | Circular | 103 |
| 14 | 4 x 12 | 0.013 | RCP | Rectangular | 398 |
| 15 | 4 x 12 | 0.013 | RCP | Rectangular | 190 |
| 16 | 4 x 12 | 0.013 | RCP | Rectangular | 39 |

| Galt Street | | | | | |
|---|---|---|---|---|---|
| Pipe ID | Size (ft) (W x H) | Roughness | Material | Shape | Length (ft) |
| 6 | 3 | 0.013 | RCP | Circular | 25 |
| 7 | 3 | 0.013 | RCP | Circular | 279 |

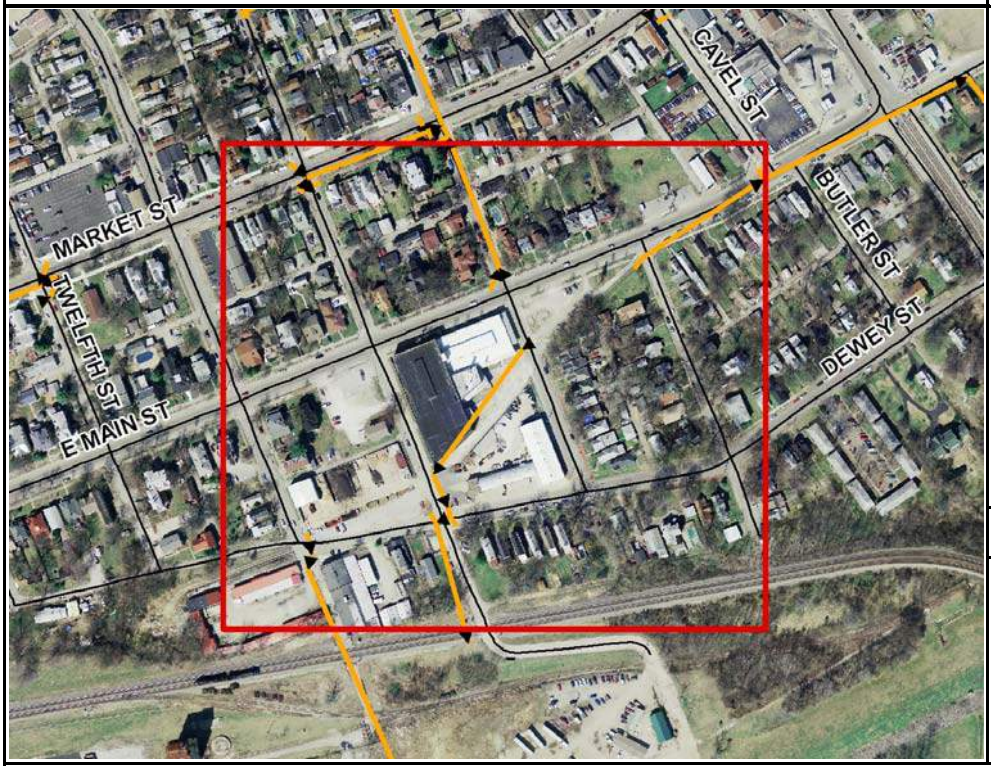
# Appendix 8.3

# Stormwater Master Planning
# City of New Albany

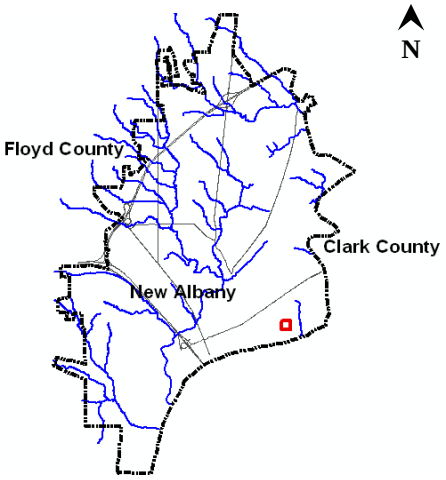
Capital Improvement

## Galt Street Fact Sheet

Project Map




Key Map




Site Description

The pipe on Galt Street drains portions of East Main Street and 18th street to an outlet structure on the Ohio River Levee system to the south of Galt Street.
City Council District 3.

Site Pictures

Current Concerns

Complaints in the area indicate that flooding occurs due to multiple catchbasin and pipe failures. There is no existing drainage infrastructure outlet for rear yards and alleys. The number of existing catchbasins in streets is not adequate to serve the area.

Scope of Work

- Construct 5,650 linear feet of storm sewers
- Install 50 catchbasins/yard inlets

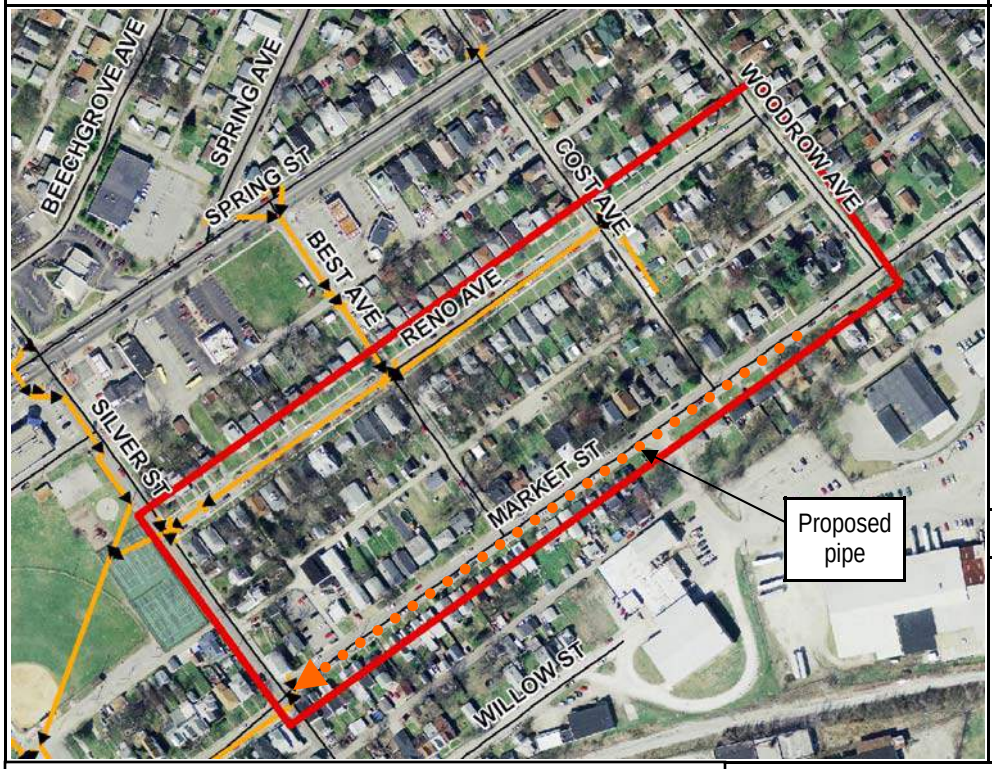
Cost $809,000

# Stormwater Master Planning
# City of New Albany

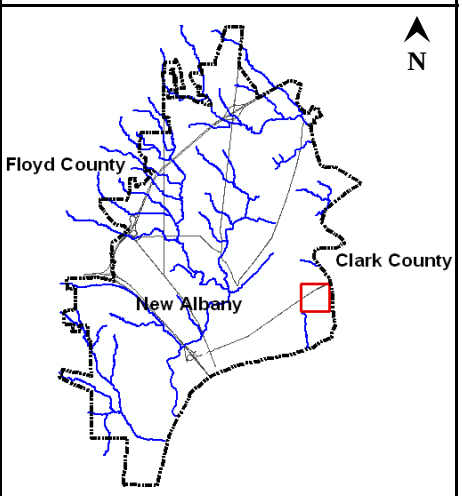
**Capital Improvement**

## Reno Ave - Market Street Fact Sheet

### Project Map




### Key Map




### Site Description

Surface runoff flows southwest in a curb and gutter system along Reno Ave and Market Street towards a ditch draining into the Ohio River. City Council District 3.

### Current Concerns

Flooding occurs during storm events due to the lack of a sufficient stormwater system. During field reconnaissance it was observed that a limited number of catchbasins exist on Reno Avenue while no catchbasins exist on Market Street.

### Site Picture

### Recommended Improvements

- Install curb and gutter, catchbasins and storm sewers on Market Street and improve the existing stormwater system on Reno Avenue.
- Routine maintenance plan of stormwater infrastructure

### Scope of Work

- Right-of-way requirements
- Existing infrastructure removal
- 32 catchbasins to be replaced/installed
- Construct 5,600 linear feet of storm sewers
- Construct 5,600 linear feet of curb and gutter

### Probable Cost

$847,000*

*Cost includes construction cost plus 25% Engineering and Contingency only.

*Costs reflect replacement of entire system. A phased approach may be more financially feasible.*

# 9.0 Project Prioritization and Funding

The 2010 New Albany Stormwater Master Plan developed capital improvement projects for each area of concern for the Falling Run watershed, Silver Creek Tributaries, Middle Creek watershed and Ohio River drainage areas. In **Section 9.1**, priorities for stormwater drainage projects are developed using an objective function based on the following criteria:

- Severity of flooding problems;
- Lack of drainage infrastructure;
- Failed drainage infrastructure;
- Safety concerns;
- Streambank erosion;
- Water quality benefits;
- Complexity of permitting; and
- Project dependency.

Culvert replacement projects were identified in **Sections 5, 6, 7, and 8**. Culvert replacements were prioritized based on the frequency of roadway flooding in each watershed or drainage area. An overall prioritization for the culvert replacement projects in the City of New Albany is provided in **Section 9.2**. A list of studies relevant to the planning, funding, design and construction of watershed-scale projects is presented and prioritized in **Section 9.3**.

The Master Plan represents a massive and wide-reaching effort to provide significant improvements in the drainage system for residents and businesses of the community. It goes without saying that such a substantial improvement plan requires a proportional scale of financial commitment. Because the City must maintain certain standards of service for the constituents of the community, as well as satisfy state and federal stormwater requirements, ample funding must be allocated annually to meet these needs.

However, maintaining the existing system and following stormwater quality requirements do not necessarily include large capital improvement projects outlined in this report that will relieve drainage and flooding issues throughout New Albany. System service needs include the maintenance and replacement of almost 1,400,000 linear feet of stormwater infrastructure, including channels, culverts, storm sewers, bridges, and curb-and-gutter. The City must also follow a stormwater quality program in order to comply with state and federal stormwater requirements. Significant fines and penalties exist for noncompliance with this program.

The estimated cost of implementing the master plan is $22,400,000. Potential sources of capital for implementation of the stormwater program include local, state and federal funds. **Section 9.4** identifies local funding opportunities that may be available to support the

implementation of the master plan. An overview of funding options from state and federal agencies and programs is provided in **Sections 9.5** and **9.6**, respectively. Drainage improvement projects meet the goals of a variety of state and federal funding programs. Implementation of the master plan at a reasonable cost to customers will require funding from a number of sources.

## 9.1 PRIORITIZATION OF CAPITAL IMPROVEMENT PROJECTS

Five types of flooding problems were identified in drainage requests: (1) first floor flooding; (2) basement flooding; (3) major road flooding; (4) minor road flooding and (5) yard flooding. Lack of infrastructure indicates that no storm drainage infrastructure exists in an area while drainage requests related to failed infrastructure indicate that the integrity of existing drainage structures has been compromised and is causing problems. Safety concerns are generally related to requests citing failed infrastructure where soil piping into open joints and/or collapsed storm sewers may undermine pavement or create sink holes. In some area streambank erosion is the primary concern even though drainage is adequate.

Typically detention basins alone can provide limited water quality benefits. In setting criteria for water quality benefits it was assumed that the capacity to improve water quality would be enhanced by integrating extended detention and/or wetland treatment into the design of detention basins. The complexity of permitting is determined based on a project's need for either nationwide or individual Section 404 permits from the Corps of Engineers. It is important to consider downstream and upstream impacts if the success of an upstream or downstream project depends upon the implementation of a given project. For example, a project that improves outlet conditions will also improve the effectiveness of upstream improvements to the drainage system.

Scores were assigned to each criteria identified above. Highest priorities are assigned the highest scores. The objective function for prioritization is the sum of criteria scores for a project. Scores assigned for each of the criteria in the objective function are shown in **Table 9.1**. The maximum objective function value for a project is 440.

The objective function criteria were applied to the capital improvement projects identified in **Sections 5, 6, 7 and 8**. Incremental costs based on the objective function were determined for each project by dividing the cost of the project by its objective score. Project priorities are set by sorting the projects by objective score then by incremental costs. Objective scores are sorted in descending order and incremental costs are sorted in ascending order. Incremental costs are the cost per objective score unit. If two or more projects have the same objective score projects with lower incremental costs take priority over those with higher costs. The results of the prioritization of capital improvement projects are shown in **Table 9.2**. Details of the criteria and scoring of the projects are provided in **Appendix 9.1**.

**Table 9.1. Objective Function Scoring Table for Project Prioritization.**

| | | | |
|---|---|---|---|
| **Severity of Flooding** | First Floor | 100 | |
| | Basement | 50 | |
| | Yard | 30 | |
| | Major Road | 25 | |
| | Minor Road | 10 | |
| | **Safety Concern** | 50 | |
| **Bank Erosion** | *Not a Threat to Structure(s)* | *Threatens Structure(s)* | |
| | 10 | 50 | |
| | **Water Quality** | 20 | |
| **Infrastructure** | Lacking | 35 | |
| | Failed | 40 | |
| **Permitting** | *None Required* | *Nationwide* | *Individual* |
| | 10 | 5 | 0 |
| | **Downstream or Upstream Impacts** | 20 | |

Three priority tiers were developed to be used in the budgeting and scheduling of capital improvements. Tier 1 projects have an objective score between 275 and 440; Tier 2 projects have scores from 160 to 275 and Tier 3 projects have objective scores less than 160. This approach gives the Stormwater Drainage Board the ability to manage its annual budget.

For instance, if a Tier 1 project is scheduled for construction in a given year and the remaining budget is not sufficient to construct a second Tier 1 project, Tier 2 and then Tier 3 projects that can be constructed within the annual budget can be scheduled for construction that year. This process can be used to generate a 5-Year Capital Improvement Plan based on project priorities and costs.

**Table 9.2. Capital Project Prioritization Based on Objective Scores and Incremental Costs.**

| Project | Watershed | Cost | Objective Score | Incremental Cost | Tier |
|---|---|---|---|---|---|
| Castlewood Drive | Silver Creek | $ 300,000 | 330 | $ 909 | 1 |
| 13th-Vincennes Street | Falling Run | $ 1,139,000 | 305 | $ 3,734 | |
| Reno Ave-Market Street | Ohio River | $ 847,000 | 285 | $ 2,972 | |
| Culbertson-Market Street | Falling Run | $ 1,301,000 | 275 | $ 4,731 | 2 |
| Carlton Drive | Falling Run | $ 283,000 | 245 | $ 1,155 | |
| Hickory Vale Drive Side Streets | Falling Run | $ 451,000 | 235 | $ 1,919 | |
| Industrial Boulevard | Silver Creek | $ 948,000 | 240 | $ 3,950 | |
| Galt Street | Ohio River | $ 809,000 | 195 | $ 4,149 | |
| Kraft Cemetery | Silver Creek | $ 128,000 | 160 | $ 800 | |
| Charlestown Road near Coes Lane | Falling Run | $ 142,000 | 160 | $ 888 | |
| Miller Lane | Silver Creek | $ 147,000 | 160 | $ 919 | |
| Brookview Drive - McDonald Lane | Falling Run | $ 231,000 | 155 | $ 1,490 | 3 |
| Corydon Pike | Middle Creek | $ 741,000 | 155 | $ 4,781 | |
| Cherry Street and West 9th Street | Falling Run | $ 473,000 | 150 | $ 3,153 | |
| South of McDonald Road | Falling Run | $ 272,000 | 145 | $ 1,876 | |
| Silver Street and Roanoke Avenue | Falling Run | $ 418,000 | 145 | $ 2,883 | |
| Aebersold Drive | Falling Run | $ 529,000 | 145 | $ 3,648 | |
| Captain Frank Road | Falling Run | $ 358,000 | 120 | $ 2,983 | |
| Old Ford Road | Silver Creek | $ 722,000 | 105 | $ 6,876 | |

The Board should also consider breaking larger projects into phases rather than delaying the start of a large project until all funding for the complete is available in a budget year. This will avoid delays in construction and will allow the Board to provide incremental benefits to its customers until all phases of a project are complete.

Examples of projects that can be phased are: 13th Street and Vincennes Street; Reno Avenue and Market Street; and Culbertson Street and Market Street. These projects involve rehabilitation of existing stormwater infrastructure; construction of additional collectors and laterals to increase capacity; and improvements to main trunks and outfalls necessary to realize the full benefit of the project. In this case, Phase 1 is cleaning and rehabilitation of existing sewers and inlets; Phase 2 is the construction of relief sewers to provide additional capacity to laterals and collectors and to provide additional inlets; and Phase 3 is construction of a relief sewer along the existing storm sewer main to provide greater outlet capacity and/or a more effective outlet that reduces backwater effects on the effectiveness of the drainage system.

## 9.2 CULVERT REPLACEMENT PRIORITIES

Three priority levels were established for culvert replacements in **Sections 5, 6, 7**, and **8**. The priorities from each watershed are lumped together to provide tiers for prioritization of culvert replacement projects in New Albany as shown in **Table 9.3**. Tier 1 projects should take first priority when seeking sources of funding for design and construction of the projects.

**Table 9.3. Culvert Replacement Priorities.**

| Watershed | Location | Tier |
|---|---|---|
| Falling Run | Daisy Lane Road Improvements | 1 |
| Falling Run | Country Club Drive Crossing Improvements | |
| Falling Run | Wildwood Drive on Valley View Creek | |
| Silver Creek | Preswick Square Drive on a Tributary to Slate Run | |
| Falling Run | Captain Frank Road on Valley View Creek | |
| Middle Creek | Busch Place - East on Corydon Run | |
| Falling Run | Greenview Drive - South on Tributary of Fork Run | |
| Silver Creek | Brookside Lane on Tributary of Slate Run | 2 |
| Falling Run | Tingle Drive on Green Run | |
| Silver Creek | Southern Drive on Rail Run | |
| Falling Run | Wellington Drive on Fork Run | |
| Silver Creek | Slate Run Road, North of Town Run | |
| Silver Creek | Hausfeldt Lane on Tributary of Slate Run | |
| Middle Creek | Busch Place - West on Vincennes Run | |
| Falling Run | Harris Court on Trinity Run | |

**Table 9.3. Culvert Replacement Priorities (Continued).**

| Watershed | Location | Tier |
|---|---|---|
| Falling Run | Rolling Creek Drive/Creekwood Court on Fall Run | 3 |
| Falling Run | Grant Line Road on Fall Run | |
| Falling Run | Beechwood on Tributary of Falling Run | |
| Falling Run | Vance Avenue on Tributary of Falling Run | |
| Falling Run | Wildwood Road on Silvercrest Run | |
| Falling Run | Falcon Run Road on Silvercrest Run | |
| Falling Run | Clearstream Court on Holy Run | |
| Falling Run | Wooded Valley Drive on Holy Run | |
| Falling Run | Graybrook Lane on Falling Run | |
| Silver Creek | Earnings Way on Flat Run | |
| Silver Creek | Tammy Court on Tributary of Slate Run | |
| Middle Creek | Eagles Lane on Vincennes Run | |
| Middle Creek | William Lane on Middle Creek | |
| Middle Creek | Broeker Lane on Tributary of Middle Creek | |

## 9.3 WATERSHED-SCALE PROJECT STUDIES

Problems such as structural flooding in established floodplains along major streams such as Falling Run, Silver Creek, Middle Creek and some of their tributaries require a series of interdependent projects that work in concert to reduce flood damages along streams without increasing flooding in upstream or downstream areas.

Typical watershed-scale flood reduction projects include a number of components such as detention basins, levees and floodwalls, channel improvements, bridge and culvert improvements and pump stations. Detailed studies are required to conduct reconnaissance to determine eligibility for federal funding assistance, project feasibility before a project can go to design and construction. Four watershed-scale projects have been identified in New Albany: Falling Run (including Pamela Drive, Linda Drive and Zurschmeide Drive areas); Silver Creek; Middle Creek and the Ohio River drainage area. The priorities for pursuit of these projects are provided in **Table 9.4**.

The US Army Corps of Engineers is able to support projects through funding authorized by the Water Resources Development Act of 1986 (WRDA, 1986). The corps conducts reconnaissance studies to determine the extent of federal interest in a project. Reconnaissance studies are usually funded 100% by federal funds. Feasibility studies are cost-shared with the local sponsor at ratios from 25%-75% to 50%-50%. Construction phases (including design and support services) are supported with similar matching requirements by the local sponsor.

**Table 9.4. Watershed-Scale Project Study Priorities.**

| Project | Priority |
|---|---|
| Falling Run | 1 |
| Silver Creek | 2 |
| Middle Creek | 2 |
| Ohio River | 3 |

## 9.4 LOCAL FUNDING SOURCES

### 9.4.1 User Fee

In 2006 the City of New Albany implemented an impervious surface-based stormwater user fee of $3.17 per month per equivalent residential unit (ERU). As a result of significant rain events causing flooding in 2009, the monthly rate was increased by one dollar in an effort to accelerate implementation of projects identified in the New Albany Stormwater Master Plan. The total cost of implementing all project identified in the 2009 Stormwater Master Plan is $22,400,000. Assuming no increase in construction costs, it would take approximately 45 years to implement all projects, if funded at the current level of $4.17 per month per ERU. Below are possible funding sources that should be considered to supplement the stormwater user fee.

### 9.4.2 General Fund

The stormwater program may also be supplemented with contributions from the General Fund. This approach is sometimes used when initiating a stormwater user fee or when one-time, large-scale projects are being implemented. Of course these funds are traditionally very competitive to request, especially when a user fee rate structure is already established for a specific City service.

### 9.4.3 Tax Increment Financing (TIF) District Revenues

An additional option is to supplement the stormwater program with tax increment financing (TIF) district, but it is only applicable in certain circumstances. Because TIF collections must be used inside TIF boundaries, these revenues can only be used in those isolated districts that have been designated. However, these collections should be considered, especially in redevelopment areas where TIF districts are typically intended.

## 9.5 LOW INTEREST LOANS

### 9.5.1 State Revolving Loan Fund

The State Revolving Fund (SRF) loan program provides low interest loans to communities to improve wastewater and drinking water infrastructure as well as assist with nonpoint source pollution projects that are associated with a wastewater loan. The program seeks to provide the lowest interest loans possible to communities implementing improvements seeking to protect public health and the environment. The SRF loan rate is based on two main criteria; median household income (MHI) and system user rates. Additional rate discounts may be awarded for incorporating a nonpoint source pollution reduction project into both the wastewater and drinking water loan programs.

### 9.5.2 Bonding

Many municipalities have resorted to bonding in order to finance large-scale improvements and projects for the community. Like with any borrowing, a variety of components must be carefully analyzed in order to determine the suitability. A single project or a series of projects must be identified when bonds are obtained. The time frame for implementing the improvements must also be defined. Specific project costs must be established and evaluated for appropriateness and feasibility. Typically, bonds are bid in order to provide the municipality with the most competitive and financially responsible alternative.

## 9.6 GRANT OPPORTUNITIES

Grant funding is an option to further supplement stormwater program financing. Grants are highly competitive and should not be relied upon to meet programmatic requirements and the level of service defined by the utility. There are several sources of funding for both pre- and post-disaster hazard mitigation policies and projects. While all mitigation techniques will potentially save money by avoiding and minimizing different types of losses, the implementation of mitigation efforts can be costly and well beyond the local jurisdiction's capacity to fund the mitigation activity. There are existing federal and state funding programs that can be utilized for funding assistance. Descriptions of some sources of funding presently available follow. Periodic coordination with appropriate federal and state agencies is necessary, as new programs may be developed or existing programs could potentially be eliminated or modified over time.

### 9.6.1 Federal Grants

#### 9.6.1.1 Pre-disaster Mitigation Program - FEMA

Through the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential disaster declaration. The Pre-Disaster Mitigation (PDM) Program provides funding to states and communities for cost-effective hazard mitigation activities that

complement a comprehensive mitigation program, as well as reduce injuries, loss of life, and damage and destruction of property.

#### 9.6.1.2 Emergency Management Performance Grant - FEMA

The Emergency Management Performance Grant (EMPG) encourages the development of comprehensive emergency management at the State and local level in order to improve emergency management planning, preparedness, mitigation, response, and recovery capabilities. Funding is provided to the State, which can be used to educate people and protect lives and structures from natural and technological hazards.

#### 9.6.1.3 Public Assistance Grant Program - FEMA

The Public Assistance (PA) Grant Program provides supplemental assistance to states, local governments, and certain private non-profit organizations to alleviate sufferings and hardship resulting from major disasters or emergencies declared by the President. These grants allow State and local government to respond to disasters, recover from their impact, and mitigate impact from future disasters.

#### 9.6.1.4 Flood Mitigation Assistance Program - FEMA

FEMA's Flood Mitigation Assistance Program (FMA) provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FMA is a pre-disaster grant program, and is made available to states on an annual basis. This funding is exclusively available for mitigation planning and implementation of mitigation measures.

The community must be a participant in NFIP and the project must be cost effective, beneficial to the NFIP fund, and technically feasible. The project must conform to the minimum standards of the NFIP Floodplain Management Regulations, the applicant’s Flood Mitigation Plan, and all applicable laws and regulations.

#### 9.6.1.5 Hazard Mitigation Grant Program - FEMA

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration.

Projects must conform to the State’s Hazard Mitigation Plan, provide a beneficial impact on the disaster area, meet environmental requirements, solve a problem independently, and be cost-effective.

#### 9.6.1.6 Community Development Block Grants - HUD

The Community Development Block Grant (CDBG) program, administered by US Department of Housing and Urban Development (HUD) provides grants to local governments for community and economic development projects that primarily benefit low- and moderate-income people. The CDBG program also provides grants for post-disaster hazard mitigation and recovery following a Presidential disaster declaration. To be eligible for a CDBG, a community must have a population less than 50,000 (200,000 for counties) and be located within a Presidential disaster declaration area.

#### 9.6.1.7 Sustainable Development Assistance - DOE

A Sustainable Development Assistance, an effort through the Department of Energy (DOE), works with communities to help them define and implement sustainable development strategies as part of their comprehensive community planning efforts. The team provides technical assistance to disaster-affected communities as they plan for long-term recovery by introducing a wide array of environmental technologies and sustainable redevelopment planning practices.

#### 9.6.1.8 Emergency Watershed Protection Program- USDA

Department of Agriculture (USDA): Natural Resources Conservation Service *(NRCS)*: The Emergency Watershed Protection Program (EWP) provides financial assistance to sponsors and individuals in implementing emergency measures to relieve imminent hazards to life and property created by a disaster. Activities include providing financial and technical assistance to remove debris from streams, protect destabilized stream banks, and purchase floodplain easements. The program is designed for the implementation of recovery measures. It is not necessary for a national emergency to be declared to be eligible for assistance.

#### 9.6.1.9 Emergency Relief Program (Transportation Infrastructure) - FHA

The Emergency Relief (ER) Program provides assistance for repair of Federal-aid roads through the Department of Transportation, Federal Highway Administration (FHA). This funding is allocated to rebuild transportation facilities that are damaged extensively, causing a “disastrous impact” on transportation services. States must request ER funding in order to initiate this assistance program.

#### 9.6.1.10 United States Army Corps of Engineers (USACE)

Congress delegated the United States Army Corps of Engineers (USACE) the authority and appropriations for projects every two years through the Water Resources and Development Act (WRDA). Projects eligible for funding include the following: disaster response, water supply, shore protection, navigation, facilities design & construction, installation support, hydropower, recreation, flood damage reduction, environmental infrastructure, ecosystem restoration, master planning, regulatory projects, and the rehabilitation of flood control structures.

### 9.6.2 State Grants

#### 9.6.2.1 Watershed Management 104(b) (3)

These grants are available through the Indiana Department of Environmental Management (IDEM) to assist public or non-profit agencies in developing, implementing, and demonstrating innovative approaches to understanding the causes, effects, extent, prevention, reduction, and elimination of water pollution. Funding priorities have included: watershed approaches for solutions to wet weather activities (combined sewer overflows, stormwater discharge, animal feeding operations); pretreatment and biosolids (sludge program activities, decentralized systems); and alternative ways to enhance or measure the effectiveness of point source programs. Trading, water efficiency, asset management, and sustainable infrastructure have been areas of consideration as well.

#### 9.6.2.2 Water Quality Planning 205(j)

Funds for the program are to be used to determine the nature, extent, and causes of point and non-point source pollution and to develop plans to resolve these problems.

#### 9.6.2.3 CWA Grant Funding 319(h)

These grants are designated for projects that reduce documented sources of nonpoint source water quality impairments. These funds may be used to develop and implement Total Maximum Daily Loads (TMDLs) and watershed management plans, provide technical assistance, demonstrate new technology, conduct assessments, and provide education and outreach. These funds may not be used to implement applicable Federal and State water quality requirements for stormwater quality, such as the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer (MS4) program. However, MS4 communities may be eligible for 319 CWA grant funding if funding for activities is shown to be “above and beyond” the community’s MS4 implementation plan.

*Note:* Some *of these grants require the City to partner with other organizations. Also, the City should check with the grant administration agencies as grant programs are updated and suspended from time to time.*

## 9.7 SUMMARY

The capital improvement and culvert replacement projects identified in the master plan study were prioritized using criteria developed from drainage request logs to quantify the severity of flooding to develop an objective score. Projects were prioritized based on their scores and incremental costs. Tier 1 projects are highest priority followed by Tier 2 projects with Tier 3 projects a lower priority. The Falling Run watershed and Silver Creek tributaries have the highest concentrations of Tier 1 projects.

Potential sources of funding for implementing the master plan include local sources, low interest loans, and federal and state grants. Local funding sources include the storm water user fee, the general fund, and TIF District Revenues. The State Revolving Loan Fund and bonding were identified as low interest loan opportunities. A variety of federal grants are available from FEMA, USACE, HUD, USDA, FHA and DOE. State grants include Watershed Management Section 104(b) (3); Water Quality Planning Section 205(j) and CWA Section 319(h) grants. Three capital funding scenarios that generate $347,000, $427,000 and $511,000 for capital improvements in 2010 using rate increases based on 0%, 2.5% and 5.0% inflation factors were presented.

# Appendix 9.1

## Appendix 9.1. Objective Scoring Table

**City of New Albany**

**Stormwater Master Plan**

*Captial Improvement Project Prioritizatior*

2/15/2010

| | | Reported Flooding | | | | | | | | | Bank Erosion | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Watershed | Location | First Floor | Basement | Major Road | Minor Road | Yard | Failed Infrastructure | Lack of Infrastructure | Permitting | Dependency US or DS | Bank Erosion | Structure Threat | Water Quality | Safety | Total | Cost | Incremental Cost | Cummulative Cost | Tier |
| Silver Creek | Castlewood Drive | yes | yes | no | yes | yes | yes | yes | nw | yes | no | no | yes | no | 330 | $ 300,000 | $ 909 | $ 300,000 | |
| Falling Run | 13th-Vincennes Street | yes | yes | yes | yes | yes | yes | no | no | yes | no | no | no | no | 305 | $ 1,139,000 | $ 3,734 | $ 1,139,000 | 1 |
| Ohio River | Reno Ave-Market Street | yes | yes | yes | yes | yes | no | no | no | no | no | no | no | no | 285 | $ 847,000 | $ 2,972 | $ 1,986,000 | |
| Falling Run | Culbertson-Market Street | yes | no | yes | yes | yes | yes | no | no | no | no | no | no | no | 275 | $ 1,301,000 | $ 4,731 | $ 3,287,000 | |
| Falling Run | Carlton Drive | no | yes | no | yes | yes | yes | yes | no | no | yes | no | no | no | 245 | $ 283,000 | $ 1,155 | $ 3,570,000 | |
| Falling Run | Hickory Vale Drive side streets | no | yes | no | yes | yes | yes | yes | no | no | no | no | no | no | 235 | $ 451,000 | $ 1,919 | $ 4,021,000 | |
| Silver Creek | Industrial Boulevard | yes | no | no | no | yes | yes | no | ind | yes | yes | no | yes | no | 240 | $ 948,000 | $ 3,950 | $ 7,100,000 | 2 |
| Ohio River | Galt Street | no | no | yes | yes | no | yes | no | no | no | no | no | no | yes | 195 | $ 809,000 | $ 4,149 | $ 8,115,000 | |
| Silver Creek | Kraft Cemetery | no | no | yes | no | yes | no | yes | no | no | no | no | no | no | 160 | $ 128,000 | $ 800 | $ 8,243,000 | |
| Falling Run | Charlestown Road near Coes Lane | no | no | yes | no | yes | yes | no | nw | no | no | no | no | no | 160 | $ 142,000 | $ 888 | $ 8,385,000 | |
| Silver Creek | Miller Lane | no | no | no | no | no | yes | no | no | no | no | no | no | yes | 160 | $ 147,000 | $ 919 | $ 8,532,000 | |
| Falling Run | Brookview Drive - McDonald Lane | no | yes | no | yes | yes | no | no | nw | no | no | no | no | no | 155 | $ 231,000 | $ 1,490 | $ 8,763,000 | |
| Middle Creek | Corydon Pike | no | no | yes | no | yes | no | yes | nw | no | no | no | no | no | 155 | $ 741,000 | $ 4,781 | $ 9,504,000 | |
| Falling Run | Cherry Street and West 9th Street | no | no | no | yes | yes | no | yes | nw | no | yes | no | no | no | 150 | $ 473,000 | $ 3,153 | $ 9,977,000 | |
| Falling Run | South of McDonald Road | no | no | no | yes | yes | no | yes | no | no | no | no | no | no | 145 | $ 272,000 | $ 1,876 | $ 10,249,000 | |
| Falling Run | Silver Street and Roanoke Avenue | no | yes | yes | no | no | no | no | no | no | no | no | no | no | 145 | $ 418,000 | $ 2,883 | $ 10,667,000 | 3 |
| Falling Run | Aebersold Drive | no | no | no | yes | yes | yes | no | nw | no | no | no | no | no | 145 | $ 529,000 | $ 3,648 | $ 11,196,000 | |
| Falling Run | Captain Frank Road | no | no | no | yes | yes | no | no | no | yes | yes | no | yes | no | 120 | $ 358,000 | $ 2,983 | $ 11,554,000 | |
| Silver Creek | Old Ford Road | no | no | yes | no | yes | no | no | no | yes | no | no | no | no | 105 | $ 722,000 | $ 6,876 | $ 12,276,000 | |

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