STORMWATER MASTER PLAN UPDATE

CITY OF WESTFIELD

JULY 2022

Prepared for:

City of Westfield
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EXECUTIVE SUMMARY

In January 2022, the City of Westfield hired Christopher B. Burke Engineering, LLC to update their 2018 Stormwater Master Plan. This plan provides a roadmap for the city to address known drainage, flooding and water quality problem areas, avoid future problems from new growth and development and meet the requirements of the new IDEM MS4 General Permit.

With input from city staff, a list of opportunities and challenges for protecting and improving water resources was developed. From this list, the following 11 recommended solutions were selected:

Recommended Solutions:

1. Improve long-term best management practice maintenance procedures
2. Implement *E. coli* practices to meet total maximum daily load requirements
3. Explore alternative ditch maintenance practices
4. Promote flood resilience, low impact development, and green infrastructure
5. Implement updates to municipal separate storm sewer system general permit and construction stormwater general permit programs
6. Address flooding on Tomlinson Road
7. Address ponding in the Southridge Subdivision
8. Address flooding on Grassy Branch Road
9. Address drainage problems in the Centennial Subdivision
10. Address flooding on Union Street and Penn Street
11. Complete detailed studies to understand road flooding

Each recommended solution was evaluated to determine their feasibility to address water quantity and water quality problems as well as, the economic, social and environmental performance criteria set by city staff. The proposed implementation plan in this plan identifies both short-term (12 months or less) and long-term (multi-year or on-going annually) implementation tasks. The total estimated cost to implement these recommended solutions is $5,738,700. Once established, the estimated annual cost is $150,500.

CHAPTER 1: PROJECT OVERVIEW

1.1 PROJECT OVERVIEW

The City of Westfield continues to be one of the fastest growing communities in Indiana. According to the 2020 census, the city's population grew 54.4% from 30,068 in 2010 to 46,410 in 2020. It is expected that this rapid growth and development will continue as Westfield remains a desirable and attractive place to live, work and play. To address existing and avoid future the drainage, flooding, and water quality problems often associated with rapid growth and development, the city retained Christopher B. Burke Engineering, LLC (Burke) to prepare this Stormwater Master Plan (SWMP).

1.2 PROJECT PURPOSE AND APPROACH

The purpose of this SWMP is to identify drainage, flooding and water quality problem areas and recommended solutions. Selected recommended solutions were further analyzed, evaluated, and prioritized based on a matrix of social, environmental, and economic criteria. For each recommended SWMP solution, an implementation schedule, conceptual layout (where applicable), and cost estimate was prepared.

The outcome of this SWMP is to provide an overall understanding of the drainage, flooding, and water quality conditions in the city and provide recommended solutions that will:

- Solve or reduce existing water quality/quantity problems,
- Prevent an increase in water quality/quantity problems as growth occurs,
- Prevent or minimize future damages,
- Preserve the natural and beneficial function of the drainage system, and
- Preserve and enhance stormwater quality.

1.3 ORGANIZATION OF DOCUMENT

The City of Westfield SWMP is divided into the following chapters, with appendices of supporting data and analysis.

Chapter 1: Project Overview – provides an overall project introduction, project purpose and approach.

Chapter 2: Project Goals and Evaluation Criteria – describes the project goals and the evaluation criteria used to screen and prioritize the recommended solutions.

Chapter 3: Understanding Current and Future Conditions – summarizes the extent and severity of water quantity and quality concerns based on information gathered from the city, review of previous studies, data collection, and a screening-level analysis. It includes anticipated future land uses and the severity and extent of drainage, flooding and water quality problems that could arise as a result.

Chapter 4: Opportunities and Challenges – summarizes the opportunities and challenges to protecting and improving water resources. It takes into consideration both known drainage, flooding, and water quality problems as well as those anticipated with future growth and development.

Chapter 5: Identify and Evaluate Solutions – provides a summary of the detailed evaluation for each recommended solution including a description of the situation, proposed solution, the general approach and assumptions for the evaluation, and the recommendations for implementation.

Chapter 6: Summary and Implementation Plan – lists short-term and long-term implementation steps for each of the recommended solutions.

CHAPTER 2: PROJECT GOALS AND PERFORMANCE CRITERIA

Setting realistic and measurable goals is essential to the successful implementation of this SWMP. Goals are the desired change or outcome because of this planning effort. Depending on the magnitude of the problem, goals may be general, specific, long-term, or short-term. Performance Criteria are measures that will be used to formulate and/or screen the recommended solutions. This chapter describes the project goals, the evaluation criteria used to screen and prioritize the recommended solutions.

2.1 PROJECT GOALS

1. Reduce drainage and flooding problems
2. Improve water quality of stormwater runoff
3. Protect, enhance, and restore natural systems for stormwater conveyance and storage
4. Integrate SWMP recommendations into current and future policies, programs and projects

2.2 PERFORMANCE CRITERIA AND EVALUATION METRICS

Based on the nature and extent of existing and future water quality and water quantity conditions and concerns, the following set of economic, social and environmental performance criteria and evaluation metrics were developed to screen and prioritize recommended solutions. This is also referred to as the triple bottom line (TBL) evaluation. The weighting factor and rating were determined by city staff.

2.2.1 Economic Criteria

- Proposed solutions should provide the greatest total value to the community by benefiting a relatively large percentage of people
- Proposed solutions should be economically feasible and cost effective.

Table 1: Economic performance criteria and evaluation metrics

Evaluation Metric	Definition	Weighting Factor	Rating
Capital Cost	Estimated/planning level costs	0.45	0 = > $10M 1 = > $5M < $10M 2 = > $1M < $5M 3 = > $500K < $1M 4 = > $100K < $500K 5 = < $100K
Lifecycle Operation and Maintenance (O&M) Cost	Magnitude of cost for operation and maintenance based on typical lifecycle	0.20	0 = Very High 1 = High 2 = Moderate to High 3 = Moderate 4 = Low to Moderate 5 = Low

Evaluation Metric	Definition	Weighting Factor	Rating
Other Funding Opportunities and/or Shared Resources	Source of project funding includes city Stormwater Utility (SWU), county Drainage Board (DB) or other funding sources such as a grant, low-interest loan, charitable gift (Other)	0.35	0 = City 1 = City/SWU 2 = SWU 3 = SWU/DB 4 = DB 5 = Other

2.2.2 Social Criteria

- Proposed solutions should improve public health, well-being, and community livability.
- Proposed solutions should maintain flood-free roads to at least the 10% annual chance flood with no overflow from riverine sources, allow for flood-free emergency access and reduce flooding of homes to the 1% annual chance flood elevation plus 2-foot freeboard when feasible.
- Proposed solutions should promote No-Adverse-Impact (NAI) as an effective floodplain management approach. NAI policies and regulations ensure the action of any property owner, public or private, does not adversely impact the property and rights of others.
- Proposed solutions should be socially and politically acceptable to residents and, to the extent practical, to other interest groups and be permittable under existing federal, state, and local permit programs.

Table 2: Social performance criteria and evaluation metrics

Evaluation Metric	Definition	Weighting Factor	Rating
Widespread Benefit	Number of properties that will benefit	0.25	0 = 0 properties 1 = 1 to 10 2 = 11 to 30 3 = 31 to 100 4 = 101 to 300 5 = 300+
Reduce Flooding and Drainage Problems	Ability to reduce current or anticipated future flooding and drainage problem	0.25	0 = None 1 = Limited 2 = Limited to Moderate 3 = Moderate 4 = Moderate to High 5 = High
Benefit to Public Health and Safety	Ability to improve public health and safety concerns related to flooding, drainage issues and water quality	0.25	0 = None 1 = Limited 2 = Limited to Moderate 3 = Moderate 4 = Moderate to High 5 = High

Evaluation Metric	Definition	Weighting Factor	Rating
Promotes Revitalization, Quality of Life and Publicly Acceptable	Consistent with city's growth and development goals; improves quality of life; generally accepted by the public	0.25	0 = None 1 = Limited 2 = Limited to Moderate 3 = Moderate 4 = Moderate to High 5 = High

2.2.3 Environmental Criteria

- Proposed solutions should not have any significant and/or permanent negative impacts on the environment, recreational opportunities, and/or fish and wildlife resources.
- Proposed solutions should be consistent with the city's Stormwater Quality Management Plan (SWQMP) and address water quality impairments identified on IDEM's 303(d) Impaired Stream list and Total Maximum Daily Loads (TMDL) studies.

Table 3: Environmental performance criteria and evaluation metrics

Evaluation Metric	Definition	Weighting Factor	Rating
Treat Pollutants of Concern	Effectiveness to treat pollutants of concern carried by stormwater runoff	0.40	0 = No Removal 1 = 1% to 20% 2 = 21% to 40% 3 = 41% to 60% 4 = 61% to 80% 5 = > 80%
Improve and/or Protect Stream Habitat	Ability to improve and/or protect riparian and instream habitat	0.30	0 = No Change 1 = Limited 2 = Limited to Moderate 3 = Moderate 4 = Moderate to High 5 = High
Restore and/or Protect the Natural & Beneficial Function of Floodplain	Ability to restore and/or protect the natural and beneficial function of the floodplain	0.30	0 = No Change 1 = Limited 2 = Limited to Moderate 3 = Moderate 4 = Moderate to High 5 = High

CHAPTER 3: UNDERSTANDING CURRENT AND FUTURE CONDITIONS

Identifying effective solutions to stormwater problems depends on a thorough understanding of the current water quantity and water quality conditions and concerns. This chapter summarizes the extent and severity of these concerns based on information gathered from local staff, review of previous studies, data collection, and a screening-level analysis.

3.1 CHANGES IN POPULATION AND LAND USE

In rapidly growing communities like the City of Westfield, stormwater management becomes increasingly important to prevent increased flooding and decreased stream health. Increased impervious cover from roads, rooftops and parking lots directly impacts stormwater runoff. With development, rain or snowmelt that once naturally absorbed into the ground or flowed into lakes, streams and rivers is now quickly diverted to drainage ditches, storm drains, and sewer systems and then discharged, unfiltered in large volumes to the closest waterbody. This process not only disrupts the natural hydrological cycle and causes flooding but it also adversely affects water quality. As stormwater travels over impervious areas it accumulates debris, chemicals, sediment and other pollutants and deposits these into local waterways.

The City of Westfield continues to be a popular place to live, work and play. According to the 2020 census, the city's population grew 54.4% from 30,068 in 2010 to 46,410 in 2020. This is more than the population growth in Carmel (26%), Fishers (29%) and Noblesville (34%) in Hamilton County during the same period. It is expected that the population will continue to grow at this rate for the next ten or more years.

In 2001, the National Land Cover Database (NLCD) classified 75% of the city's land cover as forest, pasture and cultivated crops. It is now less than 40% with the greatest shift in the last decade to medium to high density development. This includes single and multi-family housing units, commercial and industrial development. **Figure 1** illustrates the dramatic change in land use cover from 2001, 2011 and 2019. With this much density and impervious surface, approximately 55% of the precipitation runs off and only 5-10% can infiltrate into the ground. Percent impervious is also a common indicator of stream health. Streams in watersheds with impervious cover greater than 10% will show signs of degradation. These may include excessive stream bank erosion, loss of riparian vegetation, more frequent overtopping, warmer stream temperatures, and overall degradation of aquatic habitat.

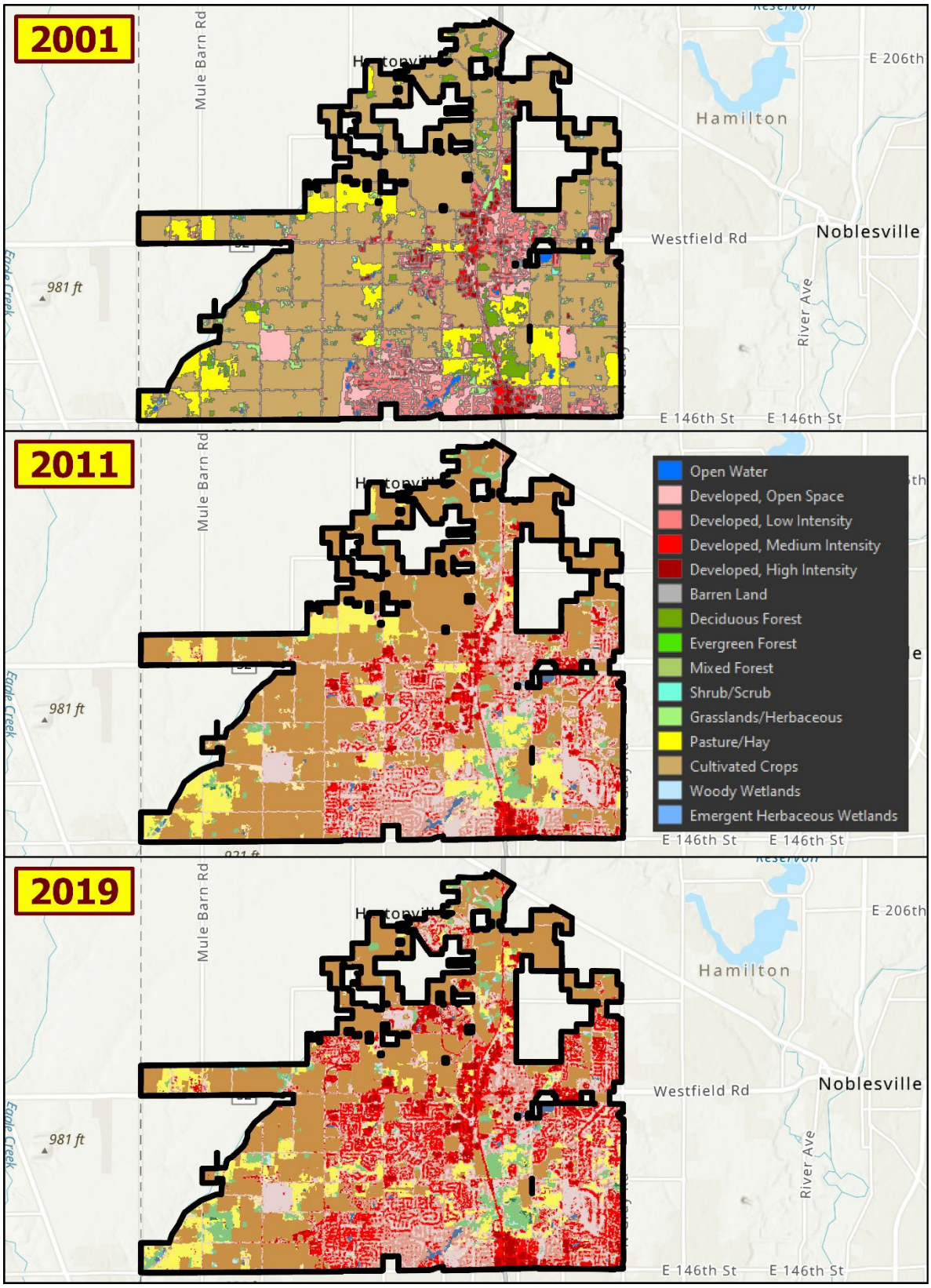

Figure 1: Change in land use (NLCD, 2019)

3.2 STATUS OF WATER QUALITY, DRAINAGE AND FLOODING

3.2.1 Water Quality

There are six watersheds that drain land in the City of Westfield (**Figure 2**). To evaluate the overall health of these watersheds, Burke used data from the EPA "How's My Watershed" tool developed through the Preliminary Healthy Watershed Assessments Project. This assessment tool was released in 2021 to protect high quality waters under the Clean Water Act (CWA) and target future watershed protection efforts.

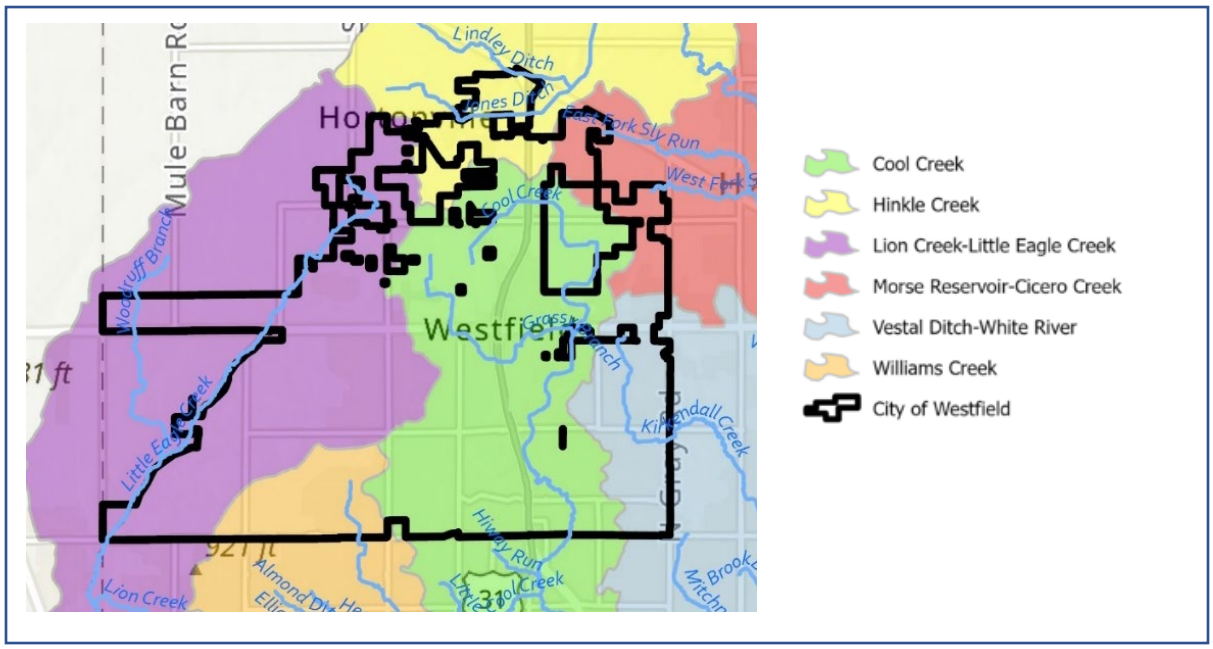

Figure 2: Watershed boundaries

The framework for this tool is based on the ecological attributes that support healthy ecosystems. These include landscape condition, geomorphology, habitat, water quality, hydrology and biological condition (**Figure 3**). Within this framework, key ecological and stressor attributes are combined to estimate overall watershed health and watershed vulnerability. This tool provides a watershed health index and watershed vulnerability index. The watershed health index is defined as an integrated measure of the current conditions of aquatic ecosystem and its surrounding watershed including landscape condition, habitat, geomorphology, water quality and biological condition. The watershed vulnerability index is an integrated measure of the potential for future degradation of watershed processes and aquatic system health including land use change, water use and wildfire risk.

Table 4 shows the index scores for watershed health and vulnerability according to the EPA's Preliminary Healthy Watershed Assessments Project. The higher the score, the healthy and more vulnerable the watershed. The percentile shows ranking within Indiana. Of the six watersheds in the City of Westfield, the Hinkle Creek watershed health index is the highest (0.71) and the vulnerability index is the lowest (0.12). This may be attributed to lower density development and more open, natural areas. Conversely, the Cool

Creek watershed has the lowest health index (0.32) and highest vulnerability index (0.28). This is most likely due to intensely urban development and impervious cover.

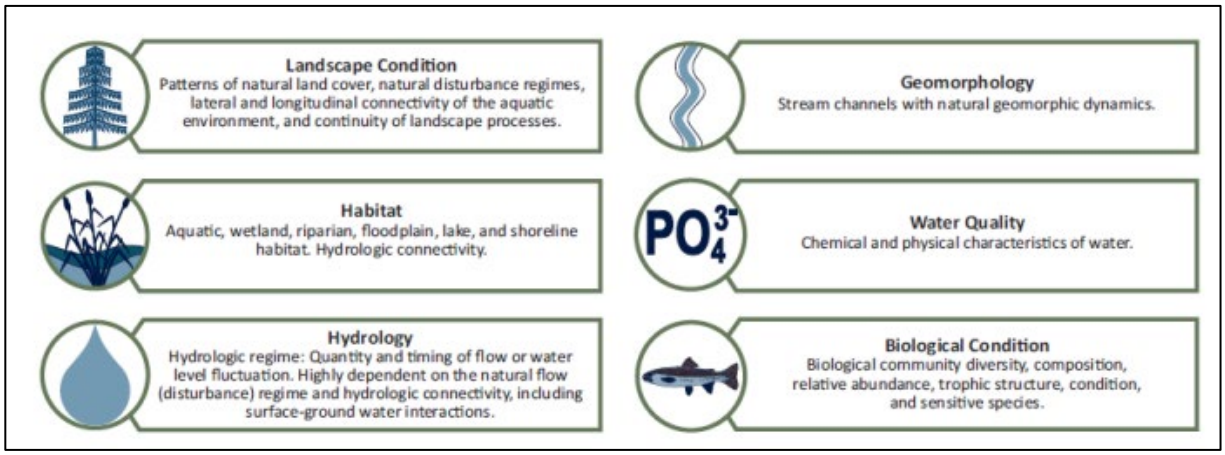

Figure 3: Attributes for a healthy ecosystem (EPA, 2021)

Table 4: Summary of watershed health and vulnerability index (EPA, 2021)

Watershed Name	Watershed Health Index		Watershed Vulnerability Index	
	Score	Percentile	Score	Percentile
Cool Creek	0.32	0.90	0.28	96.40
Hinkle Creek	0.71	74.80	0.12	72.60
Lion Creek-Little Eagle Branch	0.47	9.20	0.15	84.40
Morse Reservoir-Cicero Creek	0.47	11.10	0.23	94.30
Vestal Ditch-White River	0.51	20.10	0.26	95.60
Williams Creek	0.54	28.70	0.25	95.10

The EPA "How's My Watershed" tool also summarizes the overall condition of the waterbody, ability to support aquatic life and contact from recreation including swimming and boating. Every two years, IDEM develops a Section 303(d) List of Impaired Streams as part of the state's Integrated Water Monitoring and Assessment Report which is submitted to EPA. Streams listed as impaired do not, or are not expected to, meet water applicable state water quality standards. States are required to develop Total Maximum Daily Loads (TMDL) for these waters to achieve compliance with water quality standards. **Table 5** includes summary water quality data and **Figure 4** shows the impaired stream segments.

Kirkendall Creek and Williams Creek are reported to have good overall waterbody condition, good aquatic life and good for contact through recreational use. This is consistent with chemical, physical and biological assessment completed in the 2018 SWMP. Cool Creek, Grassy Branch, Little Eagle Creek and Sly Run are listed as having good aquatic life but impaired for recreational use. All the streams listed in Table 5 are impaired for bacteria and microbes.

IDEM has completed two TMDL studies that impact the City of Westfield. TMDLs recommend strategies for restoring impaired waters and determine the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. These studies determine pollutant load reduction targets

and implementation strategies **Table 6** summarizes the TMDL studies that impact watersheds in the City of Westfield, pollutant source and implementation strategies to improve water quality.

Table 5: Water quality summary by waterbody (EPA, 2021 and IDEM, 2022)

Waterbody	Waterbody Condition	Aquatic Life	Recreational Use
Cool Creek	Impaired	Good	Impaired
Cool Creek UNT	Impaired	Condition Unknown	Impaired
Grassy Branch	Impaired	Good	Impaired
Jones Ditch	Impaired	Condition Unknown	Impaired
Lindley Ditch	Impaired	Condition Unknown	Impaired
Kirkendall Creek	Good	Good	Good
Little Eagle Creek	Impaired	Good	Impaired
Little Eagle Creek UNT	Impaired	Condition Unknown	Impaired
Sly Run	Impaired	Good	Impaired
Sly Run UNT	Impaired	Condition Unknown	Impaired
Williams Creek	Good	Good	Good
Woodruff Branch	Impaired	Condition Unknown	Impaired

UNT = unnamed tributary

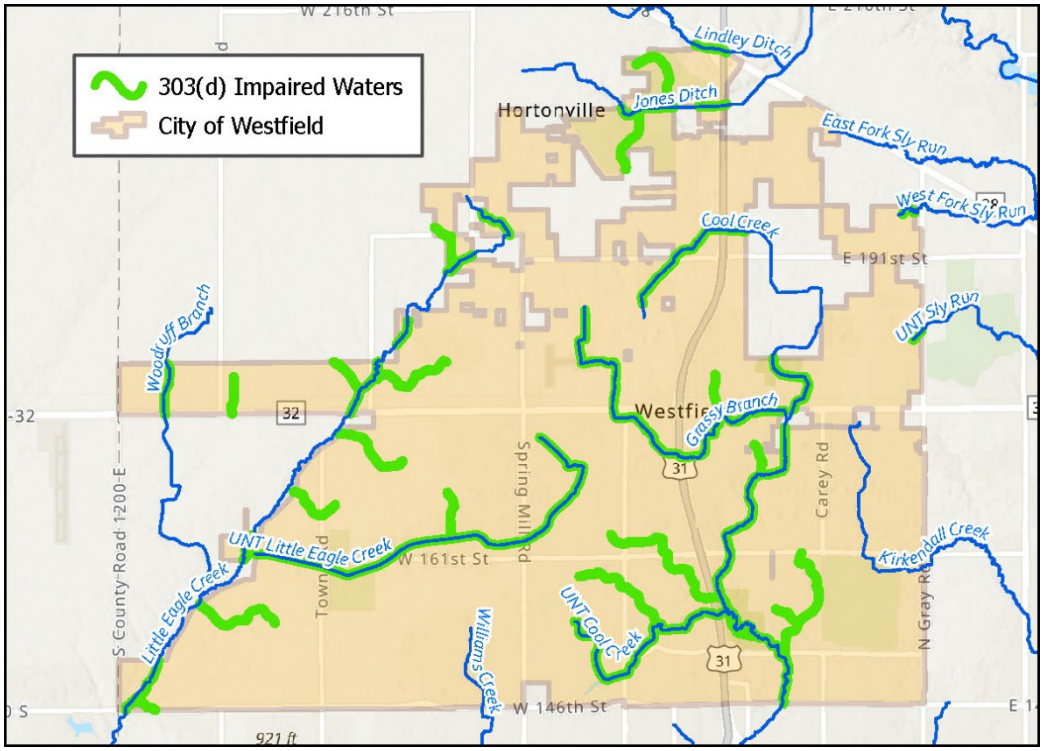

Figure 4: Impaired Streams

Table 6: TMDL summary

TMDL Study	Westfield Specific		
	Watersheds	Source Assessment	Implementation Strategies
Cicero Creek Watershed (2011)	Hinkle Creek and Morse Reservoir- Cicero Creek watersheds	• Land use and runoff • Wildlife and domestic pets • Septic Systems	• NPDES permitted dischargers • MS4 program implementation • Riparian area management • Pet clean-up/ education • Septic system management • LID/green infrastructure BMPs
West Fork White River (Muncie to Hamilton County Line) Watershed (2004)	Morse Reservoir- Cicero Creek and Vestal Ditch-White River watersheds	• Land use and runoff • Wildlife and domestic pets • Septic Systems	• Septic system outreach and maintenance • Green infrastructure BMPs

NPDES = National Pollutant Discharge Elimination System; MS4 = Municipal Separate Storm Sewer System; LID = Low Impact Development; BMP = Best Management Practices

3.2.2 Drainage and Flooding

The city gathers drainage complaints through the "WeConnect" web portal. This online service allows residents and businesses to request a service or report a problem on a wide range of city services. Stormwater service requests are categorized by property drain, flooding, sump line, erosion control/construction and sinkhole. Burke reviewed the drainage complaints database and met with city staff to discuss known drainage and flooding problem areas. city staff identified eight problem areas listed below:

1. Tomlinson Road flooding
2. Southridge Subdivision ponding
3. Grassy Branch flooding
4. Centennial Subdivision drainage
5. Union Street and Penn Street flooding
6. Little Eagle Creek erosion
7. 156th Street and Westfield Boulevard flooding
8. Eagletown Road flooding

The Flood Insurance Rate Maps (FIRM) for the City of Westfield were issued from FEMA in 2014. Since then, there have been five letters of map change that have been approved by FEMA (**Table 7**). The IDNR Best Available Floodplain Data incorporates these updates as well as refined mapping for previously unstudied streams including Woodruff Branch, portions of Little Eagle Creek and Lindley Drain. The most recent floodplain mapping for the city is shown in **Figure 5**.

Table 7: Summary of letters of map change

Revision Type	Location	Revised Information
Letter of Map Revision (1)	Little Eagle Creek and 186th St	Established flood elevations and 1% annual chance flood zone
Letter of Map Amendment (3)	Cool Creek tributary and Village Farms Subdivision	Removed 3 structures (1 residential) from the floodplain
Letter of Map Amendment (1)	Cool Creek and Lantern Park Subdivision	Removed a portion of a property from floodplain

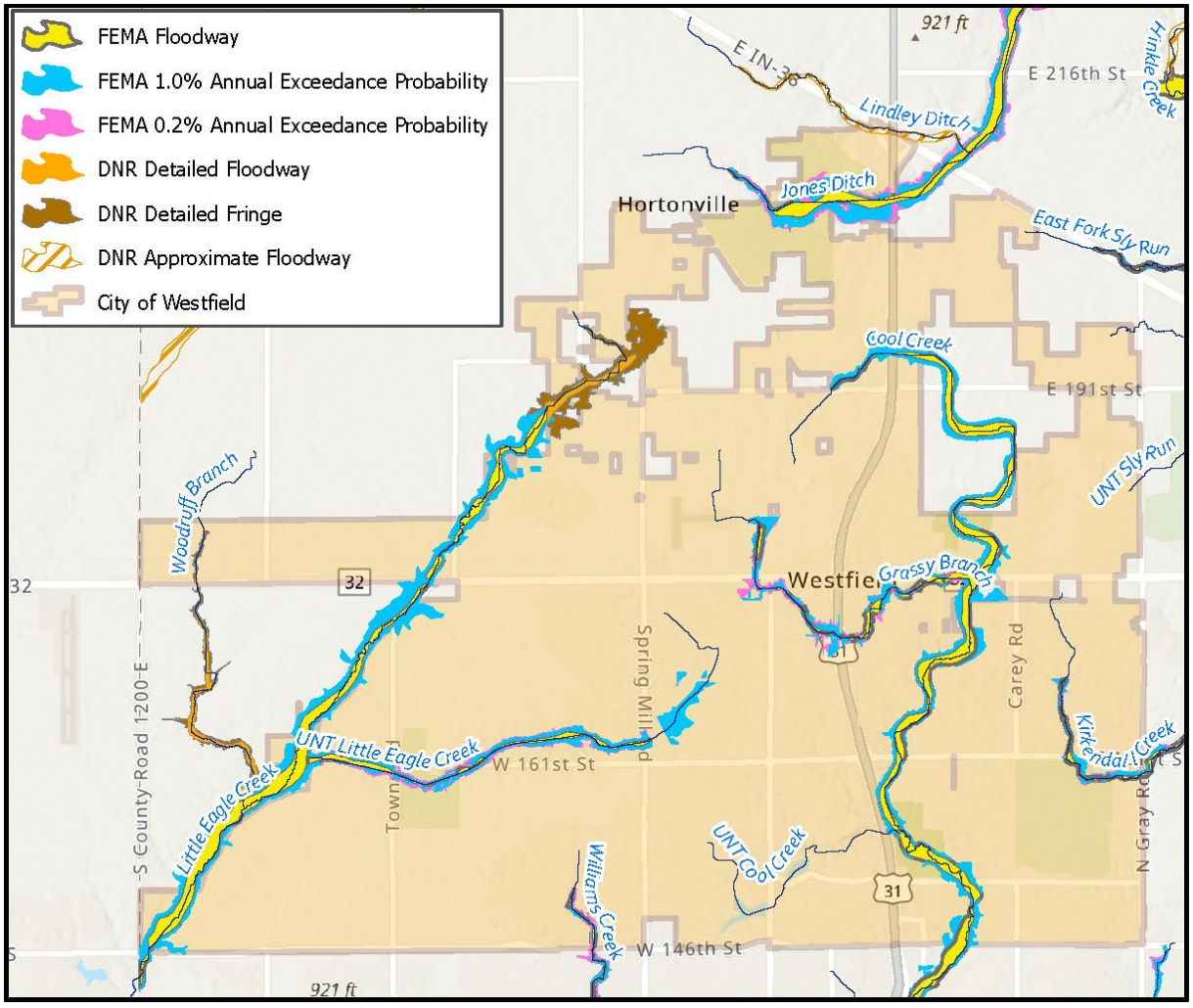

Figure 5: Floodplain designations

According to the 2019 Hamilton County Multi-Hazard Mitigation Plan (MHMP), there are 288 buildings in the floodplain in the City of Westfield with a total estimated loss value of $85.5M should a major flood inundate these buildings. To estimate flood-related losses, this plan assumes 25% of structures in each flood zone would be destroyed, 35% would be 50% damaged and 40% would be 25% damaged. **Table 8** identifies the number of structures and estimated losses for structures in the floodway, 1% (100-year) floodplain, 0.2% (500-year) floodplain and unnumbered or unstudied streams.

Table 8: Structure counts and estimated loss from flooding

Floodway		1% (100-year) Floodplain		0.2% (500-year) Floodplain		Unnumbered / Unstudied Stream		Total	
#	$	#	$	#	$	#	$	#	$
71	$25.5M	167	$38.5M	28	$15.0M	22	$3.5M	288	$83.5M

Structures and damages within each flood zone are not inclusive; only structures greater than 400 square feet were counted

Fluvial erosion hazard (FEH) areas have been mapped for portions of Little Eagle Creek, Cool Creek, Kirkendall Creek, Williams Creek, John Edwards Drain, Isaac Jones Drain and Anna Kendall Drain. These are available through the IDNR. The FEH area is the land adjacent to the stream where stream processes may occur that enable the stream to re-establish and maintain a stable slope and dimensions over time. FEH area boundaries attempt to capture lands most vulnerable to fluvial erosion in the near term.

Most of the waterways in the City of Westfield are regulated drains and under the jurisdiction of the county Surveyor. Of the 59.5 miles of regulated drains, 59% are open ditches. Regulated drains have a 75-foot easement on either side to allow access for regular drain maintenance. The Hamilton County Drainage Board has the authority to prohibit and/or limit the construction of structures, planting of trees, shrubs or wooded vegetation within the regulated drain easement.

A 2019 study from the Indiana Climate Change Impact Assessment (IN CCIA) reported an increase in annual precipitation of 6.6 inches in central Indiana from 1895 to 2019 (**Figure 6**). Also shown in Figure 3.6 is the trend in annual total precipitation has increased sharply since 1955. The IN CCIA predicts that over the next 30 years, annual precipitation is expected to increase an additional 6-8%. Indiana is expected to experience a 25% increase in winter precipitation and 20% increase in the spring, and a 5% decrease in the summer and fall precipitation. Additional precipitation in the winter and spring, when the ground is frozen and trees are dormant, will increase runoff and the risk of flooding.

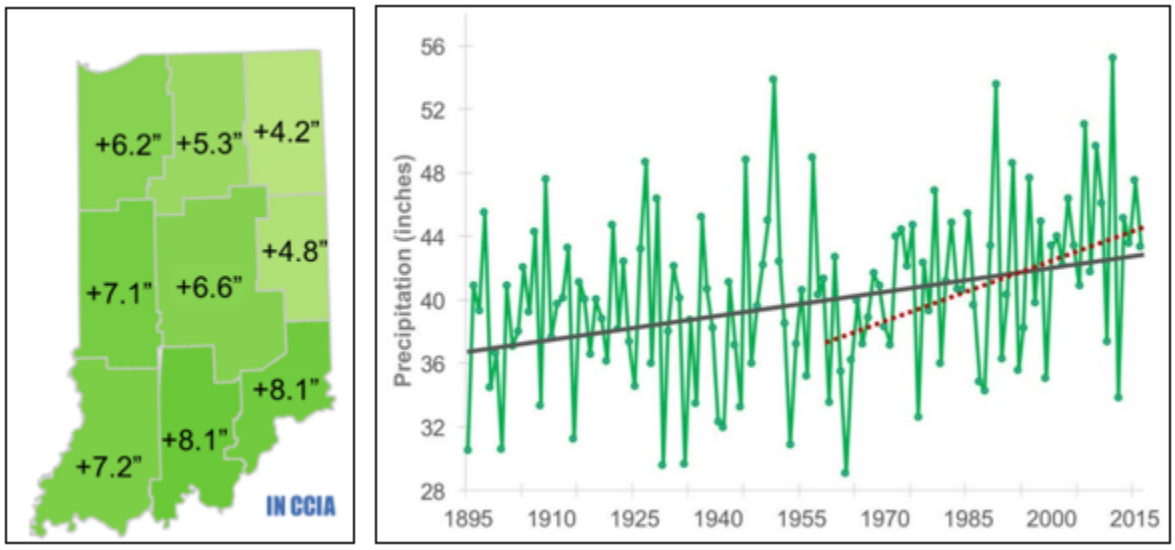

Figure 6: Historic precipitation data

The most extreme rainfall events, defined by the top 1% daily total rainfall occurrences on record, are occurring more frequently and trending to continue in doing so. The IN CCIA estimates that a one- to two-day increase in the average number of days per year with extreme precipitation is likely. Regional observations have also indicated more intense storms, with a 42% increase in the amount of rain falling during these extreme events.

Indiana is experiencing more rainfall than in the past and that some of that increased rainfall is occurring as more frequent and much more severe storm events. The increase in heavy precipitation will continue to challenge the adequacy of current approaches to stormwater and floodplain management.

3.3 POLICIES, PLANS AND PROJECTS

The Westfield-Washington Township Comprehensive Plan provides a framework for guiding future growth and development. The plan states that the City of Westfield and Washington Township are committed to planning for the future and managing growth to maximize its positive impacts (new families, businesses, tax revenue and opportunities) and minimize the negative impacts (increased traffic, strained infrastructure and threat to quality of life). The guiding policies in the Comprehensive Plan were formulated in 2007 with Addenda for critical growth areas including Grand Junction (2009, 2013 and 2016), Family Sports Capital (2009 and 2010), Spring Mill Station (2014) and Village Farms (2016).

As it relates to stormwater and floodplain management, the Comprehensive Plan includes an Open Space and Recreation chapter that discusses the value and protection of open space and natural features. These areas include stream corridors, woodlands, hedgerows, stands of trees, wetlands and waterbodies, especially Little Eagle Creek. The plan recommends an integrated stormwater management approach to maintain natural drainage patterns, attenuate water quality impacts, replenish groundwater and incorporate detention facilities as visual and environmental amenities. The implementation tools include a development review process to ensure provisions of open space consistent with these policies, establish minimum percentages for open space with new development, provide protection for Little Eagle Creek through an overlay zone

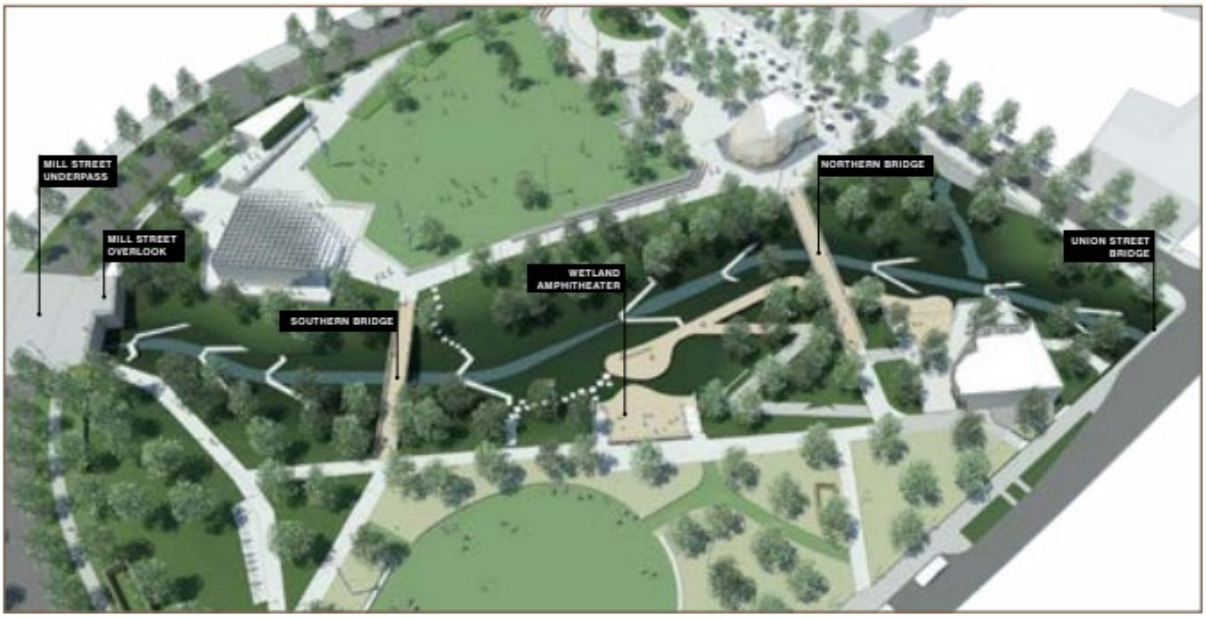

Figure 7: Grand Junction Plaza conceptual development plan

and density bonuses for additional permanent open space. The rural and suburban residential section of the Comprehensive Plan strongly encourage conservation subdivision or low impact development to protect open space and natural areas.

Grassy Branch Creek flows through Grand Junction Plaza. This plan Addenda and resulting development integrates natural and beneficial function of the floodplain, mature vegetation and riparian corridor as an amenity greenway (**Figure 7**). Green infrastructure practices are promoted to manage onsite stormwater.

The City of Westfield is designated as a Municipal Separate Storm Sewer System (MS4) community. MS4s are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying stormwater. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels, and conduits. MS4 conveyances within urbanized areas have one of the greatest potentials for polluted stormwater runoff. The CWA requires stormwater discharges from certain types of urbanized areas to be permitted under the National Pollutant Discharge Elimination System (NPDES) program. MS4s are required to implement a program for six minimum control measures (MCM) including:

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

In December 2021, IDEM issued a new general permit for MS4 communities (MS4GP) to replace Rule 13. This permit expanded the six minimum control measures, includes new requirements for managing stormwater discharges and updated five-year permit cycle timeline. Implementation of the new MS4GP means increased documentation, staff training, inspections, separate storm system maintenance, and overall permit activities for the City of Westfield. This new permit process will allow IDEM to update their stormwater permits every five years more easily. It is anticipated that the number of overall requirements will continue to increase with each permit cycle.

The City of Westfield updated their Stormwater Ordinance and Technical Standards (O&TS) Manual in 2019. This manual establishes policies relating to stormwater management, stormwater quality practices and flood control, submittal requirements and procedures for issuance of stormwater permits and procedures for inspection, testing and final acceptance of stormwater facilities. This version follows the 2009 Burke template that has been adopted by numerous communities statewide including requirements for channel protection volume, and low impact development standards as an alternative to conventional development. Hamilton County has adopted a similar O&TS. The new MS4GP requires the city (and county) to update the erosion and sediment control requirements with IDEM's new requirements for stabilization, design, monitoring and project documentation, as well as best management practices (BMP) inspection, maintenance and checklists. The City of Westfield O&TS does not currently include requirements for FEH; something that can be added as the standards are updated.

Section 8.8 of the Unified Development Ordinance (UDO) includes stormwater standards. This section states that all development shall provide for the collection and management of all storm and surface water drainage according to the city's Construction Standards. This section has been expanded from the 2017 version to include maintenance of detention basins. Specifically, that the vegetation should not be overgrown as to impede water flow or alter the design volume of the basin, inlets and outfall must remain clear of debris and access should be provided for maintenance purposes.

The 2018 City of Westfield Stormwater Master Plan included a detailed analysis of future growth areas including portions of Cool Creek, Isaac Jones, Little Eagle Creek and Sly Run watersheds. The plan concluded should the City of Westfield develop as planned, the impervious area is expected to significantly increase. Under normal circumstances this would result in an increase in runoff volume; however, both city and county stormwater ordinances currently provide limits on post-development release rates that should prevent this issue. No additional drainage and flooding issues are expected to be created by future development because of the anticipated adherence to the city and county stormwater ordinances. The existing, undeveloped unit peak release rates for the future growth areas are higher than the post-development release rates in the ordinances. As a result, in the future, the flow rate leaving a given parcel should be lower than the current condition, on average. There is still a concern that as the watersheds gradually develops, the timing of runoff could change in such a way that peak flow rates in the streams still increase.

The Flood Overlay District is in chapter five of the UDO. The flood regulations closely follow the IDNR model Flood Hazard Ordinance and includes the optional additional requirements for compensatory flood storage and critical facilities. Whenever a portion of the 1% floodplain is authorized for use, the volume of space which will be occupied by the authorized fill or building shall be balanced by an equivalent, one-to-one of excavation to compensate lost flood storage (**Figure 8**). Construction of new critical facilities shall be, to the greatest extent possible, located outside the limits of the 1% floodplain. Critical facilities inside the 1% floodplain shall be elevated and floodproofed and floodproofed. Access to critical facilities shall also be elevated to allow for flood free access. Most of the waterways in the City of Westfield are regulated drains and under the jurisdiction of the Hamilton County Surveyor's Office which in some cases, like compensatory flood storage, more strict requirements apply. The city plans to update their flood ordinance language based on the new model ordinance developed by IDNR and approved by FEMA.

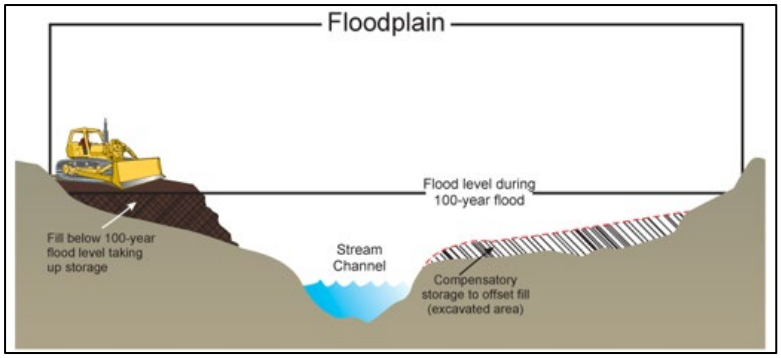

Figure 8: Illustration of compensatory flood storage

CHAPTER 4: OPPORTUNITIES AND CHALLENGES

This chapter summarizes the opportunities and challenges to protecting and improving water resources for the City of Westfield. It takes into consideration both known drainage, flooding, and water quality problems as well as those anticipated with future growth and development.

Assuming the city continues to grow as planned, the percent change of impervious cover is expected to be as much as 80%. To minimize the negative impact this will have on stream health, the city should enforce the water quality requirements in the stormwater ordinance, encourage stream protection buffers, and promote green infrastructure as development occurs. Water quality data shows most waterways are impaired for *E. coli*. Development setbacks, stream buffers, green infrastructure, and adherence to the water quality/quantity requirements and implementation of the city's MS4 program will help to improve overall stream health.

Opportunities to protect, enhance, and manage water resources

- Large undeveloped areas with opportunities to avoid or prevent drainage, flooding, and water quality problems associated with rapid growth and development
- Stretches of stream with relatively healthy habitat and water quality
- Use of larger regional ponds in place of smaller individual ponds for each new development
- 75-foot setback enforced on regulated drains
- Adopted stormwater ordinance and technical standards maximum allowable release rates, requirements for channel protection volume, and low impact development standards as an alternative to conventional development
- Adopted optional language in State Model Flood Hazard Ordinance including requirements for compensatory storage and not allowing critical facilities in the 1% floodplain
- Use of IDNR Best Available Floodplain Data for previous unstudied streams
- Stormwater utility in place to fund capital improvement projects and implementation of the MS4 program

Challenges to be addressed to minimize negative impacts on water resources

- Flooding and drainage problem areas in older neighborhoods
- Overall rapid planned growth and development
- Several streams impaired for *E. coli*
- Natural stream movement or fluvial erosion hazard and its potential to impact utilities and structures located too close to the stream, no regulations in place
- Maintenance practices for streams and regulated drains that are not conducive to natural looking waterways or good water quality
- Lack of tracking and enforcement of long-term inspection and maintenance of stormwater BMPs
- Few incentives to promote low impact development and green infrastructure in new and redevelopment projects as well as barriers to these practices in development codes
- Lack of smart growth-based flood resilience overlay zones in plans and codes
- Buildings at flood risk located in the 1% floodplain
- Increased frequency and intensity of rain events due to climate change

CHAPTER 5: IDENTIFY AND EVALUATE SOLUTIONS

Burke met with city staff to review the list of opportunities and challenges from Chapter 4 and projects from the 2018 SWMP to identify those that they wanted to explore in detail as part of this SWMP. To address both current and future problems, both structural and non-structural or policy-based solutions were selected. This chapter includes a detailed evaluation of the recommended solutions to determine their feasibility to address flooding, drainage, and water quality problems. The following is a list of the recommended solutions:

1. Improve long-term BMP maintenance procedures
2. Implement *E. coli* BMPs to meet TMDL requirements
3. Explore alternative ditch maintenance practices
4. Promote flood resilience, low impact development, and green infrastructure
5. Implement updates to MS4GP and CSGP programs
6. Address flooding on Tomlinson Road
7. Address ponding in the Southridge Subdivision
8. Address flooding on Grassy Branch Road
9. Address drainage problems in the Centennial Subdivision
10. Address flooding on Union Street and Penn Street
11. Complete detailed studies to understand road flooding

The following discussion on each of the above recommended solutions includes a description of the situation, proposed solution, the general approach and assumptions for the evaluation, and the recommendations for implementation. Short and long-term implementation tasks and associated cost is included in Chapter 6 of this SWMP.

5.1 IMPROVE LONG-TERM BMP MAINTENANCE PROCEDURES

Description of the Situation

In every development in Westfield, BMPs are designed, reviewed, and constructed to meet specific volume reduction and water quality control requirements. However, once these are in the ground, there is a concern as to whether these BMPs, especially privately-owned ones, are being inspected regularly and properly maintained to ensure the performance for which they were designed and permitted.

Description of the Proposed Solution

The city's stormwater technical standards require a maintenance agreement and long-term operation and maintenance plan for each BMP however, improvements could be made to the agreement to outline specifically what is required for inspection and maintenance of the different stormwater practices. Compliance with the new MS4GP requires the City of Westfield to update their stormwater ordinance within 24 months. In 2021, Purdue University's Local Technical Assistance Program (LTAP), through an agreement with Burke, produced a model O&TS that includes ready to adopt language to meet these requirements. The city is in the process of mapping public and private BMPs in GIS.

The owners of private stormwater BMPs, especially homeowner's associations, may not understand what inspection or maintenance needs to be performed or at what frequency. Guidance materials for BMP owners should be developed with easy-to-use maintenance schedules and inspection reporting forms (**Figure 9**).

Figure 9: Example BMP owner maintenance guide

Developing a citywide GIS-based tracking system, or similar mechanism, would help city staff regulate and enforce regular inspection, maintenance, and repair of BMPs to ensure optimal performance and protect receiving waters from stormwater pollutants. This tracking system could generate reports and annual reminders to BMP owners.

General Approach and Assumptions for Analysis

Burke reviewed the current Stormwater Technical Standards Chapter 03100 Policy and Procedures, Stormwater Management Practices Maintenance Agreement (Appendix D6/03702-6) and Maintenance Inspection Checklists (Appendix D5/03702-5) and suggested revisions to improve inspection, maintenance, and tracking of BMPs. It was assumed that the city wishes to continue as the current requirements are written so the responsibility for all inspection and maintenance of privately-owned BMPs remain with the BMP owner.

Recommendations for Implementation

1. Add detailed O&M Manual requirements to Section 03702.09 Inspection, Maintenance, Record Keeping and Reporting of Chapter 03700: Post-construction Stormwater Quality Management
2. Add a requirement to Section 03702.09 to ensure there is adequate funding to cover the costs associated with regular inspection and long-term maintenance of BMPs (maintenance fund, escrow account, etc.)
3. Prepare a standalone O&M Manual or replace Exhibit C of the existing D5/03702-6 with more detailed information on responsibility for maintenance and schedule, inspection requirements and frequency, easements or covenants for maintenance, identification of funding source for maintenance
4. Replace the Maintenance Inspection Checklists (Appendix D5/03702-5) with more detailed inspection checklists and maintenance schedules and include a wider variety of BMPs including options for green infrastructure
5. Add ponds, separators, and green infrastructure BMPs to Section 03104.03 Release of Maintenance Sureties in Chapter 03100 Policy and Procedures currently lists only pipes need to be functioning properly
6. Develop guidance materials for BMP owners with photographs/infographics and easy to follow maintenance schedules and inspection reporting forms. Post this information on the city's webpage

and conduct an annual training at the beginning of the growing season to go through BMP inspection and maintenance requirements.

7. Populate the city's GIS with BMP location and attributes as they are included on recorded plat
8. Establish a tracking database (linked to the city's GIS) with BMP specifics that will populate summary reports and send automatic mailers/reminders to BMP owners to ensure the Maintenance Agreement (Appendix D6/03702-6) is enforced including annual records of inspections, maintenance, and repair of BMPs (**Figure 10)**

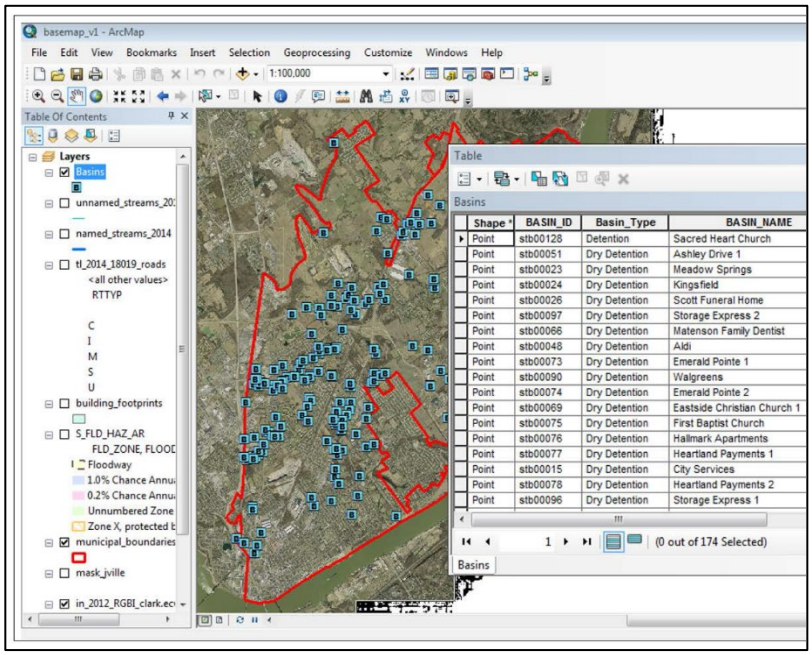

Figure 10: Example of a BMP tracking database and map

Estimated Cost and Time to Implement

This solution should take one year to establish at an estimated cost of $30,000. Annual implementation, including BMP inspections, is expected to cost $60,000.

5.2 IMPLEMENT *E. coli* BMPS TO MEET TMDL REQUIREMENTS

Description of the Situation

Under the new MS4GP, IDEM may impose additional water quality-based limitations including installation of additional BMPs to comply with waste load allocations in an EPA established or approved TMDL. There are two TMDL studies that impact the City of Westfield:

1. Cicero Creek Watershed (2011) – includes the Hinkle Creek and Morse Reservoir-Cicero Creek watersheds; listed for *E. coli*
2. West Fork White River (Muncie to Hamilton County Line) Watershed (2004) – includes the Morse Reservoir- Cicero Creek and Vestal Ditch-White River watersheds; listed for *E. coli*

The city is listed in both TMDL reports and as such is subject to applicable waste load allocations. To achieve this, the city must implement a program and update its Stormwater Quality Management Plan (SWQMP) to incorporate and implement appropriate BMPs to reduce *E. coli* pollutant loadings. Every year following the creation of the implementation plan for the TMDL, the city must continue to implement the plan and provide documentation in their annual report to IDEM of installation and maintenance of stormwater BMPs that target *E. coli.*

Description of the Proposed Solution

The TMDL source assessment lists land use runoff, wildlife and domestic pets and septic systems. To target these sources, the city should increase the number of dog waste stations available at the parks and along walking trails; increasing the riparian buffers along streams; manure management programs for hobby farms; septic system education, outreach and management; and green infrastructure BMPs.

General Approach and Assumptions for Analysis

Burke reviewed the TMDL reports, available water quality data and completed a desktop analysis of the land use in the Hinkle Creek, Morse Reservoir-Cicero Creek and Vestal Ditch-White River watersheds to better understand what potential sources of *E. coli*.

Recommendations for Implementation

1. Develop educational messaging as part of the city's MS4 program that focus on how to reduce *E. coli* loading in local streams and waterbodies. Messages should be consistent and clear with an action to change behaviors.
2. Encourage participation in the White River Alliance Clear Choices Clean Water program. Challenge neighborhoods and businesses to compete for pledges to improve water quality (**Figure 11**).
3. Partner with the city Parks Department to install and maintain pet waste stations and signage in parks and along trails.
4. Partner with the Hamilton County Soil and Water Conservation District (SWCD) to promote manure management plans for hobby farmers with livestock.
5. Partner with the Hamilton County Health Department to continue to collect and analyze water quality samples at least monthly during the recreational season.

Figure 11: Pet waste education material

Estimated Cost and Time to Implement

Implementation of this solution should be completed within a year for an estimated cost of $13,000. Annual tracking, reporting and program enhancements is expected to be the same amount.

5.3 EXPLORE ALTERNATIVE DITCH MAINTENANCE PRACTICES

Description of the Situation

Natural features such as streams and rivers are a valued asset to communities. They improve property values and enhance overall quality of life. Westfield has many waterways flowing through the city however the majority of these are regulated drains and under the jurisdiction of the county Surveyor (**Figure 12**Error! Reference source not found.). Regulated drains are a critical part of the stormwater infrastructure with the intent to convey runoff as efficiently and quickly as possible and the county Surveyor prefers to keep drain and adjacent easements clear of trees and woody vegetation. The city would like to find a way

to balance the benefit of these waterways for water quality, aesthetics, and conveyance of stormwater runoff.

Description of the Proposed Solution

The county Surveyor publishes a list each year of regulated drains for maintenance and reconstruction. The city should coordinate with the county Surveyor and identify mutually beneficial options for regulated drains in urbanized and future growth/undeveloped areas within the current drainage code. In addition to regulated drains, there are several waterways that are not regulated by the county Surveyor. For these non-regulated waterways, the city should identify options for natural looking waterways.

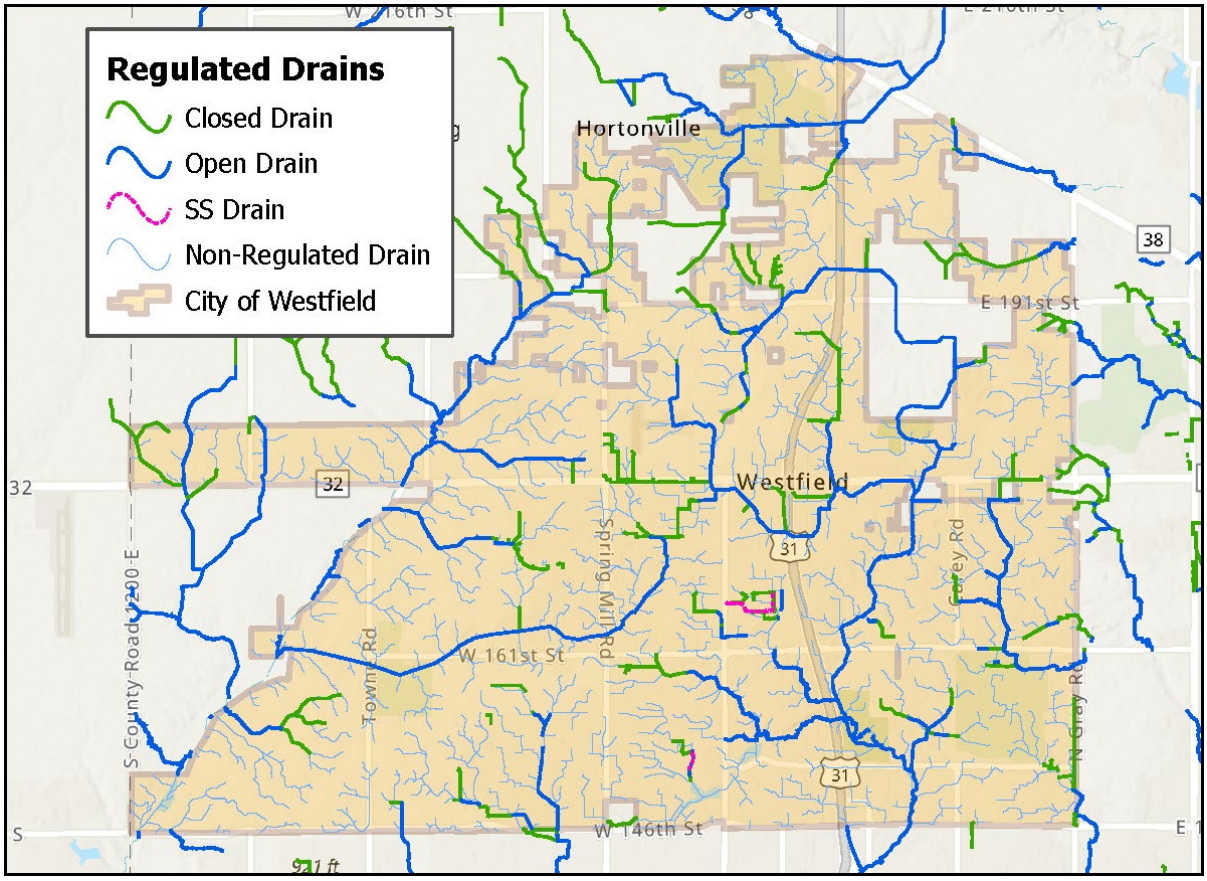

Figure 12: Regulated and non-regulated drains

General Approach and Assumptions for Analysis

Burke reviewed the Indiana Drainage Law IC 36-9-27, researched alternative maintenance practices implemented elsewhere, and mapped the regulated drains and 75-foot easement to identify recommended solutions. It was assumed that the city does not wish to, or is not permitted to, take over ownership or maintenance of the regulated drains from the county Surveyor.

Recommendations for Implementation

1. Track and maintain in GIS the classification of drains and annual schedule for reconstruction, periodic maintenance, and vacating drains

2. Support the county and adopt in the city the statewide FEH layer and regulations as an overlay zone. This layer identifies areas along waterways that are prone to natural stream erosion process
3. Regulated Drains in Urbanized Areas:
    a. Work with county Surveyor to minimize removal of large established trees while maintaining function of regulated drain
    b. Minimize ditch obstructions and emergency maintenance procedures by educating landowners adjacent to ditches to not dump leaf litter or brush near ditch or build unauthorized structures
    c. Petition for two-stage ditch or self-forming drain reconstruction which benefits both flood control and water quality
4. Regulated Drains in Undeveloped Areas:
    a. Enforce the FEH or 75-foot drainage easement (whichever is greater) and prohibit encroachment of structures or trees
    b. Work with the county Surveyor to maintain the drainage easement in native grasses
    c. Work with the county Surveyor to establish alternating pockets of native trees and native grasses along the regulated drain. The native grasses will allow access points for periodic maintenance and once established, the grasses and trees will filter sediments and pollutants to improve overall stream health and provide additional corridors for wildlife
    d. Petition for two-stage ditch or self-forming drain reconstruction which benefits both flood control and water quality
5. Non-regulated Waterways:
    a. Enforce the FEH overlay zone. This could be used toward meeting open space requirements for new development.
    b. Work with the SWCD to establish area as a conservation easement and/or work with landowners to plant with native trees and grasses

Estimated Cost and Time to Implement

This solution should take one year to establish at an estimated cost of $15,000. Annual implementation is expected to cost $2,500.

5.4 PROMOTE FLOOD RESILIENCE, LOW IMPACT DEVELOPMENT & GREEN INFRASTRUCTURE

Description of the Situation

According to the predictions on climate change, rainfall in central Indiana is projected to increase 6-8% by 2050 and 25% of this increase is expected during the winter and spring months which will further stress the stormwater infrastructure of areas already prone to flooding. Historic rainfall data shows that the Midwest has experienced a 42% increase in intensity and frequency of storms. These trends are creating a sense of urgency among communities to look for better ways to manage stormwater and flooding. Land use planning and development codes are powerful tools to build community resiliency and sustainability because they determine where and how development occurs.

Description of the Proposed Solution

To achieve flood resiliency and stormwater sustainability, the city needs to coordinate among departments to ensure plans, programs, and policies complement each other and work toward the same goal. This can be done by regularly auditing, updating, and revising plans and policies. Immediately this should include removing barriers and promoting green infrastructure and urban forestry to manage stormwater, improve

livability, and enhance quality of life. To reduce flood risk, the city should adopt flood resilience planning areas to direct growth and development to safer areas outside known flood areas.

General Approach and Assumptions for Analysis

Burke reviewed and suggested revisions to the city's Comprehensive Plan and specific sections of the Unified Development Ordinance (UDO) including the Floodplain Overlay District (Chapter 5), Landscaping Standards (Chapter 6), Parking and Loading Standards (Chapter 6), Stormwater Standards (Chapter 8) and Construction Standards and Specification Paving and Surfacing (Section 02500) to enhance stormwater and flood management efforts.

Recommendations for Implementation

1. Complete EPA's Community Resilience Checklist and/or the American Association of Planners Safe Growth Audit to ensure plans, policies, and programs citywide complement one another
2. Define and adopt flood resilience planning areas as shown in Figure 13 including:
    a. River Corridor – conserve land and prohibit new development in the FEH and floodway, whichever is greater
    b. Undeveloped High Flood Hazard/ Flood Storage Areas – conserve land as open space for flood storage in the 1% floodplain
    c. Moderate Flood Hazard Areas – preserve as open space for extreme flood events in .02% floodplain
    d. Vulnerable Settlements – protect people buildings and facilities in vulnerable areas inside the floodplain and implement mitigation projects to reduce future flood risk
    e. Safer Areas – plan for and promote development in areas outside the floodplain that are less vulnerable to future floods
    f. Watershed – promote coordination and partnerships and implement practices to slow, spread, and infiltrate flood water

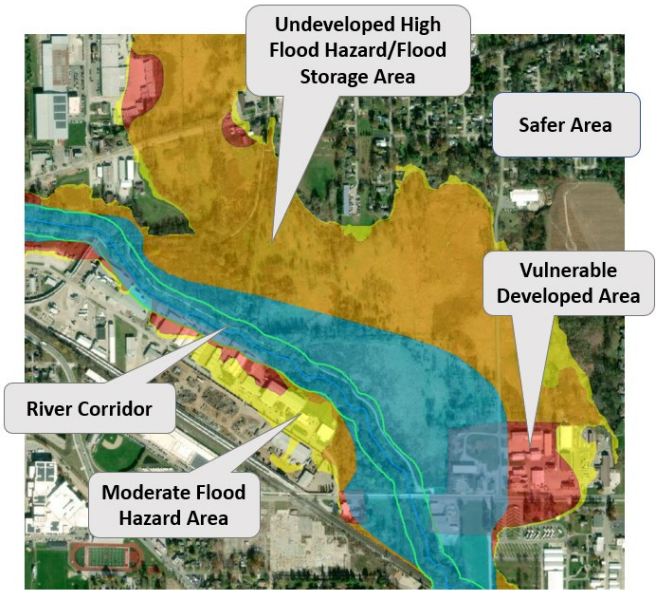

Figure 13: Flood resilience planning areas

3. Complete the Center for Watershed Protection's Code & Ordinance Worksheet (COW) to assess development codes and compare them to model sustainable codes
4. Adopt a score-based code requirement that integrates landscaping with stormwater management to promote green infrastructure stormwater management practices
5. Add language about the natural and beneficial benefits of floodplains to the Conservation Subdivision sections of the Comprehensive Plan
6. Add FEH restrictions to the Flood Overlay District (Chapter 5 UDO) to prohibit development or land disturbance due to the susceptibility and vulnerability to flooding and erosion
7. Revise Parking and Loading Standards (Chapter 6 UDO) to allow for permeable pavement and/or pavers; allow for strategic breaks in continuous curb and use of wheel stops if area is to drain to a stormwater BMP; reduce impervious area by requiring maximum instead of minimum parking space

requirement; require a percentage of parking area to be permeable; and remove the requirement for a waiver to use green infrastructure

8. Revise Landscaping Standards (Chapter 6 UDO) to promote native plants (see list in Stormwater Technical Standards); allow landscaped stormwater BMPs to count toward landscaping requirements; add depressions as an alternate to mounds and landscaped (not just groundcover) if areas to be used as stormwater BMPs; and add language to allow street trees in sidewalks to function as stormwater BMPs
9. Promote urban forestry and tree preservation as an effective stormwater management BMP using iTree and the National Tree Benefit Calculator; since urban forests are not as resilient as natural forests, increase tree replacement ratio to 5:1 and require a variety of trees to reduce risk of mass tree casualties from pest damage
10. Add definitions for Stormwater BMPs (see stormwater standards for approved list) to Chapter 12 UDO
11. Allow permeable pavement, pavers, grid block, etc. to Construction Standards and Specification Paving and Surfacing (Section 02500)

Estimated Cost and Time to Implement

This solution should take one year to update and adopt plans and codes. It is estimated that the cost for this work will be $50,000.

5.5 IMPLEMENT UPDATES TO MS4GP AND CSGP PROGRAMS

Description of Situation

In December 2021, IDEM issued a new general permit for MS4 communities (MS4GP) to replace Rule 13. This permit expanded the six MCMs, includes new requirements for managing stormwater discharges and updated five-year permit cycle. Implementation of the new MS4GP means increased documentation, staff training, inspections, separate storm system maintenance, and overall permit activities for the City of Westfield. In addition to the MS4GP, IDEM issued a Construction Stormwater General Permit (CSGP) to replace Rule 5. The CSGP targets construction activities with land disturbance of one acre or more. Implementation of the new CSGP includes updated training, performance standards for construction sites (natural buffers,

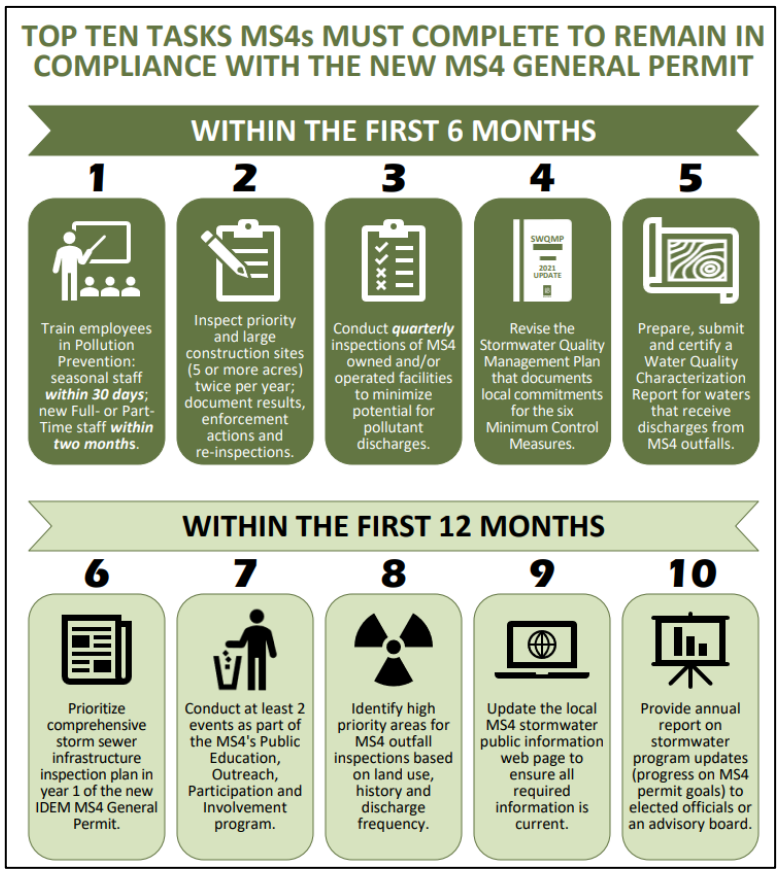

Figure 14: First year MS4GP compliance schedule

slope stabilization, dewatering, waste management and concrete washouts), frequency of site inspection and self-monitoring.

Description of Solution

To continue to be in compliance, the city should update and implement the program requirements as outlined in the permit. The maximum penalty for non-compliance is $27,500 per day per violation. **Figure 14** illustrates the implementation requirements for the first year.

General Approach

Burke reviewed the city's existing MS4 program and identified improvements to meet the new MS4GP and CSGP requirements within the five-year permit cycle.

Recommendations for Implementation

1. Prepare and submit updated permit documents and reports including the Notice of Intent (NOI) due July 2022, Water Quality Characterization Report (WQCR) and Stormwater Quality Management Plan (SWQMP) both due January 2023. Annual reports are due starting in March 2023.
2. Staff responsible for MS4 activities should receive 12 hours of training annually to maintain their skills and knowledge of the program
3. Update city's Public Education/Involvement program (MCM 1& 2) by October 2022 to include three local water quality issues and methods for involvement of the public and distribution of information. Implementation should include at least two events annually, annual training for builders, developers, etc. and annual updates to the city's webpage.
4. Update the city's Illicit Discharge Detection and Elimination (IDDE) program (MCM 3) by October 2022 to include maps of industrial facilities and outfalls as well as procedures for receiving/investigating complaints and dry weather screening. Conduct dry weather outfall screening throughout the permit term.
5. Update the city's Construction Site Stormwater Runoff ordinance (MCM 4) and train staff on procedures for plan review, tracking, site inspections and enforcement by September 2022.
6. Update the city's Post-construction Stormwater Runoff ordinance (MCM 5) and train staff on procedures for maintaining city owned BMPs and conduction BMP inspections by September 2022.
7. Update the city's Municipal Operations Pollution Prevention and Good Housekeeping program (MCM 6) to include the MS4 owned/operation facility inventory list, annual assessment and quarterly inspections for each facility, updated facility stormwater pollution prevention plans, flood control project review and evaluation and annual training.

Estimated Cost and Time to Implement

The MS4GP dictates the schedule for updates to this program. The estimated cost to update the O&TS is $20,000 and an annual program implementation cost of $75,000. This includes $15,000 annually to complete dry weather screening for the IDDE program.

5.6 ADDRESS FLOODING ON TOMLINSON ROAD

Description of the Situation:
Tomlinson Road, north of 199th Street, lacks a proper drainage structure and drainage swale to convey stormwater runoff from the west side of the road to the east side. Runoff from the south side of 199th Street drains north via an existing 12-inch culvert. The stormwater then drains to the east along a roadside ditch before traveling north but due to a lack of a drainage swale the stormwater will pond along the west side of Tomlinson Road.

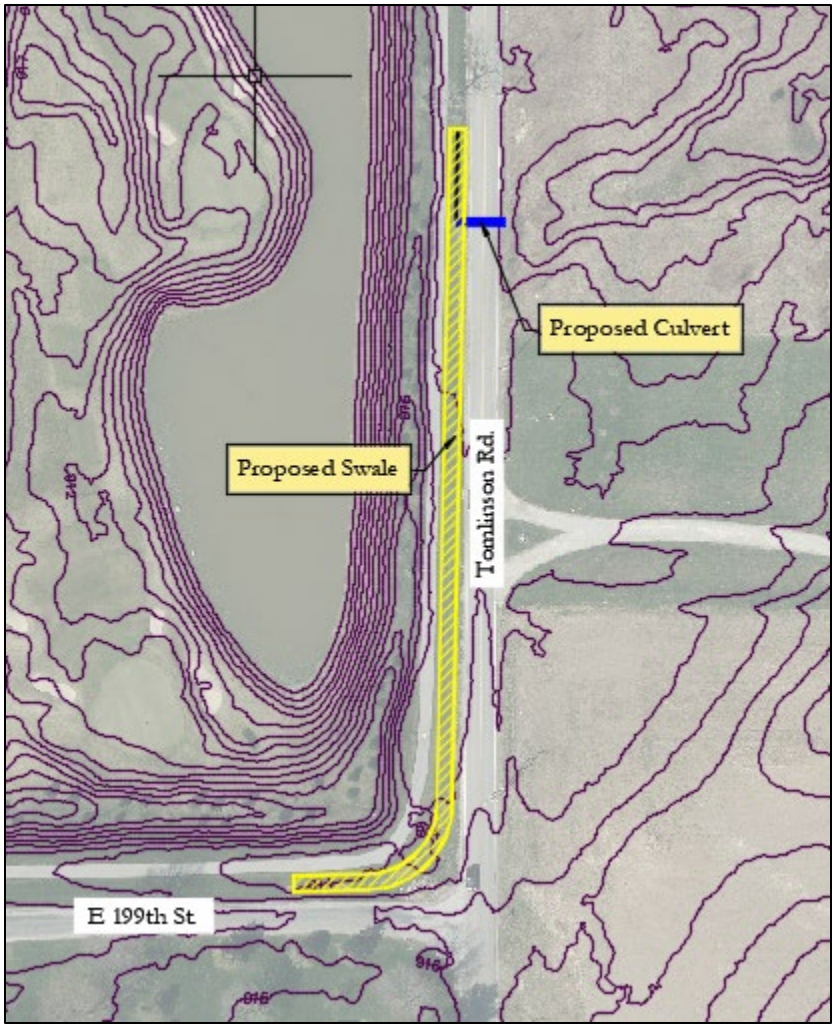

Figure 15: Tomlinson Road Improvements

Description of the Proposed Solution:
A two-component solution would be required to eliminate the flooding/overtopping of Tomlinson Road. First a swale will need to be created between the existing multi-use trail and road to convey the stormwater runoff. The swale will need to extend approximately 600 feet from a culvert under 199th Street to the new drainage culvert that will be installed under Tomlinson Road. The new culvert would need to be approximately 27-inches in size to ensure no overtopping of the road during a 100-year storm event. The culvert will discharge to the east into an existing drainage swale. The extends of the proposed project are shown in **Figure 15.**

General Approach and Assumptions for Analysis:
Burke determined preliminary watershed characteristics based on available information from Hamilton County GIS and information provided by the city. Based on preliminary rational model results, after the proposed improvements, Tomlinson Road should not overtop during the 1% Annual Exceedance Probability (AEP) flood event. Per the Hamilton County Stormwater Technical Standards, culverts need to be able to convey the 1% AEP flood event without overtopping the road.

Recommendation for Implementation:

1. Improve stormwater conveyance along under Tomlinson Road by installing a culvert

2. Improve conveyance along the west side of Tomlinson Road by installing a drainage swale.

Estimated Cost and Time to Implement

This estimated cost to resolve the flooding on Tomlinson Road is $67,000. **Appendix 1** includes a detailed cost estimate. It should take six months to complete the project assuming three months for design and three months for construction.

5.7 ADDRESS PONDING IN THE SOUTHRIDGE SUBDIVISION

Description of the Situation:

For several years, Southridge subdivision has experienced ponding in their cul-de-sac during intense rain events. The subdivision has a conventional stormwater drainage system with storm inlets/pipes and a drainage swale at the northeast corner. Currently there is only one drainage inlet for an approximately one-acre watershed that drains to the cul-de-sac. During intense rain events, the single drain inlet is not able to collect the entire watershed which results in water ponding. Additionally, the cul-de-sac grade is below the top of bank of the rear yard swale which results in water back flowing into the cul-de-sac resulting in ponding water when the swale is overwhelmed.

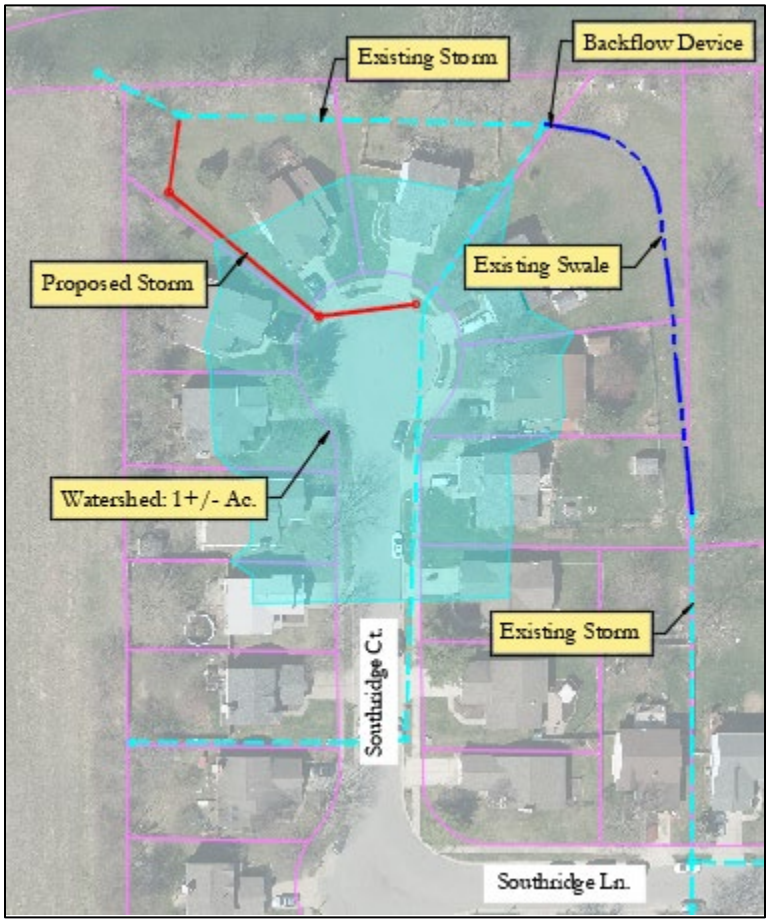

Figure 16: Southridge Improvements

Description of the Proposed Solution:

A two-component solution would be required to eliminate the ponding in the cul-de-sac. First a backflow device (inline duckbill) should be installed on the existing storm sewer to prevent water from backing up into the street from the rear yard swale. Second, an additional storm sewer outlet will be installed to help convey stormwater from the subdivision. Two additional storm sewer inlets will be installed within the cul-de-sac to help with capturing the runoff from the watershed. The storm will connect into an existing 18" storm sewer which is the primarily outfall for the subdivision. The extends of the proposed project are shown in **Figure 16.**

General Approach and Assumptions for Analysis:

Burke determined watershed characteristics based on available information from Hamilton County GIS and information provided by the city. Based on the model results, after the proposed improvements, the

cul-de-sac will be able to drain the 10% AEP flood event and will not allow the 1% AEP flood event to back flow from the rear yard swale.

Recommendation for Implementation:

1. Work with homeowners to obtains easements to install new storm sewer outfall
2. Install backflow preventor on existing storm sewer to prevent stormwater from back flowing from the swale into cul-de-sac
3. Improve stormwater conveyance by installing an additional storm sewer outfall and storm inlets

Estimated Cost and Time to Implement

This estimated cost to resolve the flooding in the Southridge Subdivision is $104,300. Appendix 1 includes a detailed cost estimate. It should take eight months to complete the project assuming five months for design and three months for construction.

5.8 ADDRESS FLOODING ON GRASSY BRANCH ROAD

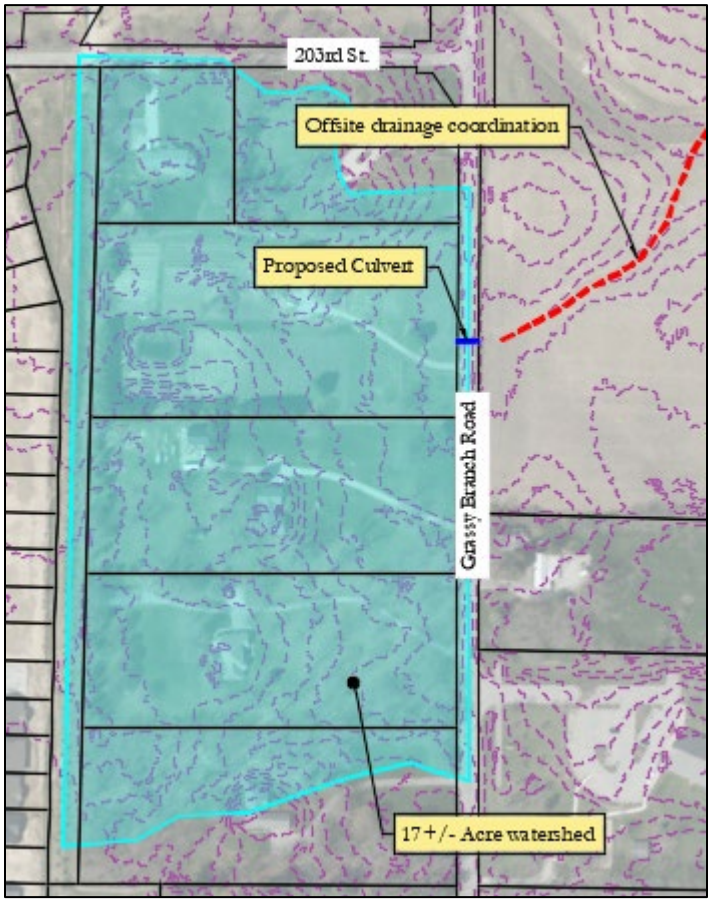

Figure 17: Grassy Branch Improvements

Description of the Situation:

Grassy Branch Road lacks a proper drainage structure to convey stormwater runoff from the west side of the road to the east side near the Northpointe Development. There is a 17+/- acre watershed that drains from the west to east to a low point approximately 500 feet south of 203rd Street along Grassy Branch Road. The stormwater enters an existing field tile but it's unclear where the outlet is. The existing tile is undersized which results in ponding water across Grassy Branch Road at the above-mentioned low point.

Description of the Proposed Solution:

Approximately a 36-inch culvert will be needed under Grassy Branch Road to ensure the 1% AEP storm event is conveyed without overtopping of the roadway as per the Hamilton County Stormwater Technical Manual. The extends of the proposed project are shown in **Figure 17.** Additionally, coordination with the Northpointe Development will be needed to ensure the stormwater can be by-passed through or around their storm sewer system.

General Approach and Assumptions for Analysis:
Burke determined watershed characteristics based on available information from Hamilton County GIS and information provided by the city. Based on the model results, after the proposed improvements, Grassy Branch Road should not overtop during the 1% AEP flood event.

Recommendation for Implementation:

1. Coordination with Northpointe Development to prepare a plan for by-passing the offsite watershed through their site.
2. Install downstream stormwater conveyance system.
3. Install culver at low point of Grassy Branch Road.

Estimated Cost and Time to Implement
This estimated cost to resolve the flooding along Grassy Branch is $111,500. Appendix 1 includes a detailed cost estimate. It should take nine months to complete the project assuming six months for design and three months for construction.

5.9 ADDRESS DRAINAGE PROBLEMS IN THE CENTENNIAL SUBDIVISION

Description of the Situation:
Centennial Subdivision was developed between 1998 and 2013. Typical with aging infrastructure, the existing subsurface drainage (SSD) system is failing throughout the subdivision. The SSD acts as the primarily outlet for homeowner's sump pumps which has resulted in backups in the basements due to not having an adequate discharge location.

Description of the Proposed Solution:
The city has been working on replacing the subsurface drainage system and associated sump pump lines that have failed. Approximately 42% of the subdivision has been corrected. About 10% is planned for the completion in 2022, leaving approximately 48% to still be fixed (**Figure 18**).

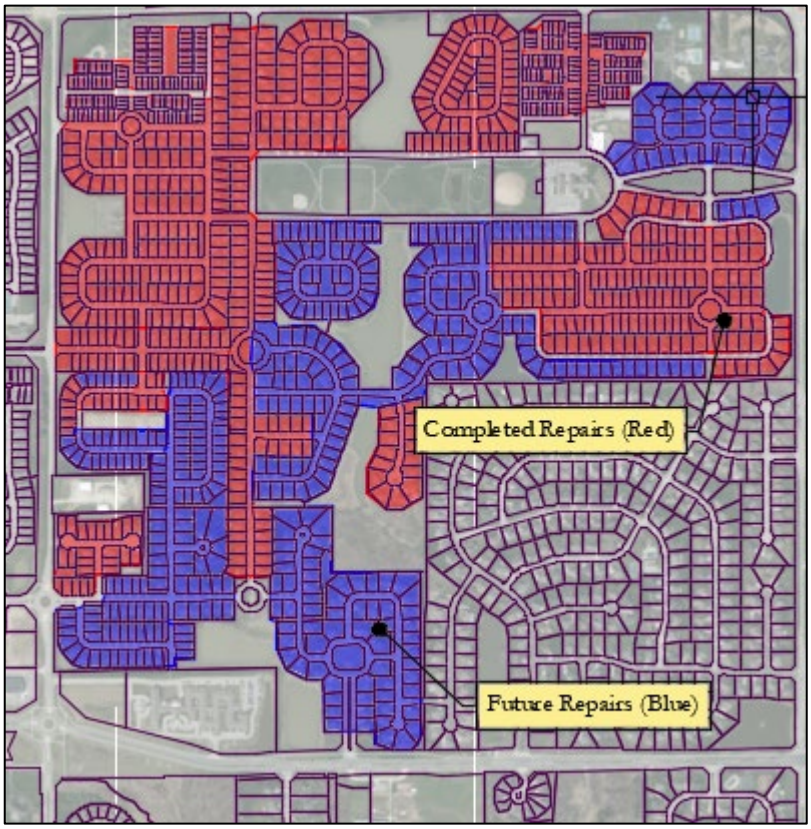

Figure 18: Centennial Subdivision

General Approach and Assumptions for Analysis:
The city provided a breakdown of the completed projects within the subdivision as well as areas of future work. Burke took previous construction costs and applied a per home cost for the remaining work.

Recommendation for Implementation:

1. Continue to break the construction in manageable phases for cost and construction disturbances.

Estimated Cost and Time to Implement
This estimated cost to resolve the drainage problems in the Centennial Subdivision is $2,450,000. **Appendix 1** includes a detailed cost estimate. This is a major project for the city and may take as long as ten years to complete.

5.10 ADDRESS FLOODING ON UNION STREET AND PENN STREET

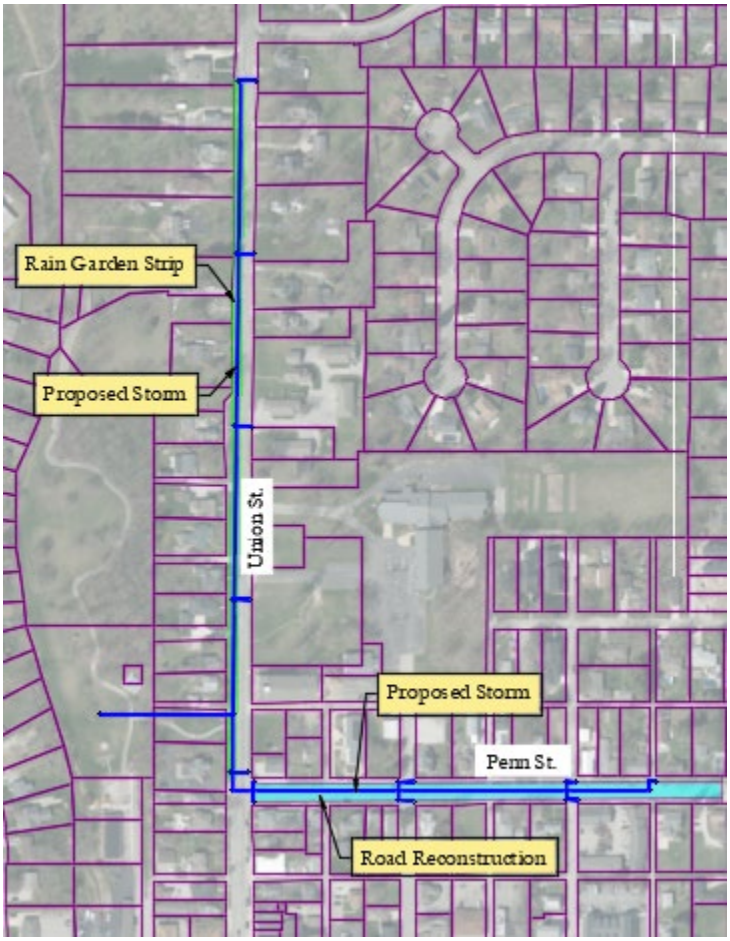

Figure 19: Union and Penn Improvements

Description of the Situation:
Union Street is a main north-south collector street for the city, and it lacks an adequate storm sewer system to allow for future development north of State Road 32. The street generally slopes north to south with minimal storm sewer infrastructure. A major concern for future development is the lack of discharge points for future homes sump pumps.

Penn Street has an aging storm sewer system with unknown routes/discharge locations as well as several areas lacking a proper drainage inlet which results in ponding water in the streets. The street is approximately 40 feet with a chairback and varying sidewalks widths with several driveway connections.

Description of the Proposed Solution:
A new storm sewer main will be installed along the west side of Union Street along with drainage inlets to collect and convey stormwater runoff.

Penn Street will be reconstructed to include a new streetscape (roadway,

Figure 20: Existing raingardens on South Union Street

curbs, sidewalks, and drainage system). The drainage system will connect into Union Street. The extends of the proposed project are shown in **Figure 19.** Drainage along Union Street, south of Penn Street and East Street will be collected by a new system being installed as part of the State Route 32 project. A series of rain gardens, like those further south on Union Street, will be added along this corridor to increase water quality within the watershed (**Figure 20**).

General Approach and Assumptions for Analysis:

Burke determined watershed characteristics based on available information from Hamilton County GIS and information provided by the city to establish the proposed storm sewer limits. The proposed system will need to be designed to drain the 10% AEP flood event. A full drainage analysis of the proposed culvert under State Route 32 will need to be analyzed to verify there is adequate capacity to accept the additional runoff from Penn Street.

Recommendation for Implementation:

1. Coordination with the city streets department to determine if additional improvements can be made to Union Street while the new storm sewer is being installed
2. Coordination with Hamilton County Surveyor's Office to create the new outfall into Anna Kendall Drain.
3. Reconstruct Penn Street

Estimated Cost and Time to Implement

This estimated cost to resolve the flooding along Union Street and Penn Street is $2,642,900. Appendix 1 includes a detailed cost estimate. This is a project could be completed in two years assuming 12 months for design and 12 months for construction.

5.11 COMPLETE DETAILED STUDIES TO UNDERSTAND ROAD FLOODING

The city has recognized that watersheds are expected to experience continued development pressure in the future and that the existing stormwater drainage system may not be adequate to service the expected development. The city has identified two areas that would benefit from a more detailed study into the existing and future conditions. These areas are as follows:

1. 156th Street and Westfield Boulevard flooding
2. Eagletown Road flooding

A type of study will determine existing and anticipated future peak discharges within the watershed, identify existing conveyance system limitations, and to develop conceptual stormwater management improvements, which may include conceptual ditch reconstruction, additional storm sewer systems, culvert replacements and opportunities for green infrastructure. Each report is estimated at $50,000 and three months to complete.

5.12 PERFORMANCE SCORES FOR RECOMMENDED SOLUTIONS

Each of the recommended solutions discussed above were scored using the performance criteria and evaluation metrics discussed in Chapter 2 of this SWMP. **Table 9** summarizes the scores for the economic, social and environmental criteria. **Appendix 2** includes the breakdown of the scores.

Table 9: Summary of performance scores for recommended solutions

Recommended Solution	Economic Criteria Score (5)	Social Criteria Score (5)	Environmental Criteria Score (5)	Total Score (15)
Improve long-term BMP maintenance procedures	4	2	4	**10**
Implement *E. coli* BMPs to meet TMDL requirements	4	3	4	**11**
Explore alternative ditch maintenance practices	3	4	3	**10**
Promote flood resilience, low impact development, and green infrastructure	5	3	4	**12**
Implement updates to MS4GP and CSGP programs	3	2	4	**9**
Address flooding on Tomlinson Road	4	4	1	**9**
Address ponding in Southridge Subdivision	3	4	0	**7**
Address flooding on Grassy Branch Road	4	4	0	**8**
Address drainage problems in Centennial Subdivision	2	5	0	**7**
Address flooding on Union Street and Penn Street	2	5	2	**9**
Prepare detailed studies to understand road flooding	4	2	0	**6**

CHAPTER 6: SUMMARY AND IMPLEMENTATION PLAN

The success of this SWMP will be in its implementation. This chapter provides a list of actions to be followed to implement the recommended solutions. Some solutions may involve several preparatory or intermediary steps. However, for simplicity, not all preparatory or intermediary steps are included. **Table 10** lists the recommended solution in order of the resulting performance score, short-term implementation tasks with estimated time and cost, and long-term implementation tasks.

Table 10: Summary of recommended solutions, implementation tasks, timeline and estimated costs

No.	Recommended Solution	Score[1] *(15)*	Short-term Implementation Tasks[2]	Est. Time to Implement	Est. Cost to Implement	Long-term Implementation Tasks
1	Promote Flood Resilience, Low Impact Development, and Green Infrastructure	12	1. Conduct Community Resilience Checklist and/or Smart Growth Audit and Code & Ordinance Worksheet 2. Establish and adopt flood resilience planning areas and overlay zones 3. Adopt score-based code requirements like Green Factor to promote green infrastructure 4. Revise UDO language to remove barriers to green infrastructure and strengthen urban forestry practices	1 year	$50,000	1. Cross check plans and ordinance with updates to ensure consistency
2	Implement *E. Coli* BMPs to meet TMDL Requirements	11	1. Develop educational messaging 2. Encourage participation in White River Alliance Clear Choices Clean Water program challenge 3. Partner with Parks to install and maintain pet waste stations 4. Partner with SWCD to promote manure management programs for hobby farms 5. Partner with Health Department to collect water quality samples during the recreation season	1 year	$13,000 annually *MS4 Education and Outreach MCM 1 and 2*	1. Track efforts in MS4 Annual Report and adjust program as needed to meet TMDL requirements of MS4GP 2. Assist with distribution of education materials and outreach efforts
3	Improve Long-term BMP Maintenance Procedures	10	1. Update the Technical Standards to clarify inspection, maintenance, and record keeping requirements 2. Prepare O&M guidance with checklists for preventative and routine maintenance schedules 3. Map BMPs in GIS and compare with recorded plat and O&M Agreement 4. Establish and implement a BMP location and maintenance tracking system linked to GIS 5. Prepare and distribute guidance materials BMP owners 6. Conduct annual educational seminar for BMP owners	1 year to establish, annual implementation	$30,000 to establish, $60,000 annually *MS4 Post-construction MCM5*	1. Regular updates to tracking map and attributes based on development and inspection reports submitted December 30th annually 2. Printing reports and reminders to send to BMP owners to submit annual inspection report 3. Annual educational seminar for BMP owners
4	Explore Alternative Ditch Maintenance Practices	10	1. Establish regulated drain layer in GIS and attribute with maintenance/reconstruction schedule; update annually based on Surveyor's published report 2. Meet with the Surveyor to discuss maintenance practices of regulated drains listed for maintenance or drain reconstruction; for drains scheduled for reconstruction, petition Surveyor to consider 2-stage or self-forming ditch design 3. Partner with SWCD to develop/distribute a brochure/post card (as example) to landowners along regulated drains on how to be a good neighbor, publish additional information on city webpage 4. Adopt FEH layer and regulations developed by the state and support the county adoption as well 5. For non-regulated waterways, partner with SWCD to establish conservation easements in FEH overlay zone and/or work with landowners to plant native trees and grasses	1 year to establish, annual updates and outreach	$15,000 to establish $2,500 annually	1. Annual updates to GIS layer and attributes based on Surveyor's report identifying drains scheduled for maintenance or reconstruction 2. Annual distribution of educational materials to landowners along regulated drains and update of information on city webpage (if needed)
5	Address Flooding on Union Street and Penn Street	9	1. Coordination with Community Development and Street Department to capture any additional improvements opportunities 2. Implementation should be in conjunction with green infrastructure 3. Complete design and construction documents 4. Construct project	2 years to design and construct, long-term O&M	$2,642,900	1. Routine and post rain event inspection and maintenance of green infrastructure
6	Address Flooding on Tomlinson Road	9	1. Complete design and construction documents 2. Construct project	6 months	$67,000	1. Routine inspection and maintenance of swale and culvert
7	Implement Updates to MS4GP and CSGP Programs	9	1. Prepare and submit NOI, WQCR and SWQMP, update O&TS 2. Conduct dry weather screening for IDDE 3. Complete quarterly inspections of municipal operations 4. Conduct annual staff training/maintain certifications	1 year to update documents, annual reporting/ implementation	$20,000 update ordinances $75,000 annual program support and IDDE implementation	1. Track program implementation via MS4 Annual Report 2. Conduct annual dry weather screening IDDE 3. Complete quarterly inspections municipal operations 4. Conduct annual staff training/recertifications
8	Address Flooding on Grassy Branch Road	8	1. Coordination with Northpointe Development to establish an offsite drainage system to the regulated drain. 2. Complete design and construction documents 3. Construct project	9 months to design and construct	$111,500	1. Routine inspection and maintenance of culvert
9	Address Ponding in Southridge Subdivision	7	1. Acquire easement to construction new storm sewer outfall 2. Complete design and construction documents 3. Construct project	8 months to design and construct	$104,300	1. Routine inspection and maintenance of backflow device, outlet and inlets

10	Address Drainage Problems in Centennial Subdivision	7	1. Phase construction as money is available in the budget 2. Construct project	10 years as funds are available	$2,450,000	1. Routine system maintenance
11	Complete Detailed Studies to Understand Road Flooding	6	1. Complete analysis and cost estimate 2. Prepare report summarizing findings	3 months each	$50,000 each	1. Evaluate findings and secure funding for implementation
				EST. TOTALS	$5,738,700 total costs $150,500 annual after	

[1] *result of performance criteria and evaluation metrics from Chapter 5*

[2] *more details provided under Recommendations for Implementation for each solution in Chapter 5*

ACRONYMS

AEP – Annual Exceedance Probability

BMP – Best Management Practice

Burke – Christopher B. Burke Engineering, LLC

CSGP – Construction Stormwater General Permit

CWA – Clean Water Act

EPA – US Environmental Protection Agency

FEH – Fluvial Erosion Hazard

FIRM – Flood Insurance Rate Map

GIS – Geographic Information Systems

IN CCIA – Indiana Climate Change Impact Assessment

IDEM – Indiana Department of Environmental Management

IDNR – Indiana Department of Natural Resources

LID – Low Impact Development

LTAP – Local Technical Assistance Program

MHMP – Multi-Hazard Mitigation Plan

MCM – Minimum Control Measure

MS4 – Municipal Separate Storm Sewer System

MS4GP - Municipal Separate Storm Sewer System General Permit

NLCD – National Land Cover Database

NOI – Notice of Intent

NPDES – National Pollution Discharge Elimination System

O&M – Operation and Maintenance

O&TS – Ordinance and Technical Standards

SSD – Subsurface Drainage

SWCD – Soil and Water Conservation District

SWMP – Stormwater Master Plan

SWQMP – Stormwater Quality Management Plan

TBL – Triple Bottom Line

TMDL – Total Maximum Daily Load

UDO – Unified Development Ordinance

WQCR – Water Quality Characterization Report

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APPENDIX 1: Conceptual Cost Estimates for Recommended Solutions

Improvement: Centennial Subdivision Drainage

Cost Estimate

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)	Conversion/ Percent
1	Cost per home (based on feedback from previous projects)	3,300	EA	$ 530	$ 1,749,000	
2						
4					$ 1,749,000	
5						
6	**Miscellaneous**					
7	Contingency (20%)	1	LS	$ 350,000	$ 350,000	20.0%
8	Construction Surveying (3%)	1	LS	$ 53,000	$ 53,000	3.0%
9	Construction Mobilization/Demobilization (5%)	1	LS	$ 88,000	$ 88,000	5.0%
10	Maintenance of Traffic (10%)	1	LS	$ 175,000	$ 175,000	10.0%
11	Bonding and Insurance (2%)	1	LS	$ 35,000	$ 35,000	2.0%
12			Estimated Miscellaneous Cost		$ 701,000	
13						
14		**Estimated Total Construction Cost**			**$ 2,450,000**	
15						

16 **Notes and Assumptions**

All costs are estimates based on the engineer's knowledge of common construction methods and materials. Christopher B. Burke Engineering does not guarantee that the actual bid price will not vary from the costs used with this estimate.
All costs are in 2022 dollars.
Estimated costs have been rounded.
This estimate does not include unforeseen costs increases that may result from shortages in fuel and materials as a result of a natural or man-made disaster.
This estimate does not include easement, right-of-way, or land acquisition costs.

Improvement: Tomlinson Road Flooding

Cost Estimate

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)	Conversion/ Percent
1	Demolition, Pavement/Curb	1	LS	$ 7,500	$ 7,500	
2	27" Culvert Pipe	50	LF	$ 150	$ 7,500	
3	Drainage Swale	600	LF	$ 35	$ 21,000	
4	Site Restoration	1	LS	$ 7,500	$ 7,500	
5	Erosion and Sediment Control	1	LS	$ 7,500	$ 7,500	
6						
7						
8					$ 51,000	
9						
10	**Miscellaneous**					
11	Contingency (10%)	1	LS	$ 6,000	$ 6,000	10.0%
12	Construction Surveying (3%)	1	LS	$ 2,000	$ 2,000	3.0%
13	Construction Mobilization/Demobilization (5%)	1	LS	$ 3,000	$ 3,000	5.0%
14	Maintenance of Traffic (5%)	1	LS	$ 3,000	$ 3,000	5.0%
15	Bonding and Insurance (2%)	1	LS	$ 2,000	$ 2,000	2.0%
16			Estimated Miscellaneous Cost		$ 16,000	
17						
18		**Estimated Total Construction Cost**			**$ 67,000**	
19						

Notes and Assumptions

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Estimated costs have been rounded.

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This estimate does not include easement, right-of-way, or land acquisition costs.

Improvement: Southridge Subdivision Ponding
Cost Estimate

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)	Conversion/ Percent
1	Demolition, Pavement/Curb	1	LS	$ 7,500	$ 7,500	
2	48" Dia Manhole	3	EA	$ 4,500	$ 13,500	
3	Storm Pipe, RCP	225	LF	$ 150	$ 33,800	
4	Core Drill Existing Structure	1	EA	$ 2,500	$ 2,500	
5	Site Restoration	1	LS	$ 7,500	$ 7,500	
6	In-Line Duckbill	1	EA	$ 5,000	$ 5,000	
7	Erosion and Sediment Control	1	LS	$ 7,500	$ 7,500	
8	Water lowering	20	LF	$ 150	$ 3,000	
13						
14					$ 80,300	
15						
16	**Miscellaneous**					
17	Contingency (10%)	1	LS	$ 9,000	$ 9,000	10.0%
18	Construction Surveying (3%)	1	LS	$ 3,000	$ 3,000	3.0%
19	Construction Mobilization/Demobilization (5%)	1	LS	$ 5,000	$ 5,000	5.0%
20	Maintenance of Traffic (5%)	1	LS	$ 5,000	$ 5,000	5.0%
21	Bonding and Insurance (2%)	1	LS	$ 2,000	$ 2,000	2.0%
22			Estimated Miscellaneous Cost		$ 24,000	
22						
23		**Estimated Total Construction Cost**			**$ 104,300**	
24						

Notes and Assumptions

All costs are estimates based on the engineer's knowledge of common construction methods and materials. Christopher B. Burke Engineering does not guarantee that the actual bid price will not vary from the costs used with this estimate.
All costs are in 2022 dollars.
Estimated costs have been rounded.
This estimate does not include unforeseen costs increases that may result from shortages in fuel and materials as a result of a natural or man-made disaster.
This estimate does not include easement, right-of-way, or land acquisition costs.

Improvement: Grassy Branch Flooding

Cost Estimate

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)	Conversion/ Percent
1	Demolition, Pavement	1	LS	$ 7,500	$ 7,500	
2	36" Culvert Pipe	50	LF	$ 200	$ 10,000	
3	Misc. Grading	1	LS	$ 5,000	$ 5,000	
4	Site Restoration	1	LS	$ 7,500	$ 7,500	
5	Erosion and Sediment Control	1	LS	$ 7,500	$ 7,500	
6	Offsite drainage routing	1	LS	$ 50,000	$ 50,000	
7						
8					$ 87,500	
9						
10	**Miscellaneous**					
11	Contingency (10%)	1	LS	$ 9,000	$ 9,000	10.0%
12	Construction Surveying (3%)	1	LS	$ 3,000	$ 3,000	3.0%
13	Construction Mobilization/Demobilization (5%)	1	LS	$ 5,000	$ 5,000	5.0%
14	Maintenance of Traffic (5%)	1	LS	$ 5,000	$ 5,000	5.0%
15	Bonding and Insurance (2%)	1	LS	$ 2,000	$ 2,000	2.0%
16			Estimated Miscellaneous Cost		$ 24,000	
17						
18		**Estimated Total Construction Cost**			**$ 111,500**	
19						

Notes and Assumptions

All costs are estimates based on the engineer's knowledge of common construction methods and materials. Christopher B. Burke Engineering does not guarantee that the actual bid price will not vary from the costs used with this estimate.

All costs are in 2022 dollars.

Estimated costs have been rounded.

This estimate does not include unforeseen costs increases that may result from shortages in fuel and materials as a result of a natural or man-made disaster.

This estimate does not include easement, right-of-way, or land acquisition costs.

Improvement: Union Street and Penn Street Flooding

Cost Estimate

Line	Description	Estimated Quantities	Units	Unit Price	Estimated Cost (Rounded)	Conversion/ Percent
1	Demolition, Pavement	9,361	LS	$ 20	$ 187,300	
2	Demolition,Curb	2,130	LF	$ 15	$ 32,000	
3	Demolition, Sidewalk	1,183	SYS	$ 30	$ 35,500	
4	Storm Structure	35	EA	$ 4,500	$ 157,500	
5	>21" Storm Pipe, RCP	2,996	LF	$ 175	$ 524,300	
6	<21" Storm Pipe, RCP	480	LF	$ 150	$ 72,000	
7	Curb	2,130	LF	$ 50	$ 106,500	
8	HMA Surface	386	TONS	$ 150	$ 58,000	
9	HMA Intermediate	902	TONS	$ 120	$ 108,200	
10	Base	4,683	SYS	$ 50	$ 234,200	
11	HMA Patching	342	TONS	$ 160	$ 54,800	
12	Concrete Sidewalk	1,183	SYS	$ 85	$ 100,600	
13	Site Restoration	1	LS	$ 35,000	$ 35,000	
14	Erosion and Sediment Control	1	LS	$ 20,000	$ 20,000	
15	Rain Garden	4,000	SF	$ 40	$ 160,000	
16					$ 1,885,900	
17						
16	**Miscellaneous**					
17	Contingency (20%)	1	LS	$ 378,000	$ 378,000	20.0%
18	Construction Surveying (3%)	1	LS	$ 57,000	$ 57,000	3.0%
19	Construction Mobilization/Demobilization (5%)	1	LS	$ 95,000	$ 95,000	5.0%
20	Maintenance of Traffic (10%)	1	LS	$ 189,000	$ 189,000	10.0%
21	Bonding and Insurance (2%)	1	LS	$ 38,000	$ 38,000	2.0%
22				Estimated Miscellaneous Cost	$ 757,000	
23						
21		**Estimated Total Construction Cost**			**$ 2,642,900**	
22						

Notes and Assumptions

All costs are estimates based on the engineer's knowledge of common construction methods and materials. Christopher B. Burke Engineering does not guarantee that the actual bid price will not vary from the costs used with this estimate.

All costs are in 2022 dollars.

Estimated costs have been rounded.

This estimate does not include unforeseen costs increases that may result from shortages in fuel and materials as a result of a natural or man-made disaster.

This estimate does not include easement, right-of-way, or land acquisition costs.

APPENDIX 2: Performance Criteria Scoring

Westfield SWMP 2022

TRIPLE BOTTOM LINE ASSESSMENT

SOLUTIONS

			ECONOMIC				SOCIAL					ENVIRONMENTAL			
		Cummulative Score (15)	**Capital Cost**	**Lifecycle O&M Cost**	**Shared Funding**	Score (5)	**Widespread Benefit (#properties)**	**Reduce Flooding Drainage Problems**	**Benefit to Public Health & Safety**	**Revitalization QOL Acceptability**	Score (5)	**Treat Pollutants of Concern**	**Improve/ Protect Stream Habitat**	**Restore/ Protect Floodplain Function**	Score (5)
	Weighting Factor=		*0.45*	*0.20*	*0.35*	*1.00*	*0.25*	*0.25*	*0.25*	*0.25*	*1.00*	*0.40*	*0.30*	*0.30*	*1.00*
	0=		*> $10M*	*very high*	*100% PW*		*0*	*none*	*none*	*none*		*no removal*	*no change*	*no change*	
	1=		*>$5M <$10M*	*high*	*75% PW/SWU*		*1-10*	*limited*	*limited*	*limited*		*1%-20%*	*limited*	*limited*	
	2=		*>$1M <$5M*	*mod-high*	*50% SWU*		*11-30*	*limited-mod*	*limited-mod*	*limited-mod*		*21%-40%*	*limited-mod*	*limited-mod*	
	3=		*>$500K <$1M*	*moderate*	*75% SWU/DB*		*31-100*	*moderate*	*moderate*	*moderate*		*41%-60%*	*moderate*	*moderate*	
	4=		*>$100K <$500K*	*low-mod*	*75% DB*		*101-300*	*mod-high*	*mod-high*	*mod-high*		*61%-80%*	*mod-high*	*mod-high*	
	5=		*<$100K*	*low*	*100% other*		*300+*	*high*	*high*	*high*		*>80%*	*high*	*high*	
1	Alternative Ditch Maintenance Practices	**10**	2	4	5	3	4	3	3	4	4	4	3	3	3
2	Flood Resilience, Low Impact Development, Green Infrastructure Strategies/Policies	**12**	5	5	5	5	4	2	2	3	3	3	4	4	4
3	BMP Maintenance Procedures	**10**	5	3	2	4	4	1	1	3	2	5	5	2	4
4	E.coli BMPs (TMDL and MS4GP)	**11**	5	3	2	4	5	0	3	3	3	5	5	1	4
5	MS4GP and CSGP Program Updates and Implementation	**9**	4	3	1	3	5	0	1	1	2	5	5	1	4
6	Tomlinson Road Flooding	**9**	5	4	2	4	1	5	5	4	4	1	1	1	1
7	Southridge Subdivision Ponding	**7**	4	3	2	3	1	5	5	5	4	0	0	0	0
8	Grassy Branch Flooding	**8**	4	4	3	4	1	5	5	4	4	0	0	0	0
9	Centennial Subdivision Drainage	**7**	2	3	2	2	5	5	4	5	5	0	0	0	0
10	Union Street and Penn Street Flooding	**9**	2	3	2	2	3	5	5	5	5	3	1	0	2
11	Preliminary Engineering Reports	**6**	5	5	1	4	3	2	2	2	2	0	0	0	0
		0				0					0				0
		0				0					0				0
		0				0					0				0
		0				0					0				0

Westfield SWMP 2022

TRIPLE BOTTOM LINE ASSESSMENT DEFINITIONS

ECONOMIC METRIC

NAME	DEFINITION
Capital Cost	Estimated/planning level costs
Lifecycle O&M Cost	Magnitude of cost for operation and maintenance based on typical lifecycle
Other Funding Opportunities and/or Shared Resources	Percent of project funding that is expected to be provided by the Public Works (PW), Stormwater Utility (SWU), County Drainage Board (DB), other funding sources including grants, low-interest loans, charitable gift (other)

SOCIAL METRIC

NAME	DEFINITION
Widespread Benefit	Number of properties that will benefit
Reduce Flooding & Drainage Problem	Ability to reduce current or anticipated future flooding and drainage problem
Benefit to Public Health & Safety	Ability to improve public health and safety concerns related to flooding and drainage issues and water quality
Revitalization, Quality of Life, Acceptability	Consistent with City growth and development goals; improves quality of life; generally accepted by the public

ENVIRONMENTAL METRIC

NAME	DEFINITION
Treat Pollutants of Concern	Effectiveness to treat pollutants of concern carried by stormwater runoff.
Improve Stream Habitat	Ability to improve and/or protect riparian and instream habitat
Restore Floodplain Function	Ability to restore and/or protect the natural and beneficial function of the floodplain

APPENDIX 3: Project Sheets

CITY OF Westfield INDIANA

Quick facts on...

Improve long-term BMP maintenance procedures

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

In every development in Westfield, stormwater best management practices (BMPs) are designed, reviewed, and constructed to meet specific volume reduction and water quality control requirements. However, once these are in the ground, there is a concern as to whether these BMPs, especially privately-owned ones, are being inspected regularly and properly maintained to ensure the performance for which they were designed and permitted.

What Can We Do?

An Operation & Maintenance (O&M) Manual and maintenance agreement is currently required for each development however, improvements could be made including preventative and routine maintenance practices and schedules. Develop a user friendly guide for BMP owners (especially for Homeowner Associations) that may not understand what or when maintenance needs to occur. Conduct an annual training at the start of the growing season. Develop a citywide GIS-based tracking system to locate and enforce O&M agreements.

What are the Next Steps?

1. Update O&M requirements and agreement to clarify inspection, maintenance, and record keeping responsibilities
2. Prepare O&M guidance with preventative and routine maintenance schedules
3. Establish a citywide GIS-based tracking system for BMP
4. Prepare and distribute guidance materials to BMP owners and conduct an annual training

BENEFITS OF THIS PROJECT:

- *Improved performance of BMPs*
- *Protect water quality of receiving streams*
- *Better recording and tracking for compliance*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
1 year to establish then annually	$30,000 to establish; $60,000 annually

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Implement E.coli BMPS to meet TMDL requirements

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
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- Address flooding on Grassy Branch Road
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- Address flooding on Union Street and Penn Street

The Situation...

Under the new MS4 General Permit, IDEM may impose additional water quality-based limitations including installation of additional best management practices (BMPs) to comply with waste load allocations in an EPA established or approved Total Maximum Daily Load (TMDL). There are two TMDL studies that impact the City of Westfield: Cicero Creek Watershed and West Fork White River Watershed. The city must implement a program and update its Stormwater Quality Management Plan (SWQMP) to incorporate and implement appropriate BMPs to reduce *E. coli* pollutant loadings. Every year the city must continue to implement the plan and provide documentation in their annual report to IDEM of installation and maintenance of stormwater BMPs that target *E. coli*.

What Can We Do?

The TMDL source assessment lists land use runoff, wildlife and domestic pets and septic systems. To target these sources, the city should increase the number of dog waste stations available at the parks and along walking trails; increasing the riparian buffers along streams; manure management programs for hobby farms; septic system education, outreach and management; and green infrastructure BMPs.

What are the Next Steps?

1. Develop consistent and clear educational messaging that focuses on how to reduce E.coli loadings; encourage participation in the Clear Choices Clean Water program.
2. Partner with the city Parks Department to install and maintain pet waste stations in parks and along trails.
3. Partner with the county Soil and Water Conservation District (SWCD) to promote manure management plans for hobby farmers with livestock.
4. Partner with the county Health Department to continue to collect and analyze water quality samples at least monthly and during the recreational season.

BENEFITS OF THIS PROJECT:

- *Improve water quality and recreational opportunities in waterways*
- *Compliance with MS4 requirements*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
Ongoing	$13,000 annually

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Explore alternative ditch maintenance practices

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

Natural features such as streams and rivers are a valued asset to communities. They improve property values and enhance overall quality of life. Westfield has may waterways flowing through the city however, the majority of these are regulated drains and under the jurisdiction of the County Surveyor. Regulated drains are a critical part of the stormwater infrastructure with the intent to convey runoff as efficiently and quickly as possible and the County Surveyor prefers to keep drains and adjacent easements clear of trees and woody vegetation. The city would like to find a way to balance the benefit of these waterways for water quality, aesthetics, and conveyance of stormwater runoff.

What Can We Do?

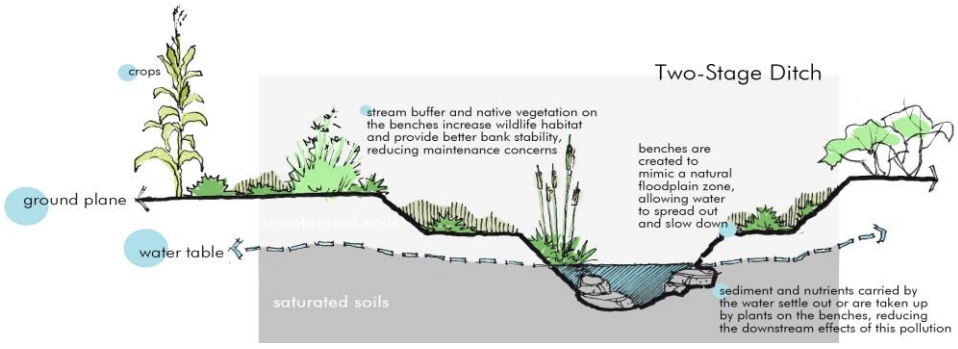
The County Surveyor publishes a list each year of regulated drains for maintenance and reconstruction. The city will work with the Surveyor in an attempt to identify mutually beneficial options for regulated drains in urbanized and future growth/ undeveloped areas. For the non-regulated waterways, the city will identify options for natural looking waterways.

What are the Next Steps?

1. Establish a regulated drain layer in GIS to track the maintenance and reconstruction schedule for regulated drains
2. Discuss maintenance practices of regulated drains with the Surveyor and petition for two-stage ditch design
3. Develop/distribute educational materials to landowners adjacent to regulated drains on how to be good neighbor to waterways
4. Adopt the fluvial erosion hazard (FEH) layer developed by the state as an overlay zone
5. On non-regulated waterways, partner with the SWCD to establish conservation easements and plant native grasses

BENEFITS OF THIS PROJECT:

- *More natural looking waterways*
- *Improved water quality, stormwater conveyance and flood control*



ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
1 year to establish then annually	$15,000 to establish; $2,500 annually

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Promote flood resilience, low impact development and green infrastructure

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

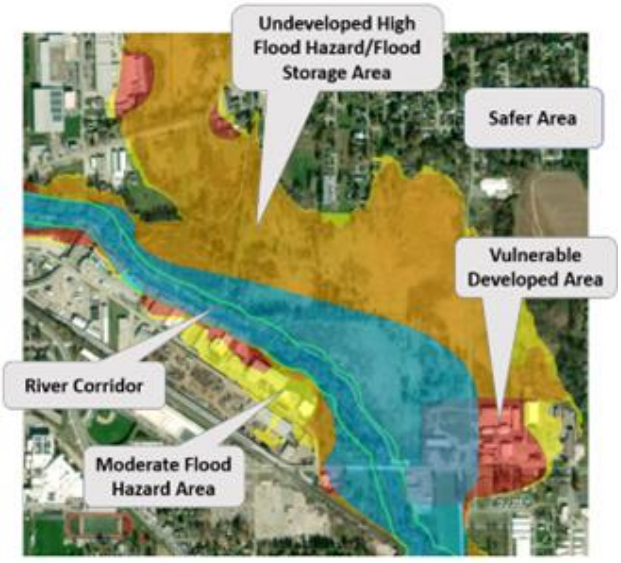
- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

According to the predictions on climate change, rainfall in central Indiana is projected to increase 6-8% by 2050 and 25% of this increase is expected during the winter and spring months which will further stress the stormwater infrastructure of areas already prone to flooding. Historic rainfall data shows that the Midwest has experienced a 42% increase in intensity and frequency of storms. These trends are creating a sense of urgency among communities to look for better ways to manage stormwater and flooding. Land use planning and development codes are powerful tools to build community resiliency and sustainability because they determine where and how development occurs.

What Can We Do?

To achieve flood resiliency and stormwater sustainability, the city needs to coordinate among departments to ensure plans, programs, and policies complement each other and work toward the same goal. This can be done by regularly auditing, updating, and revising plans and policies. Immediately this should include removing barriers and promoting green infrastructure and urban forestry to manage stormwater, improve livability, and enhance quality of life. To reduce flood risk, the city should adopt flood resilience planning areas to direct growth and development to safer areas outside known flood areas.



What are the Next Steps?

1. Complete one or more recommended checklists to determine flood resiliency, stormwater sustainability, and smart growth practices.
2. Establish and adopt flood resilience planning areas and overlay zones
3. Adopt a score-based code requirement to promote green infrastructure in development projects
4. Revise development code to remove barriers to green infrastructure and strengthen urban forestry practices

BENEFITS OF THIS PROJECT:

- *Reduced local and riverine flooding*
- *Increase green space, tree cover and natural areas*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
1 year	$50,000

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Implement updates to MS4GP and CSGP programs

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

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Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
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- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

In December 2021, IDEM issued a new general permit for MS4 communities (MS4GP) to replace Rule 13. This permit includes new requirements for managing stormwater discharges and updated five-year permit cycle. Implementation of the new MS4GP means increased documentation, staff training, inspections, separate storm system maintenance, and overall permit activities for the City of Westfield. In addition to the MS4GP, IDEM issued a Construction Stormwater General Permit (CSGP) to replace Rule 5. The CSGP targets construction activities with land disturbance of one acre or more. Implementation of the new CSGP includes updated training, performance standards for construction sites (natural buffers, slope stabilization, dewatering, waste management and concrete washouts), frequency of site inspection and self-monitoring.

What Can We Do?

To continue to be in compliance, the city should update and implement the program requirements as outlined in the permit. The maximum penalty for non-compliance is $27,500 per day per violation.

What are the Next Steps?

1. Prepare and submit updated permit documents and annual reports
2. Update programs and ordinances including: Public Education/Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff, Post-construction Stormwater Runoff and Municipal Operations Pollution Prevention and Good Housekeeping
3. Conduct dry weather screening for Illicit Discharge Detection and Elimination
4. Complete quarterly inspections of municipal operations
5. Complete required annual staff training to maintain skills and knowledge of the program

BENEFITS OF THIS PROJECT:

- *Improved water quality of receiving streams*
- *Compliance with MS4 program*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
1 year to update then annually	$20,000 to update; 75,000 annually

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Address flooding on Tomlinson Road

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

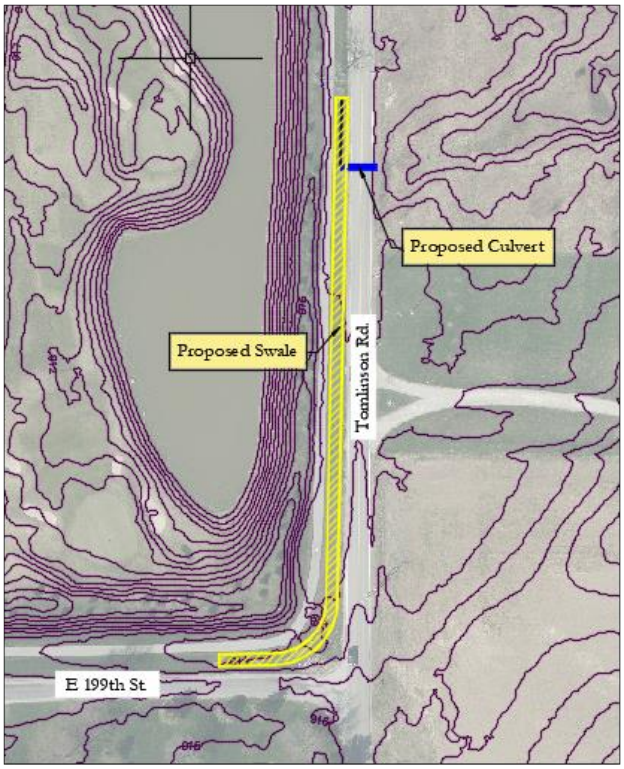
- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

Tomlinson Road, north of 199th Street, lacks a proper drainage structure and drainage swale to convey stormwater runoff from the west side of the road to the east side. Runoff from the south side of 199th Street drains north via an existing 12-inch culvert. The stormwater then drains to the east along a roadside ditch before traveling north but due to a lack of a drainage swale the stormwater will pond along the west side of Tomlinson Road.

What Can We Do?

A two-component solution would be required to eliminate the flooding/overtopping of Tomlinson Road. First a swale will need to be created between the existing multi-use trail and road to convey the stormwater runoff. The swale will need to extend approximately 600 feet from a culvert under 199th Street to the new drainage culvert that will be installed under Tomlinson Road. The new culvert would need to be approximately 27-inches in size to ensure no overtopping of the road during a 100-year storm event. The culvert will discharge to the east into an existing drainage swale.



What are the Next Steps?

1. Improve stormwater conveyance along under Tomlinson Road by installing a culvert
2. Improve conveyance along the west side of Tomlinson Road by installing a drainage swale

BENEFITS OF THIS PROJECT:

- *Improved public safety and mitigate road flooding*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
6 months	$67,000

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Address ponding in the Southridge Subdivision

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

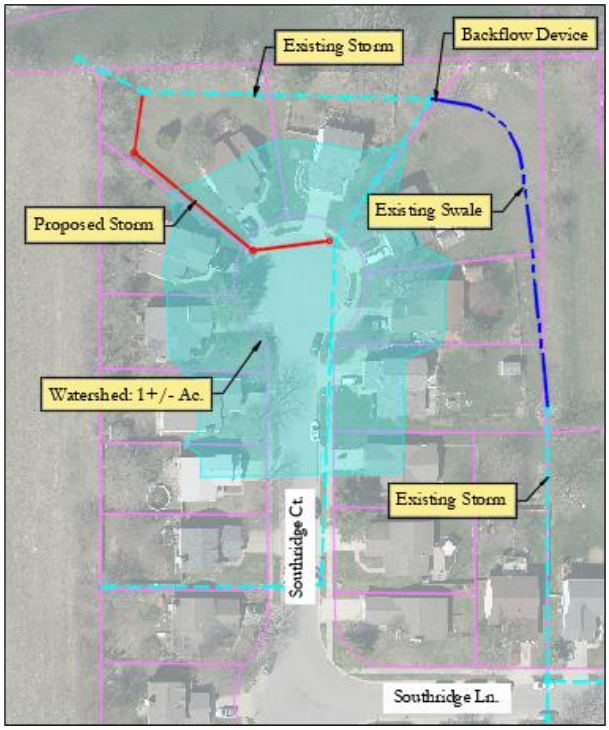
These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

For several years, Southridge subdivision has experienced ponding in their cul-de-sac during intense rain events. The subdivision has a conventional stormwater drainage system with storm inlets/pipes and a drainage swale at the northeast corner. Currently there is only one drainage inlet for an approximately one-acre watershed that drains to the cul-de-sac. During intense rain events, the single drain inlet is not able to collect the entire watershed which results in water ponding. Additionally, the cul-de-sac grade is below the top of bank of the rear yard swale which results in water back flowing into the cul-de-sac resulting in ponding water when the swale is overwhelmed.



What Can We Do?

A two-component solution would be required to eliminate the ponding in the cul-de-sac. First a backflow device (inline duckbill) should be installed on the existing storm sewer to prevent water from backing up into the street from the rear yard swale. Second, an additional storm sewer outlet will be installed to help convey stormwater from the subdivision. Two additional storm sewer inlets will be installed within the cul-de-sac to help with capturing the runoff from the watershed. The storm will connect into an existing 18" storm sewer which is the primarily outfall for the subdivision

What are the Next Steps?

1. Work with homeowners to obtains easements to install new storm sewer outfall
2. Install backflow preventor on existing storm sewer to prevent stormwater from back flowing from the swale into cul-de-sac
3. Improve stormwater conveyance by installing an additional storm sewer outfall and storm inlets

BENEFITS OF THIS PROJECT:

- *Eliminate ponding in the Southridge subdivision*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
8 months	$104,300

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Address flooding on Grassy Branch Road

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

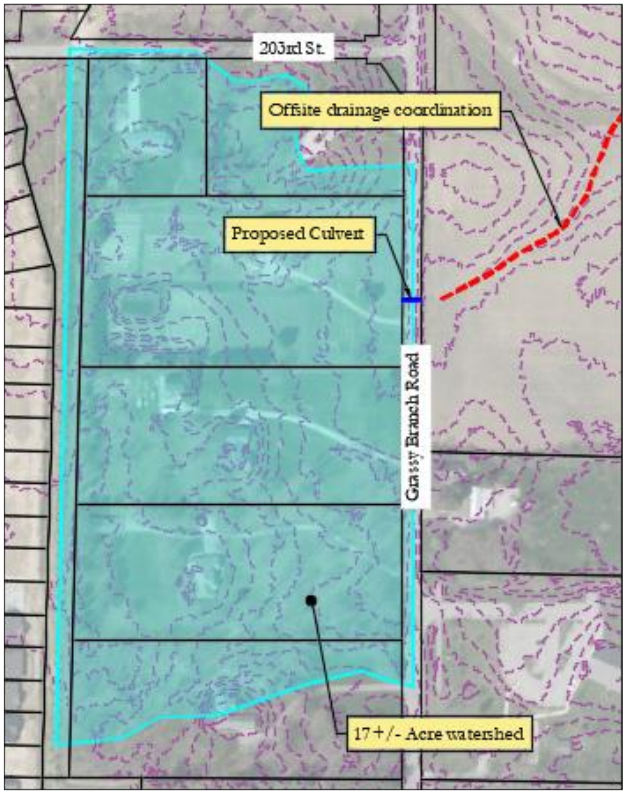
- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

Grassy Branch Road lacks a proper drainage structure to convey stormwater runoff from the west side of the road to the east side near the Northpointe Development. There is approximately a 17-acre watershed that drains from the west to east to a low point approximately 500 feet south of 203rd Street along Grassy Branch Road. The stormwater enters an existing field tile but it's unclear where the outlet is. The existing tile is undersized which results in ponding water across Grassy Branch Road at the above-mentioned low point.

What Can We Do?

Approximately a 36-inch culvert will be needed under Grassy Branch Road to ensure the 1% or 100-year storm event is conveyed without overtopping of the roadway as per the Hamilton County Stormwater Technical Manual. Additionally, coordination with the Northpointe Development will be needed to ensure the stormwater can be by-passed through or around their storm sewer system.



What are the Next Steps?

1. Coordination with Northpointe Development to prepare a plan for by-passing the offsite watershed through their site.
2. Install downstream stormwater conveyance system.
3. Install culver at low point of Grassy Branch Road.

BENEFITS OF THIS PROJECT:

- *Improved public safety and reduced flooding on Grassy Branch Road*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
6 months	$111,500

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Address drainage problems in the Centennial Subdivision

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

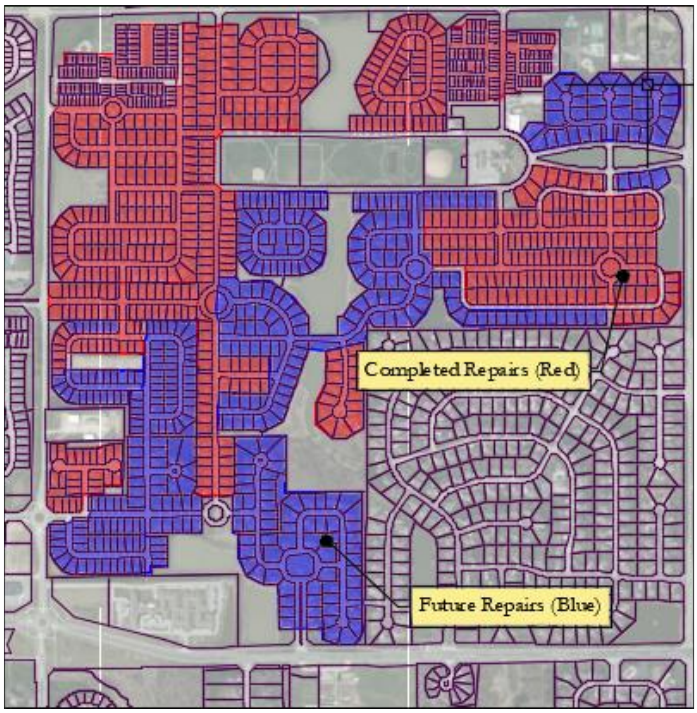
- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
- Promote flood resilience, low impact development and green infrastructure
- Implement updates to MS4GP and CSGP programs
- Address flooding on Tomlinson Road
- Address ponding in the Southridge Subdivision
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

Centennial Subdivision was developed between 1998 and 2013. Typical with aging infrastructure, the existing subsurface drainage system is failing throughout the subdivision. The subsurface drainage system acts as the primarily outlet for homeowner's sump pumps which has resulted in backups in the basements due to not having an adequate discharge location.

What Can We Do?

The city has been working on replacing the subsurface drainage system and associated sump pump lines that have failed. Approximately 42% of the subdivision has been corrected. About 10% is planned for the completion in 2022, leaving approximately 48% to still be fixed



What are the Next Steps?

1. Continue to break the construction in manageable phases for cost and construction disturbances

BENEFITS OF THIS PROJECT:

- *Improved drainage in the Centennial subdivision*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
10 or more years	$2,450,000

CBB BURKE

CITY OF Westfield INDIANA

Quick facts on...

Address flooding on Union Street and Penn Street

This Stormwater Master Plan update provides an overall understanding of the drainage, flooding, and water quality conditions in the city and provides recommended solutions that will:

Solve or reduce existing water quality/quantity problems,

Prevent an increase in water quality/ quantity problems as growth occurs,

Prevent or minimize future damages,

Preserve the natural and beneficial functions of the drainage system, and

Preserve and enhance stormwater quality.

These project sheets summarize the recommended solutions listed in the 2022 Stormwater Master Plan update.

RECOMMENDED SOLUTIONS:

- Improve long-term BMP maintenance procedures
- Implement *E. coli* BMPs to meet TMDL requirements
- Explore alternative ditch maintenance practices
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- Implement updates to MS4GP and CSGP programs
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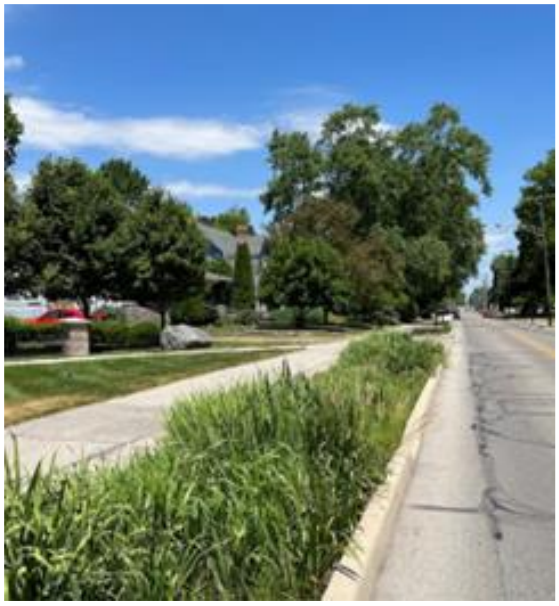
- Address flooding on Grassy Branch Road
- Address drainage problems in the Centennial Subdivision
- Address flooding on Union Street and Penn Street

The Situation...

Union Street is a main north-south collector street for the city, and it lacks an adequate storm sewer system to allow for future development north of State Road 32. The street generally slopes north to south with minimal storm sewer infrastructure. A major concern for future development is the lack of discharge points for future homes sump pumps.



Penn Street has an aging storm sewer system with unknown routes/ discharge locations as well as several areas lacking a proper drainage inlet which results in ponding water in the streets. The street is approximately 40 feet with a chairback and varying sidewalks widths with several driveway connections.

What Can We Do?

A new storm sewer main will be installed along the west side of Union Street along with drainage inlets to collect and convey stormwater runoff. Penn Street will be reconstructed to include a new streetscape (roadway, curbs, sidewalks, and drainage system). The drainage system will connect into Union Street. Drainage along Union Street, south of Penn Street and East Street will be collected by a new system being installed as part of the State Route 32 project. A series of rain gardens, like those further south on Union Street, will be added along this corridor to increase water quality within the watershed.

What are the Next Steps?

1. Coordination with the city streets department to determine if additional improvements can be made to Union Street while the new storm sewer is being installed
2. Coordination with Hamilton County Surveyor's Office to create the new outfall into Anna Kendall Drain.
3. Reconstruct Penn Street

BENEFITS OF THIS PROJECT:

- *Improved drainage along Union and Penn Streets*
- *Increased discharge points for future sump pumps*

ESTIMATED TIME TO COMPLETE:	ESTIMATED COST TO COMPLETE:
2 years	$2,642,900

CBB BURKE