YOUNG'S CREEK BASIN DRAINAGE ANALYSIS AND MASTER BASIN PLAN JULY 17, 2009

PREPARED FOR:
CITY OF FRANKLIN

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Executive Summary

In support of its commitment to alleviate drainage problems and promote the use of Green Infrastructure (GI) to improve sustainability, The City of Franklin commissioned the Young's Creek Basin Drainage Analysis. This study includes an analysis of the costs and benefits of applying Green Infrastructure Best Management Practices (GI BMPs) side by side with traditional stormwater collection methods for reducing stormwater volumes and peak storm flows in conjunction with the City's desire to reduce flooding and improve storm runoff conditions.

This Study can be used as a strategic document for the application and implementation of projects for the purpose of reducing stormwater runoff rates and volumes while improving water quality and open space, serving to make Franklin a more desirable and sustainable place to live.

Study Overview

The Study identifies opportunities to reduce the impact of storm runoff on localized flooding in the Young's Creek Drainage Basin through the use of GI BMPs and targeted system improvements to lessen the volume of runoff entering the system in prioritized drainage basins. It provides a framework for assessing and implementing pilot projects within the drainage basin.

Goals

The primary goal of the Study is to identify inadequate storm infrastructure and propose Capital Improvement Projects to mitigate or eliminate the problem. In addition to identification, a secondary goal of the Study is to investigate potential reduction of proposed storm collection infrastructure and associated cost savings that would result from the integration of GI BMPs.

System Model

GI BMPs will simulate an increase in the storage capacity of the collection system by encouraging groundwater recharge; therefore lessening the load placed on overburdened existing storm pipes. Physical processes such as filtration and, to a lesser extent, flocculation which occur within GI BMPs also provide ancillary stormwater quality benefit not provided with conventional pavement to pipe systems. The potential for groundwater recharge makes evident that there is a configuration and frequency of GI BMPs placement which can return adequate capacity to the existing conventional storm network for any given storm event.

The selection of a reasonable storm event is crucial in the development of an evenhanded cost / benefit analysis. For example, during a 0.1" rainfall, a capital cost could be generated to remove all stormwater from the existing pipe network via GI BMPs. A comparatively prohibitive cost would be necessary to remove all stormwater from the existing pipe network during severe flooding events experienced in 2008. For rational that will be detailed within this Study, a 2 year – 2 hour storm event was selected as the design storm event by which the cost / benefit analysis is based upon. By reducing the volume of stormwater entering the system, existing capacity and flooding issues may be eased, and the extent of future infrastructure improvements may be managed.

Results

This Basin Analysis Plan indicates that GI BMPs will likely provide qualitative advantages including:

- Reduced flooding, drainage problems and corresponding complaints
- Infrastructure upsizing savings
- Higher aesthetic and property values associated with urban green space
- Higher potential levels of localized flooding control
- Enhanced quality of life and economic development benefits
- Enhancement of existing natural features, restored habitat, and improved biodiversity indices

Specifically, application of a combination of selected GI BMP's in conjunction with targeted system improvements, as presented in this Study, can manage approximately 321 acres of impervious surface in the watershed. This removes and / or re-allocates an estimated 322214 cubic feet, or 2.4 million gallons of runoff volume from the system during the modeled 2 year, 2 hour storm event.

Cost

The CIPs as described in this Study intend to solve the flooding and drainage problems at the selected locations at an estimated capital cost of $2.2 million dollars.

Recommendations

Both financial and non-financial study results indicate that GI BMPs have a net benefit. Because GI is a relatively new approach to wet weather management, cost data has a greater level of uncertainty relative to other more conventional approaches. Therefore, local field verification through demonstration projects is often included during GI implementation. Stormwater infrastructure upsizing or re-allocation of drainage capacity has been recommended in certain situations when the benefit of GI ceased to be cost effective.

A recommended list of next steps includes:

Short Term (0 to 1 year)

- Discuss and determine desired level of results
- Refine proposed CIP project costs and ranking to determine final number of projects for construction
- Complete topographic survey and preliminary design documents and make recommendation for the implementation of the Circle Drive / Lynhurst Capacity Re-allocation project
- Based on results of survey and preliminary design, prepare final construction and bid documents for the Circle Drive / Lynhurst Capacity Re-allocation project
- Complete topographic survey and preliminary design documents and make recommendation for the implementation of the West Adams Street Capacity Re-allocation project
- Based on results of survey and preliminary design, prepare final construction and bid documents for the West Adams Street Capacity Re-allocation project
- Design, construct, and monitor CIP projects as recommended by this Basin Analysis Plan in the priority order listed
- Design, construct, and monitor GI BMPs in green space pilot projects where readily available City owned land provides the greatest cost-benefit potential
- Develop Technical Standards and Operation and Maintenance Plans for GI BMPs
- Develop and implement a Residential Rain Barrel and Rain Garden Program
- Update Site Plan review documents to incorporate GI on targeted sites such as Arvin Industries.

Long Term (0 to 5 years)

- Seek Federal and other grant funding for continued GI implementation
- Establish a Citywide database to track, monitor, and report efforts to install GI BMPs
- Develop a Commercial and Industrial Parking Rain Garden Program
- Establish incentives to promote the use of GI for private development projects
- Plan for the maintenance and funding of controls
- Provide Ongoing Ordinance / Policy / Incentive review relevant to Green Infrastructure

1.0 Introduction

The City of Franklin, Indiana is located in east-central Johnson County, west of I-65 approximately 22 miles directly south of Indianapolis. It was founded in 1823, and has increased in population by over 10% since 2000 to a current population of approximately 22,000 residents.

As future growth occurs, the City is committed to the promotion and use of Green Infrastructure (GI) to improve sustainability within the community. In support of that commitment, the City commissioned the Young's Creek Basin Drainage Analysis to develop a plan to evaluate existing and potential drainage and flooding problems in the Young's Creek basin and recommend corrective measures which include both traditional and GI techniques.

Though Franklin has embraced the use of GI Best Management Practices (GI BMPs) for use in stormwater infrastructure projects, the broad and strategic implementation of GI BMPs has not been widely utilized locally within the private or public sector. GI BMPs can provide benefits to existing and proposed stormwater infrastructure projects by reducing overall peak discharge to the system. System-wide reductions may result in scaled down improvement projects and may potentially mitigate the need for future Capital Improvement Projects. Though available to private development and widely used nationally in other communities, the use of Green Infrastructure BMPs has yet to occur in Franklin on a broad and consistent scale.

Increasing the use of GI BMPs within the Franklin service area is an attainable objective which can improve overall stormwater quantity and quality control without the comparatively significant capital investment required for entire storm line replacement. GI strategies can be added on as a line item onto any road resurfacing, sidewalk repair, or traditional infrastructure improvement project as every cubic foot of storage created reduces the need for conventional infrastructure. However, areas such as the downtown urban center pose unique challenges due to the lack of available space for traditional GI BMPs as well as the high cost per square foot of developable land. Ironically, these legacy stormwater systems may well benefit the most from inclusion of GI BMP systems. This is because GI BMPs can provide for volume removal *upstream* of these areas. Additionally, other cities around the country have found considerable synergies created when local communities and neighborhoods embark in GI BMP projects such as Rain Gardens or regional stormwater quality parks. It is through these types of community driven projects that public awareness regarding individual stormwater contribution is fostered and a unique opportunity to educate the public on the stormwater related programs is created.

There are strong economic arguments for the protection and enhancement of urban green space and natural open space and the implementation of Low Impact Development (LID) methodology and GI to achieve these goals. Above and beyond the intrinsic environmental, public health and recreation benefits, urban green space positively affects real estate values, which in turn increases municipal revenues, and as mentioned previously, saves infrastructure development costs. GI can provide benefits to existing and proposed infrastructure through the reduction in peak flows to the system. System-wide decreases may result in scaled down improvement projects and may potentially mitigate the need for future improvements associated with any Long Term Control Plan (LTCP).

2.0 Project Description

2.1 Purpose

This report is prepared for the City of Franklin to assist in part with their development of a GIS based drainage plan for the Young's Creek basin in and around downtown Franklin. The purpose of this report is to evaluate known and potential infrastructure inadequacies in the basin and recommend Capital Improvement Projects (CIP) to mitigate these inadequacies through the application of Green Infrastructure Best Management Practices (GI BMPs) in addition to traditional subsurface pipe upgrades. The potential construction cost impacts, as well as the projected maintenance costs have been included.

2.2 Background

The majority of the area within City limits drains to Young's Creek, which bisects the Southwest corner of the municipality and, downstream from the sewage treatment plant, has a drainage area of 80.3 square miles. Hurricane Creek and Canary Ditch are both tributaries of Young's Creek. Hurricane Creek has a drainage area of 16.4 square miles, and its confluence with Young's Creek is in Providence Park between Home Avenue and South Street. Canary Ditch has a drainage area of 6.3 square miles and its confluence with Young's Creek is farther upstream, at a point just north of Highway 144.

The City's stormwater collection system infrastructure dates back to the early 1900's, and is not adequate to support continued development in the surrounding area. Franklin has experienced ongoing flooding and stormwater management issues related to increased stormwater volumes entering the collection system, along with backups and overflows of Young's Creek. As a participant in the National Flood Insurance Program (NFIP), the City has been provided with a Flood Insurance Study (FIS) which serves as the regulatory authority for hydrologic and hydraulic analysis methodology. The present FIS was last updated August 2, 2007. According to the FIS, "Overflows from Young's Creek, Hurricane Creek, and Canary Ditch cause periodic flooding in low lying areas, especially where culverts under the railroad and highway bridges lack sufficient capacity to handle flood discharges."

The Study area for this report is depicted in ***Figure 2.1***. It is inclusive of downtown Franklin, bounded by Circle Drive / Arvin Drive on the North, U.S. 31 on the West, Champ Ulysses Street on the South, and Forsyth Street to the East. Several tributaries to Young's Creek collect and transport runoff through the downtown area within the study limits. Hurricane Creek and Roaring Run convey substantial runoff through the study area with discharge to Young's Creek. Since all storm lines in the City discharge to one of the aforementioned drains, high water in these drains provides a catalyst for localized flooding during statistically more frequent rain events due to the inability of the existing storm system to drain against high Tail water elevations.

2.3 Goals

The objectives of this analysis are:

- To prepare a GIS based drainage plan representing the City of Franklin's existing storm infrastructure
- To identify actions needed to correct drainage problems and improve stormwater quality in the Young's Creek Basin
- To provide a summary of potential CIP alternatives and offer recommendations for stormwater management based on the technical and financial feasibility of implementing Green Infrastructure (GI) design techniques and Best Management Practices (BMPs) as well as infrastructure upsizing, and capacity re-allocation if necessary
- To develop a prioritized list of conceptual Capital Improvement Project (CIP) plans and potential costs

FIGURE 2-1	PROJECT NUMBER 01.0255.A.1	**Study Area** N W E S 1 inch equals 800 feet	**City of Franklin** **Franklin, IN 46131** **WILLIAMS CREEK CONSULTING** **919 NORTH EAST STREET** **INDIANAPOLIS, INDIANA 46202** **Ph: (317) 423-0690 Fax: (317) 423-0696**

3.0 Discovery and Data Collection

3.1 Existing GIS Database

The City provided an existing GIS computer model which included the overall municipal boundaries, zoning information, property and R.O.W. lines, flood zones, contour information, and GPS locations of storm drain inlets collect by City staff, along with a supporting geo-database containing census, parcel, and land use data.

This base information was incorporated with field data collected by WCC team members, and was compiled to form the overall storm infrastructure database used for development of the hydraulic model and evaluation of appropriate stormwater CIP solutions.

3.2 Site Visits

Members of the WCC team met with the City Engineer and performed a visual inspection of the local streets within the project boundaries. The site reconnaissance resulted in a series of candidate sites for inclusion in the drainage analysis. Proposed sites generally experienced frequent flooding and extended ponding of stormwater during relatively nominal storm events. On June 21st, 22nd, 23rd, and July 8th, the WCC project team conducted field visits to complete pipe data collection and confirm storm sewer routing. At that time, the team conducted a preliminary review of each of the proposed sites, took site photos, interviewed City staff regarding the issues of concern, and identified other potential sites worthy of further review. A summary of the site visit field notes are provided in ***Appendix A***. Additional site information was gathered on a site by site and as needed basis. Site project locations selected for preliminary evaluation are listed and described in detail in Section 4.

3.3 Existing Data Review

A preliminary review of existing data was conducted to determine disparities requiring further collection of information. The record drawings supplied by the City provided historical background information which was evaluated in conjunction with GPS data obtained by City personnel and fieldwork completed by the WCC team. Historical data, plan information and record drawings integrated include:

- FEMA Flood Insurance Study for Johnson County, Effective August 2, 2007
- 1952 Sanitary Sewer Plans including Young's Creek Interceptor and Hurricane Creek Interceptor
- 1976 – 14th Street Storm Sewer
- 1976 & 1978 - Duane Street Storm Sewer
- Masonic Home Storm Sewer
- 2001 – Premier Ag building addition site plan
- 2002 – Arvin Industries Storm Drainage Plan
- 2009 – North Main Street Road Rehabilitation Plans (Preliminary)
- GIS Flood Damage data

Figure 3-1 depicts the GIS database developed for the City's stormwater infrastructure and pertinent information as delineated throughout the report.

Floodplain data is included in the GIS model. GIS floodplain information for Young's Creek is based on Federal Emergency Management Agency (FEMA) information, and places the approximate (A Zone) 100-year flood hazard zone from elevation 727.1 at US 31 to 720.4 at South Street. These elevations are referenced to the North American Vertical Datum of 1988.

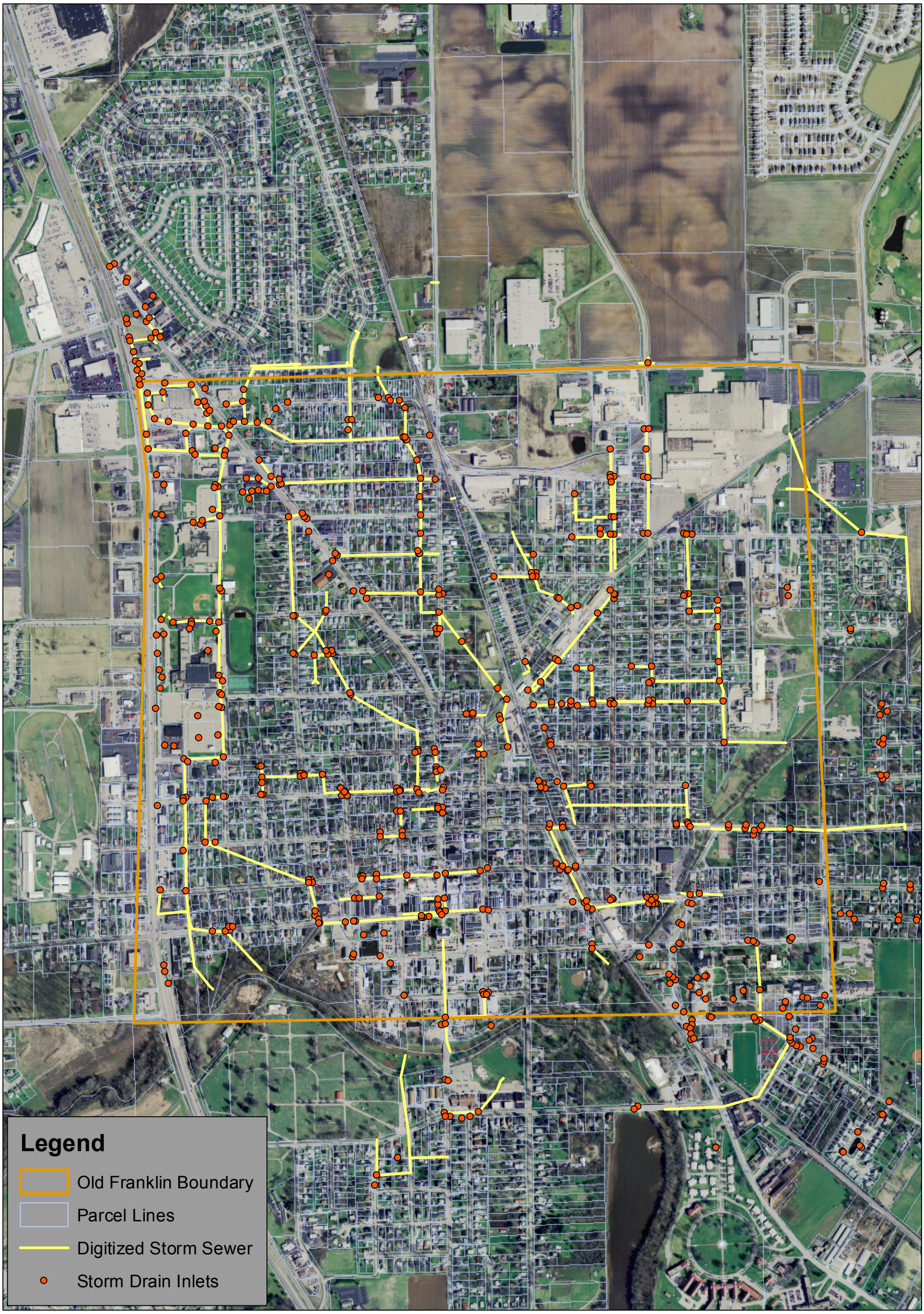

FIGURE 3-1

PROJECT NUMBER
01.0255.A.1

Existing Storm Infrastructure

N
W E
S

1 inch equals 800 feet

City of Franklin
Franklin, IN 46131

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3.4 Storm Line Contributing Drainage Area Determinations

Figure 3-2 illustrates the watershed sub-basins. Contributing drainage areas for the storm infrastructure has been delineated and GIS sub-basins generated by cross-referencing two foot contour data derived from a 1996 aerial survey with WCC's understanding of the developed storm network. This allowed for a measure of which storm lines were most overburdened and which contained residual capacity. In order to more fairly consider the context of the overburden, it is necessary to understand the affect of tailwater elevations where these storm lines discharge. For example, if Young's Creek stages high enough during a particular storm event, then upsizing drainage pipes which discharge to Young's Creek could increase the rate at which the City floods via unanticipated backflow.

3.5 Open Drain Contributing Drainage Area Determinations

In order to model the stormwater discharge points as accurately as possible, contributing drainage areas for Young's Creek and Hurricane Creek were taken from the Flood Insurance Study. The peak 100-year discharge in these drains was available in official hydraulic computer models on file with the Indiana Department of Natural Resources – Division of Water. Due to the scale of these watersheds, they are not shown graphically on Figure 3-2, but do exist within the hydraulic model.

Figure 3-2 illustrates the watershed sub-basins

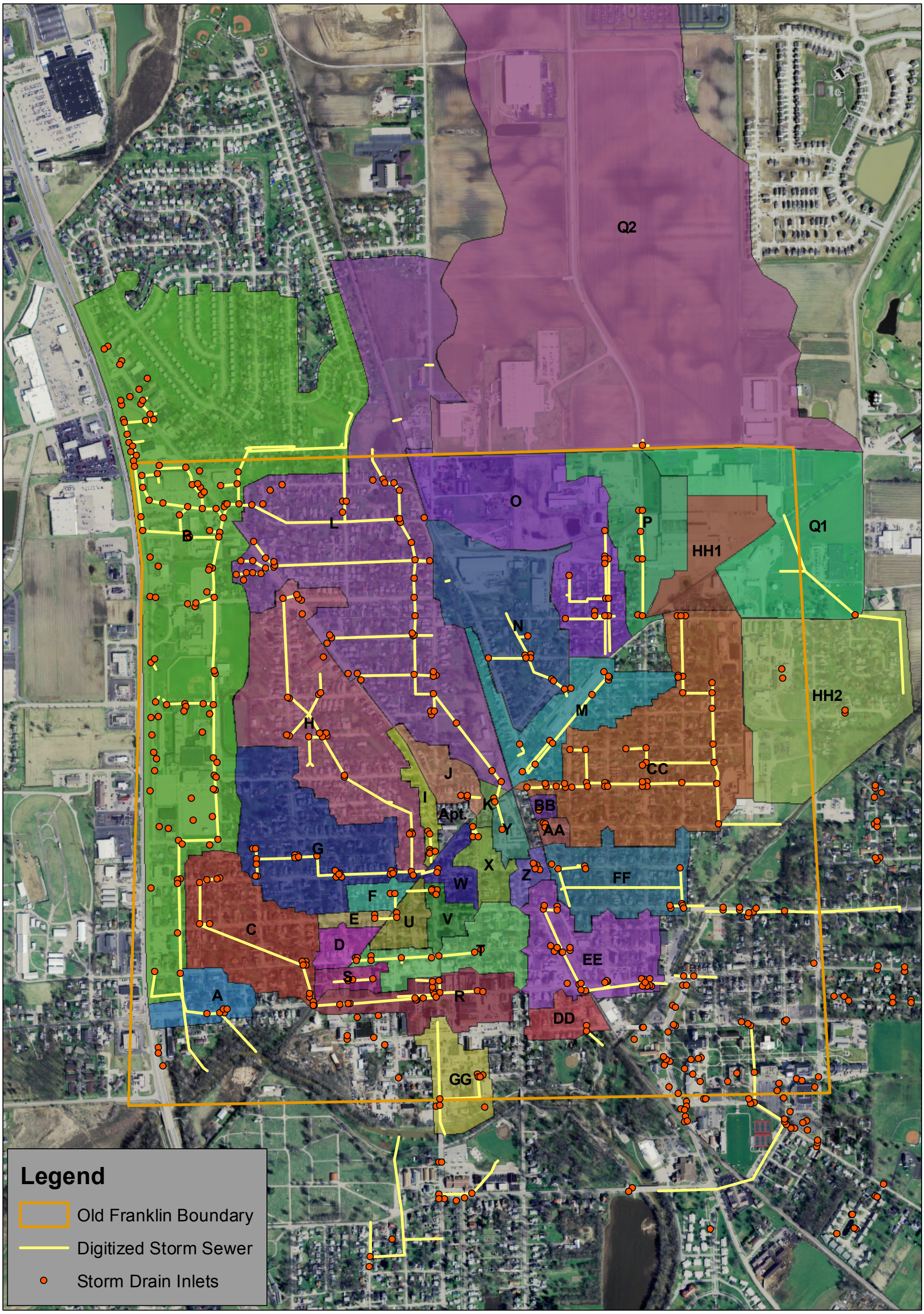

FIGURE 3-2	PROJECT NUMBER 01.0255.A.1	**Sub-Watersheds** N W E S 1 inch equals 800 feet	**City of Franklin** **Franklin, IN 46131** **WILLIAMS CREEK CONSULTING** **919 NORTH EAST STREET** **INDIANAPOLIS, INDIANA 46202** **Ph: (317) 423-0690 Fax: (317) 423-0696**

4.0 Concept Development

4.1 Conceptual BMP Identification and Selection

The Young's Creek Basin Analysis has identified three primary drainage issues. The most alluded to is (1) capacity issues with the historical pipe network. This is largely an eventuality of continual additions to a system which was likely sized appropriately at the time of construction. The second drainage issue relates to (2) minor grading irregularities which encourage localized ponding on the smallest of rain events. The most substantial threat to life and property comes from (3) regional flooding due to Young's Creek and its tributaries. However, the application of GI BMPs and traditional system upsizing cannot address the control of stormwater which originates outside the control of the City. Therefore, the GI & system upgrade identification and selection is geared towards easing causes associated with issues (1) and (2). To model the effects of retrofitting GI BMPs, in conjunction with system upgrades, each of the sites selected for further review required a conceptual identification of appropriate GI BMPs for retrofitting with approximate size and likely locations. Specific GI BMPs and conceptual locations were selected based upon the nature of the drainage issue, space available for GI conversion, the developed GIS storm infrastructure and sub-basin information, and previous experience with GI redevelopment in urban areas. These conceptual GI BMP locations were then overlaid on the aerial mapping to provide context and facilitate understanding. The types of GI BMPs are described below. Site specific selected GI BMPs follow in Section 4.2 below. Site reconnaissance within each basin was conducted to verify the general viability of proposed BMP locations. Since Study solutions focused on publically owned right-of-way, the majority of locations were found to be viable. Some BMP locations may have other technical complications such as underground utilities that were beyond the scope of this study to fully evaluate. Actual implementation and design will require more detailed analysis and confirmation of specific locations.

Conceptual GI BMPs or LID technique selection was conducted on a site by site basis. A preliminary list of GI BMPs that were identified for potential use includes:

- Pervious Concrete
- Permeable Pavers
- Grass Pavers
- Rain Garden / Bio-retention
- Stormwater Wetland
- Vegetated Swale
- Bio-swale
- Vegetated Filter Strip
- Infiltration Trench

BMPs were selected with specific intent for each function to fit the soils, topography and existing resources of the proposed application and using best professional judgment given the type of input conveyance (i.e., end of pipe, sheet flow) or pollutant source (i.e., oil and grit, grass clippings).

Each BMP is evaluated based on general criteria. Treatment suitability refers to the capacity of the BMP to control for stormwater quantity and quality. Site applicability addresses general drainage area and space requirements as if it adds aesthetic site amenity. Implementation considerations deal with general capital costs, maintenance costs, and whether a BMP is appropriate for high density urban areas. Water quality performance compares common urban pollutants such as heavy metals, hydrocarbons, nutrients, and thermal pollution, with the primary treatment capacity the BMP is designed to handle. Generally, any properly designed GI BMP which forces infiltration can absorb upwards of 95% of coliform bacterias,

transform most dissolved heavy metals, as well as provide a nutrient sink to discourage downstream algal blooms. A discussion of the BMP types and the rationale for their selection follows.

Green Parking Lots
Green parking lots refer to the practice of converting impervious surface or traditional raised landscape islands to sunken, self-irrigated bioretention islands.

Green Streets
Green streets refer to the practice of converting street surfaces and / or the area between the street and sidewalk to bioretention. Green streets were broken into 3 primary categories:

Bump In	Bioretention between curb and sidewalk. Existing condition assumed to be turf and directly connected to the storm collection system.
Flush Curb	Bioretention where no sidewalk or curb is present. Existing condition assumed to be turf and disconnected from direct connection to the storm collection system.
Bump Out	Bioretention in existing areas of on street parking. In general, bump outs were assumed to be located near intersections where inlets are already present. Bump outs were generally excluded from streets that appear to be primary transportation routes for through traffic.

Rain Garden in a Box
There are several pre-manufactured vegetated biofiltration units available. For the purposes of this study, the filter unit is assumed to be 4 x 10 feet with a capacity of 40 cubic feet below the overflow weir. These units can be placed at most existing inlet locations. Their cost effectiveness is greatest in highly urbanized areas where other forms of storage and infiltration are not technically feasible, and where inlet rehabilitation and tree planters are already programmed for installation.

Green Space
Green space refers to public and private lands where area may be available for stormwater management. Because much of the green space mapped in GIS is privately owned or otherwise unavailable, this study only considered moderate grading exercises in the Temple and Memorial Parks, but also a more aggressive stormwater park on privately owned green space between Johnson and Graham, just north of Cincinnati.

4.2 Project Site Data

The 17 potential CIP's were assigned a site identification number and name. See *Figure 4-1* for a Key Map showing the site locations geographically by number.

Conceptual design plans were developed for each site utilizing the information gathered and described in Section 3. Preliminary selection of appropriate type and size of proposed GI BMPs improvements were identified with specific intent based on previous experience with GI re-development, and the concept BMPs were selected for each site to function in conjunction with the existing ***observed*** resources, topography, soils and limited infrastructure information available from GIS.

The proposed GI BMPs for each site were then sized and evaluated based on several criteria including the watershed primary land use, drainage area, and runoff constituents. Ideally, BMPs would be designed to capture approximately 0.9" of runoff depth from their respective sub-sewershed. This is generally the average runoff depth during the 2 year – 2 hour storm event when dealing with 1.52" of rainfall in Franklin, Indiana, and a nominal antecedent moisture condition. However, the relationship between storm events and GI BMP sizing can be exceedingly complex when assigning cost / benefit. For example, if a particular GI BMP is sized to infiltrate to groundwater all flow from a 10 year storm event, then it is likely under-utilized for years at a time and would skew the cost / benefit. Thus, the cost / benefit ratio is maximized when the GI BMPs are under-designed relative to a chosen storm event. Therefore, the GI BMP proposals have been slightly undersized in order to completely take advantage of infiltration during smaller storm events. The modeling and resultant cost / benefit metrics are difficult to consider in absolute terms because they change when considering different storm events. However, their values do provide an accurate comparison with regard to ranking the proposed CIPs.

Table 4.1 summarizes the data and the BMPs proposed for each project site, and the figures in Appendix B represent scaled illustrations of each concept plan with corresponding photos. The site locations and BMP selection rationale are discussed in detail in this Section. The preliminary cost information is developed in Section 6.

Site 1 – E. Monroe Street from Main Street to Home Avenue

Description: Monroe Street between S. Main Street and Home Avenue carries two-way traffic with parallel parking on the north and a combination of parallel and angled parking on the south. There are no drainage structures along the 800 foot length.

Basis of Selection: The site was selected because of its high visibility, the opportunity to coordinate with the proposed Greenways / Gateways project, the ability to reduce a wide expanse of impervious surface, and the absence of existing storm infrastructure.

Potential Issues: This area has been identified as part of the Urban Streetscape portion of the Gateways / Greenways project and coordination GI BMP's with the study overlay will be necessary.

Site 2 – Jefferson Street from W. Court St. to E. Court St.

Description: Includes the section of Jefferson Street R.O.W. on the south side of the road, directly in front of the courthouse between W. Court and E. Court Street.

Basis of Selection: High visibility and ease of conversion of existing planters to assist with removal of surface runoff. Inlet structures on Jefferson backflow during regular storm events.

Potential Issues: Existing storm utilities are old and not well identified in this area. There is a possible collapsed pipe run which does not allow surface runoff to enter the system. The City does not know where the inlets connect. They have vacuumed the structures down to an elevation of 8' and continue to get sand & find no outlet. Any work on Jefferson (State Road 44) will require INDOT approvals.

Site 3 – Province Street from Duane St. to Hurricane St.

Description: A very flat area without significant storm infrastructure, which experiences frequent ponding and local flooding. The railroad spur closest to the road is abandoned, the other spur is private. Holbrook Manufacturing has a newer paved parking area directly off the street and runoff drains to the street.

Basis of Selection: Selection was based on the frequency of flooding, the absence of existing storm infrastructure, drainage from private property flowing to the R.O.W., and the potential to utilize area along the abandoned rail spur.

Potential Issues: None identified at this time.

Site 4 – Graham Street at Highland Avenue

Description: The roadway does not have curb & gutter and the gravel shoulders / parking area traps the runoff from the yards. Localized flooding is common, and there are many complaints on basement flooding and ponding water on Graham south of Highland.

Basis of Selection: Availability of green space at existing ponding areas within R.O.W. and opportunity to reduce flow into overburdened sewer.

Potential Issues: None identified at this time.

Site 5 – Younce Street at Highland Avenue

Description: The roadway does not have curb & gutter and the gravel shoulders / parking area traps the runoff from the yards. Localized flooding is common.

Basis of Selection: Availability of green space at existing ponding areas within R.O.W. and opportunity to improve drainage through the use of filtration trenches in gravel parking areas.

Potential Issues: Reduction of some area currently used for parking.

Site 6 – Walnut Street from Banta Street to King Street

Description: Wide, well maintained residential street with curb and gutter, but not significant storm infrastructure. The sidewalk is lower than the road in some locations and surface runoff flows on sidewalk. The Walnut Street area experiences some surcharging, and a significant volume of water flows down the street creating safety issues during rainstorms. Water backs up along adjacent side streets and there are localized complaints. The area flows to Roaring Run – any volume reduction will help.

Basis of Selection: Volume reduction to Roaring Run and ease of implementation of Bump In Rain Gardens, proximity of 60" interceptor pipe for potential capacity re-allocation.

Potential Issues: A topographic survey and sewer invert data will need to be collected in order to determine if the capacity re-allocation is feasible.

Site 7 – Home Avenue south of E. Monroe Street

Description: Monroe carries a high volume of water to Home, then to the creek. There is flooding at Caisson Drive at the far south end as water sheet flows to the farm field & Young's Creek. Franklin Planners are interested in providing traffic calming measures on Home.

Basis of Selection: The site was selected because of its high visibility, connectivity between downtown and the existing greenway, the opportunity to coordinate with the proposed Greenways / Gateways project, the ability to reduce impervious surface, and the absence of existing storm infrastructure.

Potential Issues: None identified at this time.

Site 8 – Hurricane Street from Madison Street to Ohio Street

Description: Drains east to Hurricane Creek – significant volume of surface flow creates problems.

Basis of Selection: The width of the roadway allows space within the R.O.W. for GI BMPs applications. It is a flat area with no storm infrastructure.

Potential Issues: None identified at this time.

Site 9 – E. Kentucky Street from Johnson Avenue to Ott Street

Description: This is the flattest area. The street is higher than the homes & there is no real storm system. There is available greenspace to work with in the park on the east end. The building adjacent to the park is Franklin Power Products – it is vacant and could be a good opportunity for a GI pilot project when it has to come back through Planning for site plan approval. Hurricane Creek does flood into the field at the end of Kentucky.

Basis of Selection: Poor condition of roadway shoulders and drainage issues.

Potential Issues: None identified at this time.

Site 10 – Ott Street at Ohio Street

Description: There are localized pockets of drainage issues and house flooding in the area. Pipes are old, 8" vitrified clay.

Basis of Selection: Outdated, undersized infrastructure and ample space for rain gardens and opportunity to improve aesthetics.

Potential Issues: Existing storm pipes are old, 8" vitrified clay.

Site 11 – Young Street from Ohio Street to Oyler Street

Description: Young Street is one way south with a wide pavement section and newer overlay. All of the runoff is surface flow.

Basis of Selection: The width of Young Street allows space within the R.O.W. for GI BMPs applications. It is a flat area with no storm infrastructure.

Potential Issues: None identified at this time.

Site 12 – Memorial Park at Johnson Avenue and Hamilton Avenue

Description: The Park is bisected by an open drainage ditch which overflows and floods the entire area. It outlets via a culvert under Hamilton Avenue and continues via pipe to Roaring Run. The building to the North of the park is for sale and does not appear to have storm detention.

Basis of Selection: The park area provides an excellent opportunity for green space rain garden and storage enhancements and a public education display.

Potential Issues: The ditch outlet is on private property.

Site 13 – Alley North of Jefferson between N. Jackson Street and Walnut Street

Description: The alley and adjacent parking share a somewhat undefined boundary and paving deterioration and overlay issues have resulted in ponding. The water does not flow to the inlet.

Basis of Selection: Opportunity to better define traffic circulation, improve aesthetics, and correct a surface drainage issue.

Potential Issues: Possible work in parking lot may be outside R.O.W.

Site 14 – Circle Drive east of Main Street

Description: Area north of Circle Drive is lower than the road and traps water. Storm pipes in the Circle Drive/Lynhurst area are beyond capacity due to upstream storm collection.

Basis of Selection: Existing open space is available in the R.O.W. to assist with volume reduction on overloaded storm lines. Proximity of 36" interceptor for potential capacity re-allocation.

Potential Issues: Possible coordination with Gateways/Greenways trail proposed along N. Main Street. A topographic survey and sewer invert data will need to be collected in order to determine if the capacity re-allocation is feasible.

Site 15 – Cincinnati Street – Johnson Avenue – Ohio Street

Description: Confusing intersection of 3 streets and a parallel railroad. The area is very flat, and does not drain to the limited storm system.

Basis of Selection: Opportunity to improve surface drainage and traffic circulation safety.

Potential Issues: Existing "cut through" northeast between Cincinnati and Johnson is on private property.

Site 16 – Cincinnati / Martin Place Proposed Storm Water Wetland Nature Park

Description: An under-utilized piece of property adjacent to the railroad track with access on the south on property currently owned by the City. The site slopes from west to east and currently includes two structures.

Basis of Selection: The site was selected based on the potential availability of a large piece of property to construct stormwater storage at a location where existing infrastructure is undersized and residents basements flood, while at the same time creating a community natural resource asset. In addition, there are potential funding sources available for development of this type of project.

Potential Issues: The property is not currently owned by the City. If the City can acquire the property, demolition of existing structures will be necessary in order to implement the plan.

TABLE 4.2 Potential Funding Options for Site 16 Proposed Storm Water Wetland Nature Park			
	Land and Water Conservation Fund (LWCF)	IDEM Pollution Prevention Grant (suspended in 2009, will be active in 2010)	State Revolving Fund (SRF) Loan Program
Types of Projects Funded	Applications may consist of land acquisition and/or outdoor recreation and natural area facility construction.	Projects that increase pollution prevention (P2), water & energy conservation, & source reduction of substances on the EPA's priority chemicals list. Projects must demonstrate measureable results.	Any project where pollution abatement is needed, including wetland restoration, BMPs for stormwater runoff.
Funding Source	Federal	State	USEPA through State
% Match	50/50 reimbursement match	50% cash and in-kind match	Low interest rate loans
Min/Max Amount	$10,000-200,000	$10,000-100,000	Fixed rate, 20-yr loan
Grant Rounds	Applications due by June 1		
Eligibility	Park Board with 5-Year Park and Recreation Master Plan	Any Indiana organization	Cities, towns, counties, RSWDs, conservancy districts, water authorities
Funds Available	Estimated $500,000		
For more info:	http://www.in.gov/dnr/outdoor/4071.htm	http://www.in.gov/idem/5224.htm	http://www.in.gov/ifa/srf/2379.htm

Land and Water Conservation Fund (LWCF): The LWCF is a grant program administered by the Indiana Department of Natural Resources (IDNR) Division of Outdoor Recreation, and is funded primarily from revenues from Federal offshore oil leases. The objective of the LWCF program is to fund DNR and local government park projects involving acquisition of land, and/or construction or renovation of public parks for outdoor recreation. Park and Recreation boards established under Indiana law are the only entities eligible to apply for LWCF grants. The Park and Rec board must have an approved, current five-year master plan on file with the Division of Outdoor Recreation in order to qualify for an LWCF grant. In addition to acquisition of parkland or natural areas, examples of projects can include creation of natural areas and interpretive facilities, restrooms, utilities and park maintenance buildings. Applicants must demonstrate that they have secured 50% of the costs of the project for which they are seeking funding; projects receiving grants will be reimbursed for the remaining 50% of project costs.

The Indiana Department of Environmental Management (IDEM) Pollution Prevention (P2) Grant Program: The Indiana P2 Grant Program is administered by IDEM's Office of Pollution Prevention and Technical Assistance. In addition to measurable reduction of pollution sources, objectives of the program include conservation of water and energy. Pollution prevention can include practices that reduce or eliminate generation of pollutants, through conserving natural resources or increasing the efficiency of resource use. Any Indiana organization may apply for a P2 grant. 50% of the project must be funded by cash or matching funds provided by the applicant, and grant applicants must present documentation of cash and in-kind matches that are dedicated to the project proposed in the grant application. No work may be conducted on the project until a grant agreement is signed by all participating parties. Projects should document significant environmental, health and safety benefits, a positive economic impact, and sustainability after funding ends. In 2010, the priority of the P2 program will be to fund projects that minimize pollutants on the USEPA's priority chemical list (available at http://www.epa.gov/epawaste/hazard/wastemin/priority.htm).

State Revolving Fund (SRF) Loan Programs: The Indiana SRF Loan Program provides low-interest loans to communities for projects that address existing pollution problems. Pollution abatement projects can include wastewater, drinking water, and non-point source projects. Non-point source projects may include wetland protection and restoration, best management practices for stormwater and agricultural runoff, riparian buffers and conservation easements, wellhead and source water protection practices. Funding for the SRF Loan Program is provided by the USEPA and a State match. Funds are provided to Indiana communities in the form of fixed, 20-year, low interest rate loans. Cities, towns, counties, regional sewer and water districts, conservancy districts and water authorities are eligible for financing through the SRF Loan Program, and applications may be submitted at any time.

Site 17 – Temple Park Stormwater storage expansion

Description: Existing storm water detention pond at Temple Park

Basis of Selection: The downstream storm system is overloaded and the site provides an opportunity to mitigate overloading of the system.

Potential Issues: Expansion of the pond will move the boundary closer to the playground area.

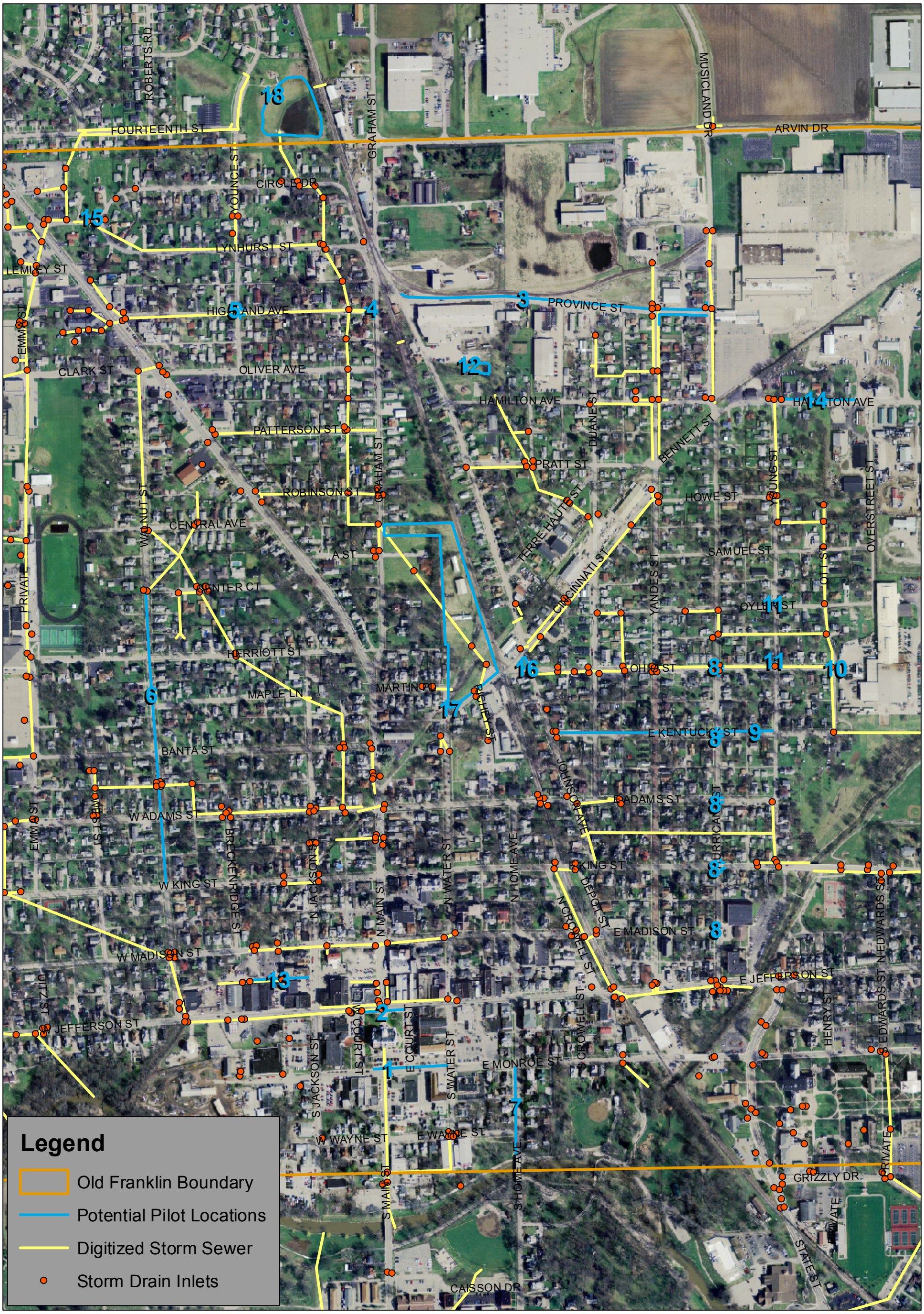

FIGURE 4-1

PROJECT NUMBER 01.0255.A.1

Potential Pilot Project Locations

N W E S

1 inch equals 500 feet

City of Franklin
Franklin, IN 46131

WILLIAMS CREEK CONSULTING
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

TABLE 4.1 CITY OF FRANKLIN YOUNG'S WATERSHED CAPITAL IMPROVEMENT PROJECTS - PROJECT SITE DATA

POTENTIAL CIP ID	SITE DESCRIPTION	TYPE OF PROBLEM (inadequate system, poor grading)	PROPOSED SOLUTION METHOD (Vol removal, re-route flow, collection system upgrade)	PROPOSED CIP & EROSION CONTROL MEASURES	WATERSHED PRIMARY LAND USE	APPROX. WATERSHED AREA (ac)	POTENTIAL RUNOFF VOLUME (cft) CAPTURED / REMOVED	IN FLOODWAY (Y / N / PART)	PRELIMINARY CIP CONSTR. COST EST.	AVE. CAPITAL COST/CFT CAPTURED	CAN BE COMPLETED BY CITY FORCES?
1	E. Monroe Street from Main St. to Home Ave.	High flow volume, no inlets, poor grading	re - route and remove surface flow	Green Street Bump in and Bump Out Rain Gardens- Impervious Surface Reduction Coordinate with Greenways & Gateways project	Commercial/Retail	10.1	3376	N	$154,366	$45.72	
2	Jefferson Street from W. Court St. to E. Court St.	runoff not entering inlets, inlets surcharging; apparent collapsed pipe run or blocked intlet at Courthouse	collection system upgrade, volume removal	Extend pipes & moe inlets to gutter line; surcharge and collapsed pipe addressed by Main St. proeject, convert landscape islands on south side to rian gardens	Commercial/Retail	4.2	1668	N	$61,950	$37.14	
3	Province Street from Duane St. to Hurricane St.	poor grading, no storm system	surface flow volume removal	Bump in with underdrain	Industrial/Commercial	27.0	19880	N	$77,892	$3.92	
4	Grahm Street at Highland Ave.	poor grading, few storm inlets	surface flow volume removal	Bump in's at intersection	Residential	3.5	1703	N	$27,973	$16.43	
5	Younce Street at Highland Ave.	Poor grading, ponding	surface flow volume removal	Bump in Rain Gardens at intersection corners with filter drains under gravel parking	Residential	3.5	1703	N	$40,888	$24.01	
6	Walnut Street from Banta to King St.	High flow volume, no storm system	surface flow volume removal; re-allocation of volume	Bump in Rain Gardens along roadway between large trees with underdrain; add storm connection to west	Residential	59.1	85310	N	$274,302	$3.22	
7	Home Avenue south of E. Monroe St.	High flow volume, nor storm system	surface flow volume removal	Curbless Rain Garden, pervious pavement parking lane, dedicated bike lane, impervous surface reduction	Residential/Comercial	7.4	3990	Y	$162,612	$40.75	
8	Hurricane Street (1 Way North) from Madison to Ohio	No Storm system, ponding	Surface flow volume removal with underdrain tie in	Bump Out Rain Garden with underdrains - some parking elimintated; tie into drainage system to east	Residential	24.2	7700	N	$122,348	$15.89	
9	E. Kentucky Street from Johnson to Ott	Very flat, no storm system	Surface flow volume removal with underdrain tie in	Flush Curb Bump in Rain Garden	Residential	3.0	1402	N	$98,917	$70.55	
10	Ott Street at Ohio Street	poor grading, not draining to inlets and pipe capacity	surface flow volume removal and pipe upsizing	Bump in Rain Garden at intersection - surface or underdrain connection to 42", upsize 12", 15" and 18" pipe to 24"	Mixed use	26.3	7161	N	$191,729	$26.77	
11	Young Street (1 Way South) from Ohio to Olyer	poor grading, not draining to inlets	Surface flow volume removal with underdrain tie in	Bump In/Bump Out Rain Garden	Residential	7.3	2288	N	$69,249	$30.27	
12	Memorial Park at Johnson & Hamilton	stream capacity exceeded	increased stream section, wetland plantings for uptake, offline storage	Depressional and wetland storage	Park/Recreation	7.7	7882	N	$39,852	$5.06	
	ADDITIONAL SITES IDENTIFIED BY WCC TEAM										
13	Alley N. of Jefferson between Jackson & Walnut	Ponding	surface flow volume removal	Bump In/Bump Out Rain Garden	Commercial	4.2	1668	N	$28,604	$17.15	
14	Circle Drive east of Main St.	Yard Flooding and pipe capacity	surface flow volume removal and re-allocation	Curbless Rain Garden; new storm pipe connection to west	Residential	50.7	70803	N	$178,371	$2.52	
15	Cincinnatti - Johnson - Ohio	GI Opportunity/Flooding	re-grading	Curbless Rain Garden	Mixed use	5.7	6226	N	$78,920	$12.68	
16	Cincinnati / Martin Place Storm Water Nature Park	Storm Water capacity re-allocation opportunity	re-route & store volume	Created Wetland and off line depressional storage	Residential	42.8	61091	N	$483,052	$7.91	
17	Temple Park Storm water storage expansion	Storm Water capacity re-allocation opportunity	storage volume enhancement	Created wetland and off line depressional storage	Park/Recreation	34.7	38363	N	$62,238	$1.62	
	PRELIMINARY SITES - NOT FURTHER INVESTIGATED										
-	Behind Church at Patterson at Main	trapped water in rear yards - poor grading	Possible to fill area and regrede to drain to south, but problem is on private property	None - Private Property	Mixed use						
-	Buyout Area	flooding on private property	Greenspace Development	Green Space or Depressional Storage	Residential						
-	Madison Street	Poor grading, few inlets, pipe undersized	collection system upgrade	addressed by Main St. project - possible parking lot rain gardens for water quality	Commerical/Residential						
-	King at Jackson	No storm inlets, ponding	collection system upgrade	Addressed by Main Steet project	Residential						
-	King at Main	No storm inlets, ponding	collection system upgrade	Addressed by Main Steet project	Commerical/Residential						
-	Hamilton Drive N. of Street Dept.	flooding on private property	surface flow volume removal	possible rain garden in ROW to reduce runoff volume or regrade or pipe to field behind - No existing storm infrastructue in Hamilton at this location	Residential/Industrial						
						321.2	322214				

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5.0 Hydraulic Analysis and Evaluation

5.1 Existing System Model Development and Calibration

A computerized hydraulic model was developed for the Young's Creek Basin Drainage Analysis study area utilizing StormNET software by BOSS International. The pipe, node, and drainage sub-basin data developed in GIS were imported into StormNET software to provide the basic system framework for the physical infrastructure configuration. Data from State approved regulatory models developed previously for IDNR for Hurricane Creek and Young's Creek were downloaded into the Young's Creek Drainage Basin hydraulic model to characterize regional runoff and flood information.

Each inlet basin within the system was separated into sub-sewersheds. Each sub-sewershed is an area that is tributary to one manhole within the basin.

Once the existing system was modeled, it was possible to choose a design storm event. The initial philosophy was to analyze the regulatory 10 year storm event for the City of Franklin. This is because the Standard of Practice in hydraulic design tends to be sizing pipe infrastructure to handle 10 year flows. However, the hydraulic model created predicts that when the region experiences a 10 year storm event, flooding in the City is governed regionally by the respective staging in the Young's Creek and Hurricane Creek drains. Therefore, although GI BMPs will remove volume from the system, and system upgrades will provide adequate capacity, their effect will not be substantial during this event. Storm events of this magnitude will require regional solutions such as high flow relief channels to divert flood waters from the City, or large scale regional detention projects to attenuate flows along the drain. These solutions fall outside the scope of this analysis.

Next, a 2 year event was modeled. Tailwater values in the regional drains during this event do inhibit the City's storm sewers ability to drain. However, the model does indicate that GI BMPs and system upgrades can noticeably reduce localized flooding. Of all the durations of 2 year storm events, the 2 year, 2 hour was found to place the largest burden on the existing stormwater network. The 2 year, 2 hour storm dictates that 1.52" of rainfall occur in two hours. This storm event was applied to the model and the results reviewed for consistency with field observations and information obtained during the site visit and data collection phase of the Study.

Figure 5-2 indicates surface flooding and pipe surcharges consistent with problem areas noted.

5.2 Post Main Street Improvement Project Model

The City has planned to augment the existing storm sewer in conjunction with an improvement project on Main Street. As it relates to the stormwater infrastructure, the plan appears to focus on alleviating capacity issues along Roaring Run. The above referenced plan sheets were analyzed and input into the hydraulic model to help understand the effects of the proposed capital improvement. *Figure 5-3* illustrates the effect of the Main Street improvement project on existing flooding and surcharges. This model is used as a starting point to understand where GI BMPs can have the greatest impact.

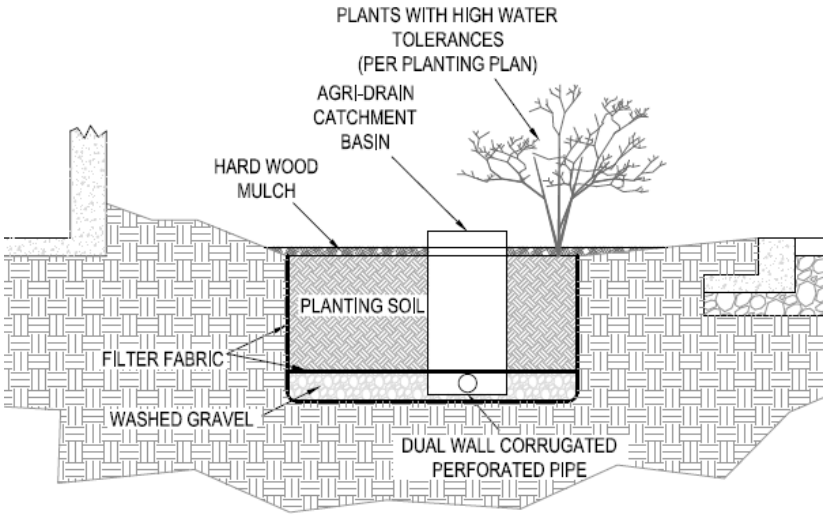
To accommodate modeling constraints, many of the green infrastructure projects were grouped together and assigned to one manhole. Similarly, for model configuration purposes, several Green Street Rain Gardens or parking lot rain gardens were modeled as one large rain garden, rather than as separate individual GI BMPs. As noted above, this may not absolutely model the effects of individual GI BMPs accurately, but does provide an accurate comparison between competing CIPs.

5.3 Post GI BMP Project Model

To model the outflows of the GI BMPs, a "dummy" node was created upstream of the tributary manhole. It was modeled as a storage node with an overflow device set approximately 6 inches below the adjacent pavement grade. Therefore, stormwater which is routed to these nodes will infiltrate to groundwater unless the staging value rises above the overflow elevation. Infiltration was modeled via the Horton wetted area method. The variables utilized by the hydraulic model are consistent with observed in-situ soils and have been assigned a decay rate via professional engineering judgment. Assuming each infiltration based GI BMP is slightly undersized for the design event, each GI BMP will remove *at least* as much volume as provided below the overflow elevation. In reality, each GI BMP will remove slightly more volume than provided below the overflow because infiltration to groundwater will begin before the BMP is full. In this manner the 2 Year, 2 Hour design storm selected claims a conservative volume reduction. For example, if a 2 Year, 24 Hour storm were executed, a GI BMP which overflows during the 2 hour duration may not overflow at all during a 24 hour duration.

Figure 5-1, below, illustrates a typical cross-section of a infiltration based GI BMP. Note that the dual walled underdrain specified can be an option should a site-specific GI BMP be extraordinarily undersized and require help completely draining. Given the in-situ soils prevalent in the City, this is not anticipated. The effect of the 17 GI BMPs can be viewed on *Figure 5-4*.

Figure 5-1 Rain Garden Detail



5.4 Proposed GI CIP Projects

A GIS shape file was created that represented the proposed green infrastructure within basins as depicted in the concept plans in Appendix B. The GIS shape file enabled the modeling team to assign each project to a sub-sewershed and to determine the affected acreage. Runoff catchment information was updated to reflect the impact of the proposed GI BMPs.

5.5 Proposed Capacity Re-allocation Projects

Areas of the system where pipes were beyond capacity were identified for further analysis. The following capacity re-allocation scenarios contributed to the reduction of surcharging in the system:

Circle Drive / Lynhurst Neighborhood:
The existing 18" -24" VCP storm collection line which runs south from the Circle Drive / Lynhurst neighborhood surcharges over one foot beyond the top of the structure castings under modeled storm conditions. Proposed GI BMP's 16 and 17, at Temple Park and the proposed Storm Water Wetland respectively, assist in the relief of this pipe, but do not fully address the issue. There is an existing 36" diameter RCP available west of the problem region which was constructed in the early 1980's to serve the 14th Street residential area. This pipe drains south and increases to 60" diameter as it flows to Young's Creek. Preliminary Hydraulic Modeling shows that this pipe has acceptable residual capacity to accept a portion of the additional flows currently routed through the Circle / Lynhurst neighborhood area.

Ott Street North of Ohio:
The storm infrastructure on Ott Street is undersized to convey the runoff from its contributing watershed, which includes a portion of the Arvin Industries facility to the north. The proposed rain garden alleviates the ponding in the immediate area, but does not have the capacity to completely mitigate the upstream flow volume. Preliminary modeling shows that replacing the existing 12", 15" and 18" pipes on Ott and Young north to Hamilton with 24" pipe eliminates the upstream surcharging.

West Adams Street / Walnut Street:
This area is at the upstream end of two overburdened lines that affect inlets at Adams, West, King, and Madison, in addition to the alley north of Adams. If topography and inverts allow, the upstream sections of these lines may be able to be re-routed to the 60" storm sewer on N. Vaught Street. Modeling confirms that the surcharging can be addressed. This will need to be confirmed with survey, and additional study of the residual capacity in the 60" storm sewer.

5.6 Design Expectation

Overall volume control can be addressed in many different ways given the design parameters of GI BMPs, such as use of overflow dry wells, raised underdrains, deeper soil medians and/or staging depths. Consideration for seasonal wet weather, frozen conditions, draw down times are all items that must be factored into actual design goals per basin. GI BMPs will work best when designed to maintain a wet condition at the soil interface to maximize infiltration during antecedent dry periods between storm events. Adjustment of these parameters in actual design of BMPs for a given basin should address the targeted reductions. This study is intended to quantify overall potential effects on system dynamics for decision making purposes with incentive programming. General assumptions are made for volume storage and reduction, however, these assumptions will likely change during design. Effects on system flows too will change with actual design, but may be more robust in relation to actual system effects. In general, BMPs were sized based on their anticipated location and associated physical constraints and the anticipated runoff volume from a 2 Year, 2 Hr, 1.52 inch rain event.

The preliminary evaluation of the effectiveness of the GI BMPs and the capacity re-allocation is the removal of surface surcharging and ponding during the selected storm event. Further analysis can yield additional information about pipe capacity and performance under altered conditions. Figures 5.2, 5.3, and 5.4 are graphic representations of the reduction in surface surcharging at existing storm structures, and do not reflect improvements in areas such as Kentucky Street where GI BMP's remove surface ponding where no storm infrastructure exists.

On Figures 5-2 through 5-4, The blue dots are representative nodes where surcharging occurs. These nodes were input into the model based on the GIS inlet information provided by the City, and the additional data collected by Williams Creek staff.

Figure 5-2 depicts surface surcharging conditions for the existing system under the 2 year, 2 hour storm event. Figure 5-3 shows the improved situation for the same storm when the storm system in Main Street improvement project is added to the model. The number of surcharged nodes is reduced from 52 to 34. Figure 5-4 includes the 17 GI BMP and capacity re-allocation projects, and indicates that all but 9 nodes are mitigated for the design storm. 8 of the remaining 9 nodes remain surcharged due to tailwater effect on Roaring Run. The last outstanding node at Main and Clark is an isolated inlet pipe crossing Main St. It can be addressed in Phase 2 of the Main Street project.

A potential solution to reduce the tailwater effect on Roaring Run would need to include approximately 2 acre-feet of stormwater storage and management on the Arvin Industries property.

Figure 5-2: Existing Conditions Model

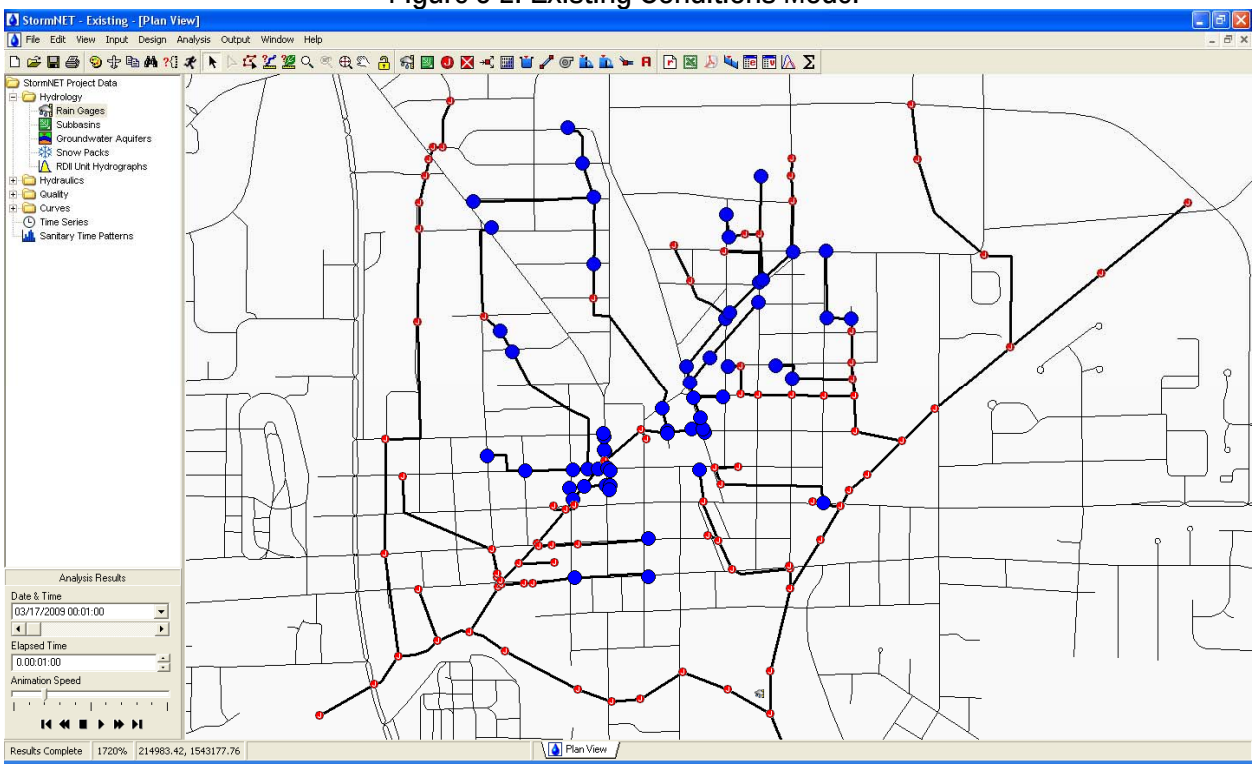


Figure 5-3: Modeled with Main Street Project

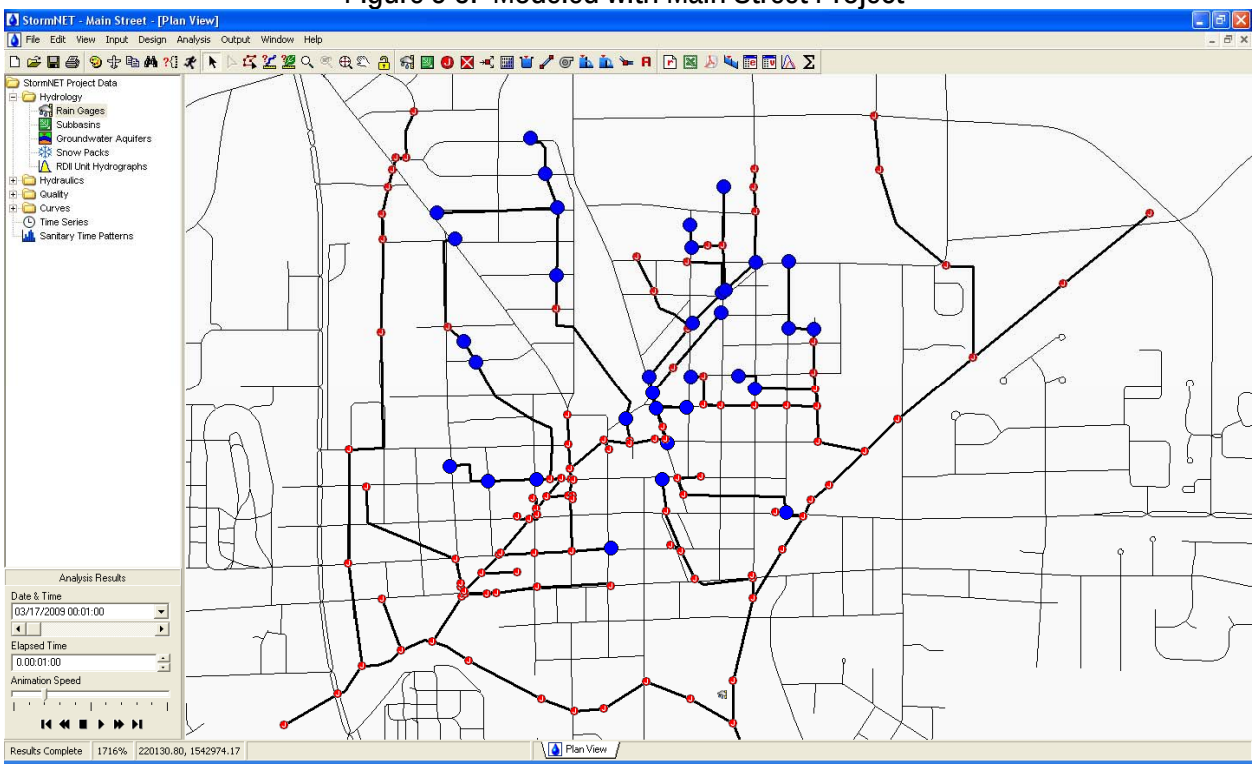
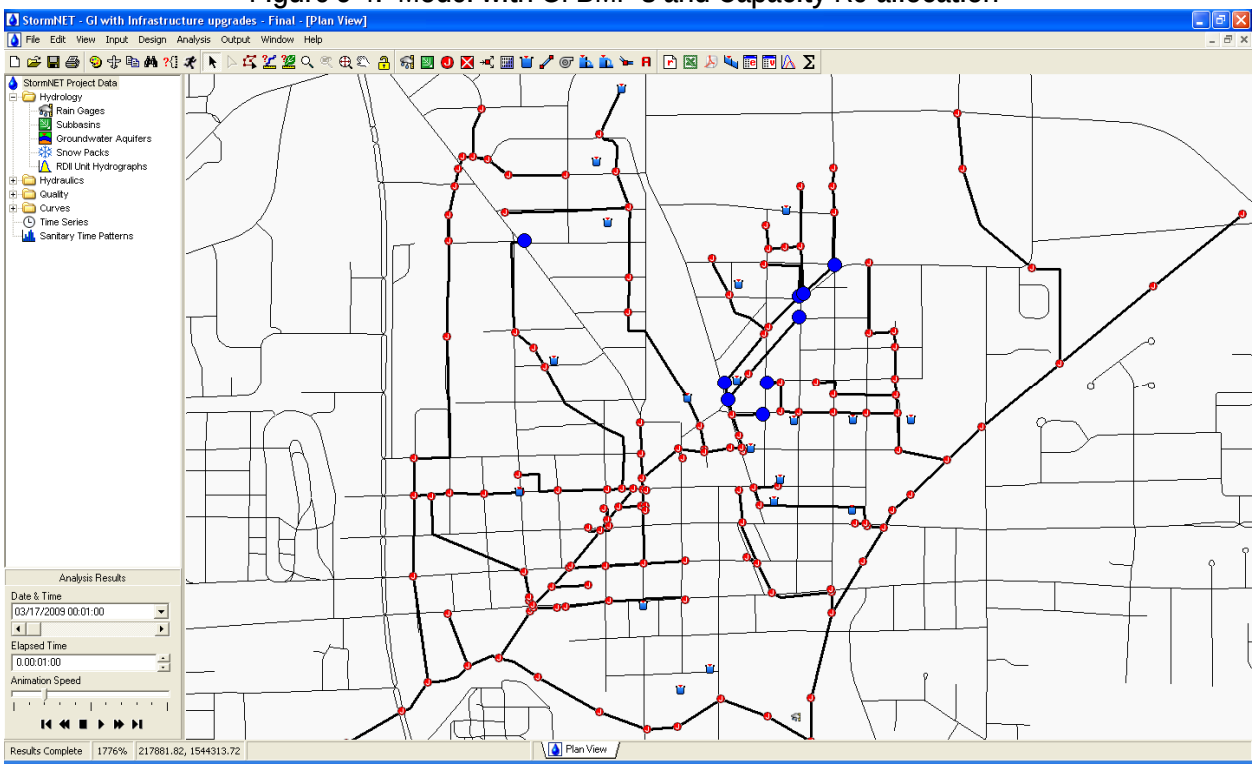


Figure 5-4: Model with GI BMP's and Capacity Re-allocation



6.0 Preliminary Opinion of Probable Cost

Preliminary costs to construct the CIPs were estimated to assist with prioritizing the proposed improvements. Costs estimates were also necessary for allocating available funding appropriately. GI BMPs construction costs were evaluated using published values, where available. Data from several references were tabulated and compared to yield estimated cost ranges for green infrastructure components. Detailed cost data tables generated from the desktop analysis are provided in *Appendix C.* Table 6.1 summarizes projected construction costs by proposed CIP site.

TABLE 6.1
YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
OPINION OF PROBABLE CONSTRUCTION COST
PRELIMINARY COST ANALYSIS BY SITE
July 7, 2009

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SITE	SITE DESCRIPTION	SUBTOTALS
1	Monroe Street from Main Street to Home Avenue	$ 154,366.23
2	Jefferson Street from W. Court Street to E. Court Street	61,950.18
3	Province Street from Duane Street to Hurricane Street	77,892.21
4	Graham Street & Highland Avenue	27,972.66
5	Younce Street & Highland Avenue	40,887.66
6	Walnut Street from Banta Street to King Street	274,301.75
7	Home Avenue South of Monroe Street	162,612.15
8	Hurricane Street from Madison Street to Ohio Street	122,348.10
9	Kentucky Street from Johnson Avenue to Ott Street	98,916.60
10	Ott Street & Ohio Street	191,729.33
11	Young Street from Ohio Street to Oyler Street	69,249.00
12	Memorial Park at Johnson Avenue & Hamilton Avenue	39,852.00
13	Alley north of Jefferson Street from Jackson Street to Walnut Street	28,603.65
14	Circle Drive east of Main Street	178,370.91
15	Cincinnati Street-Johnson Avenue-Ohio Street	78,919.88
16	Cincinnati Street/ Martin Place Storm Water Wetland Nature Park	483,051.75
17	Temple Park Storm Water Wetland Expansion	62,238.00
	GRAND TOTAL	**$ 2,153,262.05**

7.0 Site Analysis and Screening

7.1 Project Site Prioritization

In order to compare and prioritize the 17 potential CIPs, each site was evaluated based on site data and performance measures including watershed area and primary land use, current system conditions, impervious surface managed, projected volume reduction, construction and maintenance costs, and engineering judgment of non-monetary implications. The evaluation of the 17 locations was a screening process leading to the development of a recommended prioritization schedule for implementation. The process included consideration of the following attributes:

- Cost and Performance
- Non Monetary Factors
- Advantages / Disadvantages

Selection and prioritization is not based solely on cost, therefore, non-monetary factors were considered in the prioritization. For the proposed GI BMPs sites, Non-Monetary Factors include:

- Location and Project Visibility (including traffic and site access)
- Potential Water Quality Volume Treated
- Surrounding Land Use / Public Education / Aesthetic Opportunities
- Ease of Construction
- Floodway and Floodplain constraints
- Coordination with other CIP Projects
- Ongoing Maintenance Requirements
- Ease of Monitoring

7.2 Discussion of Ranking Criteria

The attributes above are compiled in Table 7.1 and each column containing a screening attribute was generally ranked on a scale of 0 to 5 with the associated values:

0 = None
1 = Poor
2 = Fair
3 = Average
4 = Very Good
5 = Excellent

Detailed discussion of each of the parameters addresses any variations from the general scale.

Location / Project Visibility:

Sites that are along a major roadway, support significant public use, and are highly visible to the general public were ranked highest. Little used sites with minimal public impact received low scores for this parameter.

Potential Volume Treated:
The sites were divided into 4 sections. The 4 sites that treated the highest volume of water received a score of "4". The next 4 sites in the ranking received a score of "3", the following 4, a "2", and the remaining 5 sites that treated the least volume of water received a score of "1".

Site Use for Education and Aesthetic Opportunities:
Sites were ranked 1 through 5 based on overall public use, existing and potential opportunities to provide educational signage.

Ease of Construction:
Sites with less numerous or less complicated BMP's were ranked higher. For example, the Temple Park storm water expansion requires only earthwork, no pipes or extended system, so it was ranked with a "5". Whereas E. Monroe Street received a "2" because the site will need to incorporate urban streetscape elements.

Floodplain:
Sites in the floodway were ranked with a "0" and sites outside the floodway were given a "3". Sites part in and part out of the floodway were listed with a "2".

Opportunity for Coordination with other CIP Projects:
At this time, there is minimal information available regarding other projects that may be underway near the proposed GI BMP's sites aside from the Main Street Improvements and the Greenways/Gateways. Sites within the boundaries of either of those projects were given a ranking of "1", while sites outside the potential work area were given a "0".

BMP Capital Cost/Benefit:
This parameter was evaluated based on the construction cost per cubic foot or runoff captured and ranked in a similar format to the potential volume treated with the highest cost benefit (lowest construction cost per cubic foot captured) receiving the highest score.

7.3 Weighted Ranking Factors

After the raw ranking numbers were applied, the site attributes were weighted based on relative importance with respect to their overall impact in relation to the project objectives. For the draft report, Potential Volume Treated and BMP Capital Cost Benefit were weighted a 2, and the remaining attributes were evenly weighted at 1. For the columns weighted other than 1, the multiplier was applied and the weighted total calculated.

7.4 Prioritized Ranking

Once the weighted total was calculated, the spreadsheet was sorted by the Weighted Total column, and the results noted as the "Overall Priority Ranking".

TABLE 7.1 CITY OF FRANKLIN YOUNG'S CREEK WATERSHED CAPITAL IMPROVEMENT PRIORITY RANKING

			Weighting Factor			1	2	1	1	1	1	2		
OVERALL PRIORITY RANKING	WEIGHTED RANKING	NON - WEIGHTED TOTAL	POTENTIAL CIP ID	SITE DESCRIPTION	PROPOSED CIP DESCRIPTION	LOCATION / PROJECT VISIBILITY	POTENTIAL VOLUME MITIGATED	SITE USE (EDUCATION & AESTHETIC OPPORTUNITIES)	EASE OF CONSTRUCTION	FLOODWAY IN = 0 OUT = 3	OPPORTUNITY FOR COORD W/OTHER CIP PROJECTS	CIP CAPITAL COST / BENEFIT	Opinion of Probable Const. Cost	Cumulative Cost
1	25	25	17	Temple Park Storm water storage expansion	Depressional and wetland storage	5	4	4	5	3	0	4	$62,238	$62,238
2	23	23	6	Walnut Street from Banta to King St.	Bump in Rain Gardens along roadway between large trees with underdrain; new storm connection to west	4	4	4	4	3	0	4	$274,302	$336,540
3	23	22	16	Cincinnati / Martin Place Storm Water Nature Park	Depressional and wetland storage	5	4	5	2	3	0	3	$483,052	$819,592
4	22	23	12	Memorial Park at Johnson & Hamilton	Depressional and wetland storage	5	2	5	5	3	0	3	$39,852	$859,444
5	22	20	1	E. Monroe Street from Main St. to Home Ave.	Green Street Bump in and Bump Out Rain Gardens- Impervious Surface Reduction	5	3	5	2	3	1	1	$154,366	$1,013,810
6	21	21	2	Jefferson Street from W. Court St. to E. Court St.	Extend pipes & move inlets to gutter line; surcharge and collapsed pipe addressed	5	1	5	5	3	1	1	$61,950	$1,075,760
7	21	22	3	Province Street from Duane St. to Hurricane St.	Bump in with underdrain	4	3	3	5	3	0	4	$77,892	$1,153,652
8	20	20	14	Circle Drive east of Main St.	Flush Curb Bump in Rain Garden; new storm connection to west	2	4	2	4	3	1	4	$178,371	$1,332,023
9	19	19	8	Hurricane Street (1 Way North) from Madison to Ohio	Bump Out Rain Garden with underdrains - some parking elimintated; tie into drainage	3	3	3	4	3	0	3	$122,348	$1,454,371
10	18	19	15	Cincinnatti - Johnson - Ohio	re-grading to promote surface runoff	4	2	4	3	3	0	3	$78,920	$1,533,291
11	18	17	10	Ott Street at Ohio Street	Bump in Rain Garden at intersection - surface or underdrain connection to 42"; upsize existing pipes	3	3	2	4	3	0	2	$191,729	$1,725,020
12	17	17	11	Young Street (1 Way South) from Ohio to Olyer	Bump In/Bump Out Rain Garden	4	2	2	4	3	0	2	$69,249	$1,794,269
13	16	15	7	Home Avenue south of E. Monroe St.	Bump Outs, pervious pavement parking lane, dedicated bike lane, impervous	4	2	4	3	0	1	1	$162,612	$1,956,881
14	15	16	13	Alley N. of Jefferson between Jackson & Walnut	Bump Out Rain Garden with underdrains - some parking elimintated; tie into drainage	3	1	3	3	3	1	2	$28,604	$1,985,485
15	14	15	4	Grahm Street at Highland Ave.	Bump in's at intersection	3	1	3	3	3	0	2	$27,973	$2,013,458
16	14	14	5	Younce Street at Highland Ave.	Bump in Rain Gardens at intersection corners with filter drains under gravel	3	1	3	3	3	0	1	$40,888	$2,054,345
17	14	14	9	E. Kentucky Street from Johnson to Ott	Flush Curb Bump in Rain Garden	2	1	2	5	3	0	1	$98,917	$2,153,262

Project Element Ranking Scale:

0 = None
1 = Poor
2 = Fair
3 = Average
4 = Very Good
5 = Excellent

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TABLE7.1

8.0 Results

Modeling GI BMPs

All of the identified sites and proposed GI BMPs show potential, beneficial results in capturing a portion, if not all, of the storm water runoff. Therefore, a method to prioritize the individual sites was developed and utilized to rank the sites. The detailed ranking is listed in Table 7.1.

Specific items of note are listed below:

Best:

1. Lowest Capital Cost Per Gallon Managed = Temple Park storm water storage expansion
2. Largest Projected Volume Reduction = Cincinnati / Martin Place storm water nature park
3. Most Impervious Surface Managed = Walnut Street

Worst:

1. Highest Capital Cost Per Gallon Managed = E. Monroe Street from Main St. to Home Ave.
2. Smallest Projected Volume Reduction = Alley north of Jefferson
3. Least Impervious Surface Managed = Jefferson Street

The estimates of probable construction cost are conservative and contain a 20% contingency amount since they were developed at a conceptual level. The estimated total of all sites is approximately **$2,153,262.**

The scope of this study was to provide a recommendation for 10 sites. Following is a list of the sites recommended for final design. This listing is developed under the assumption that all of the recommended sites will be included in the design plan set that is advertised for public bid. If there are some sites that the City of Franklin desires to construct with City staff, additional sites can be added to the list. Any revisions to the list based on in-house construction will be addressed as the report is finalized.

The construction of the projects, including GI BMPs, will have a positive impact on public perception and water quality. The BMPs will become an amenity in public areas and even improve the aesthetics of downtown residential and commercial streets.

9.0 Cost Benefit Analysis

This section presents the basis and summarizes conceptual costs and benefits of potential green infrastructure relative to traditional infrastructure reconstruction and / or improvements. Green infrastructure construction and operation/maintenance costs were evaluated using published values where available. Data from several references were tabularized and compared to yield estimated cost ranges for green infrastructure components. This section summarizes the results. Detailed cost data tables generated from the desktop analysis are provided in *Appendix C.*

9.1 Cost Analysis

Financial costs were analyzed based on anticipated financial construction and annual maintenance values. Table 4.1 summarizes construction and annual maintenance costs by GI BMPs Type.

All GI BMPs were modeled using a 1.5" rainfall event in order to develop cost efficiency comparisons. *Table 9.1* summarizes cost effectiveness by BMP type.

Unit costs in Table 4.1 were applied to each of the 5 sewersheds using the proposed GI BMPs areas and application rate to generate an estimate cost of construction and annual maintenance.

Table 9.1 GI BMPs Cost Effectiveness per Square Foot of Impervious Surface Managed

		Construction per Square Foot of surface area managed		Annual Maintenance per Square Foot of surface	
GI BMPs Type	Impervious Area Managed per BMP Area	Low	High	Low	High
Green Parking Lot	16	$0.73	$1.50	$0.02	$0.04
Green Street Rain Gardens	16	$0.76	$1.52	$0.02	$0.04
Residential On-Lot Rain Gardens	8	$0.13	$0.44	$0.00*	$0.59
Green Space	22	$0.11	$0.77	$0.003	$0.01
Rain Barrel w/ 4' x 10' Irrigation Bed	110	$0.33	$1.77	$0.00*	$0.03
*Assumes homeowner maintained BMP					

10.0 Conclusions and Recommendations

To maximize the cost / benefit of GI BMPs, their implementation should generally coincide with complementary CIP. For example, green streets and alleys should be designed and constructed concurrent with street renovations in the City's long term transportation plan, and parking lot resurfacing creates opportunities for the rain garden parking program.

A recommended list of next steps includes:

Short Term (0 to 1 year)

- Discuss and determine desired level of results
- Refine proposed GI project costs and ranking to determine final number of projects for construction
- Complete topographic survey and preliminary design documents and make recommendation for the implementation of the Circle Drive / Lynhurst Capacity Re-allocation project
- Based on results of survey and preliminary design, prepare final construction and bid documents for the Circle Drive / Lynhurst Capacity Re-allocation project
- Complete topographic survey and preliminary design documents and make recommendation for the implementation of the West Adams Street Capacity Re-allocation project
- Based on results of survey and preliminary design, prepare final construction and bid documents for the West Adams Street Capacity Re-allocation project
- Design, construct, and monitor GI BMPs as recommended by this Basin Analysis Plan in the priority order listed
- Design, construct, and monitor GI BMPs in green space pilot projects where readily available. City owned land provides the greatest cost-benefit potential
- Develop Technical Standards and Operation and Maintenance Plans for GI BMPs
- Develop and implement a Residential Rain Barrel and Rain Garden Program
- Site Plan review to incorporate GI on targeted sites

Long Term (0 to 5 years)

- Seek Federal and other grant funding for continued GI implementation
- Establish a Citywide database to track, monitor, and report efforts to install GI BMPs
- Develop a Commercial and Industrial Parking Rain Garden Program
- Establish incentives to promote the use of GI BMPs for private development projects
- Plan for the maintenance and funding of controls
- Provide Ongoing Ordinance / Policy / Incentive review relevant to Green Infrastructure

APPENDIX A
Site Visit Notes

Corporate
Babeca Building
919 North East Street
Indianapolis, IN 46202

Ohio
247 East Livingston Ave
Suite B
Columbus, OH 43215

Missouri
7211 Manchester Ave
St. Louis, MO 63143

Zurich
Grossackerstrasse 64
8041, Zurich
Switzerland

1-877-668-8848
info@williamscreek.net
www.williamscreek.net

City of Franklin
Downtown Drainage Analyisis
Site Visit Notes

Date	**Wed. May 27th 12pm – 4:30pm**
Attended	Todd Wilkerson – City of Franklin; City Engineer Jean Wodarek, P.E. – Williams Creek Consulting Mike Ramsey – Williams Creek Consulting
Location	Multiple locations within original downtown
Project	Young's Creek Basin Drainage Analysis WCC project # 01.0255.A.1

Notes
Overall: - Soils in the area are Brookston/Crosby . The water table is variable, but somewhere between 5' and 8' below grade. GPS Data collection is underway and must be complete by June to comply with MS4

Location 1: SE of Courthouse near College
Experiences high volumes of runoff but not a lot of flooding

Location 2: Yandes & Providence
Very flat area, not much storm infrastructure, much ponding and local flooding. The RR Spur closest to the road is abandoned, the other spur is private. Holbrook Manufacturing has newer paved parking area directly off the street. Runoff drains to street. A couple of inlets were noted to the north.
Yandes South of Ohio is existing brick.

Location 3: Grahm at Highland
Localized flooding, many complaints on Grahm south. Grahm at RoRobinson – a channel has been dug along the sidewalk. There is standing water due to gravel parking area blocking drainage. Per Todd, the gravel drive approaches are in the R.O.W. , alleys are public. The City is looking to redesign for parking on one side in this area.

Location 4: Patterson at Main
There is centralized flooding at abandoned alley area behind the church – there is no access point to rear yards. The Main Street reconstruction project includes intercepting the existing 48" Roaring Run from the east and running a new 72" pipe down Main.

Location 5: Younce and Highland
Yards hold water in this area because the streets are higher and block runoff. There is no formalized path for drainage.

Location 6: Oliver
No real issues on Oliver

Location 7: Walnut
Not a lot of flooding, but high volume of water moving down the street. Side streets have localized complaints. This area goes to Roaring Run – any volume reduction will help.

Location 8: Walnut at King
Sump pump outlet observed running down sidewalk area that is lower than the street.

Location 9: King & Jefferson
96" arch pipe at this location is the outlet of Roaring Run. It crosses under Jefferson, then is enclosed into 48". Re-design is calling for 72" pipe. CB's on Jefferson backflow during regular storm events. City does not know where they connect. They have vacuumed the structures down to an elevation of 8' and continue to get sand & find no outlet. Any work on Jefferson (State Road 44) will require INDOT approvals.

Location 10: Home Avenue
Monroe carries a high volume of water to Home, then to the creek. There is flooding at Caisson Drive. Franklin Planners are interested in providing traffic calming measures on Home. Flooding occurs at the far south end as water sheet flows to the farm field & Young's Creek. Sump pumps were active during the site visit.

Location 13: Buyout Area
The buyout area extends from Pitt to Jackson, west over to Nineveh. The majority of houses will be removed, a few will be raised. The remaining area is to become greenspace. City to provide property information on GIS.

Location 14: Madison St
Flooding occurs at local intersections and inlets – Roaring Run can't handle the flow. Many problems at Madison & Breckenridge & to the east.

Location 15 – King at Jackson and King at Main
Intersection flooding - all inlets connect to Roaring Run. Flooding at apartments north of Main & Banta.

Location 16: Hurricane St:
Drains east to Hurricane Creek – significant volume of surface flow creates problems.

Location 17: Kentucky St:
This is the flattest area. The street is higher than the homes & there is no real storm system . There is available greenspace to work with in the park on the east end. The building adjacent to the park is Franklin Power Products – it is vacant and could be a good opportunity for a GI pilot project when it has to come back through Planning for site plan approval. Hurricane Creek does flood into the field at the end of Kentucky.

Location 18: Ott & Ohio
Inlets exist, but are not effective. There are localized pockets of drainage issues and house flooding in the area. Pipes are old, 8" vitrified clay.

Location 19: Young Street:
Wide pavement, newer overlay – good opportunity for GI

Location 20: Park area @ Johnson & Hamilton:

The ditch through the park overflows and floods the entire area. It outlets via culvert under Hamilton to residential backyard ditch. The building to the North of the park is for sale and does not appear to have storm detention. No other major problems on Hamilton.

Information to be provided by City:

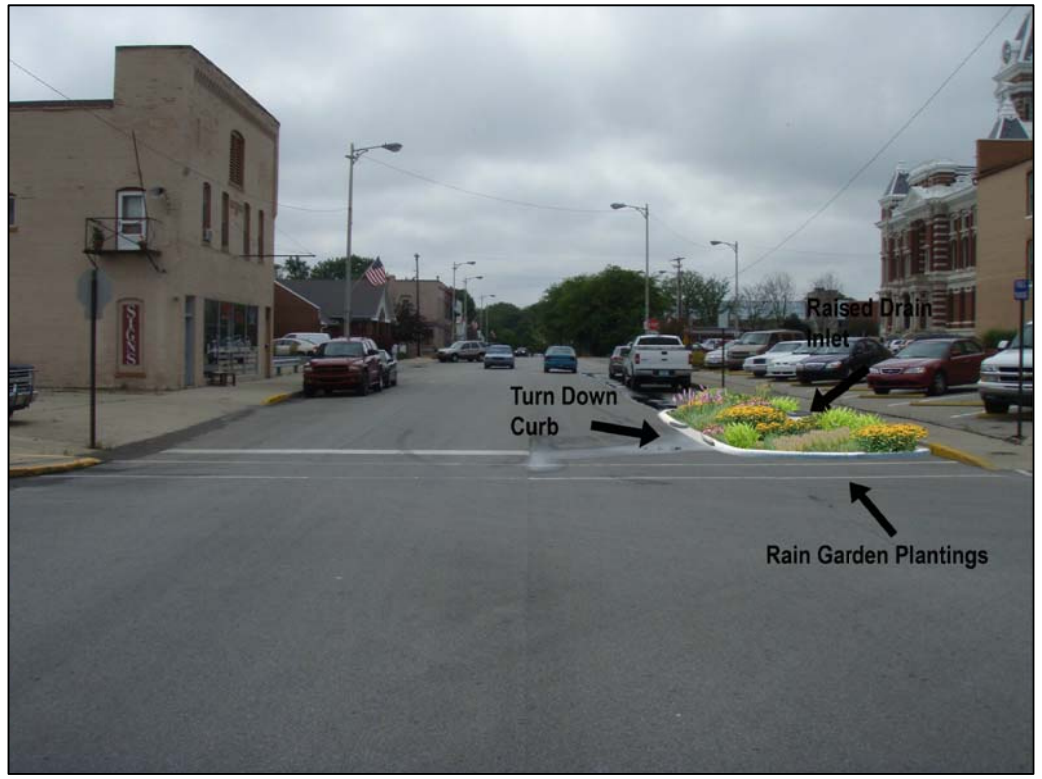
Buyout Area GIS information with property lines and properties noted
GIS information for storm system currently being collected by DPW staff
Preliminary plans for Main St. project (to be available May 29th)
Other recent street improvement or storm sewer plans

Information obtained on date of visit:

GIS base data including streets, contours, and partial storm system information
1952 sewer map and plan profile drawings

APPENDIX B
Proposed CIP Design Concept Exhibits

EXISTING CONDITION



PROPOSED BUMP-OUT RAIN GARDEN

NORTH

0 50 100

(IN FEET)
1 INCH = 100 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 100'
DATE:	

MONROE SOUTH OF COURTHOUSE

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
01
SHEET OF

EXISTING CONDITION

PROPOSED RAIN GARDEN

NORTH

0 30 60

(IN FEET)
1 INCH = 60 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 60'
DATE:	

WEST JEFFERSON ST

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
02
SHEET OF

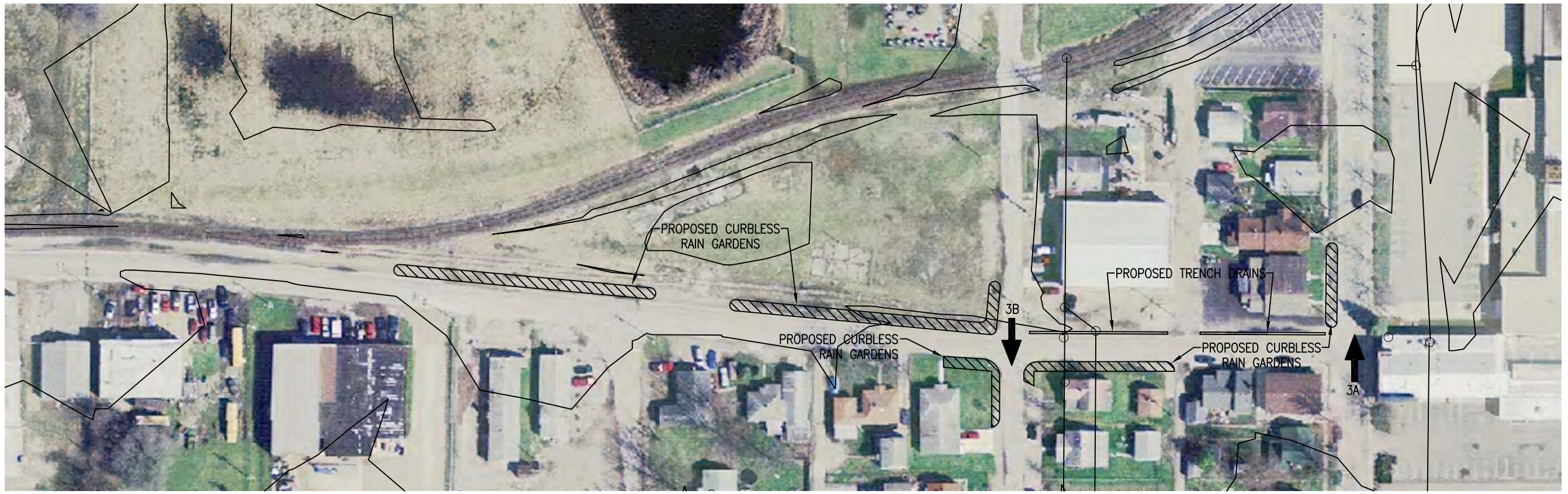
EXISTING CONDITION

PROPOSED BUMP–OUT RAIN GARDEN

NORTH

0 50 100

(IN FEET)
1 INCH = 100 FT.



CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 100'
DATE:	

PROVINCE

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
03
SHEET OF

EXISTING CONDITION

PROPOSED RAIN GARDEN

NORTH

0 50 100

(IN FEET)
1 INCH = 100 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 100'
DATE:	

GRAHM AND HIGHLAND

YOUNCE AND HIGLAND

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
04 & 05
SHEET OF

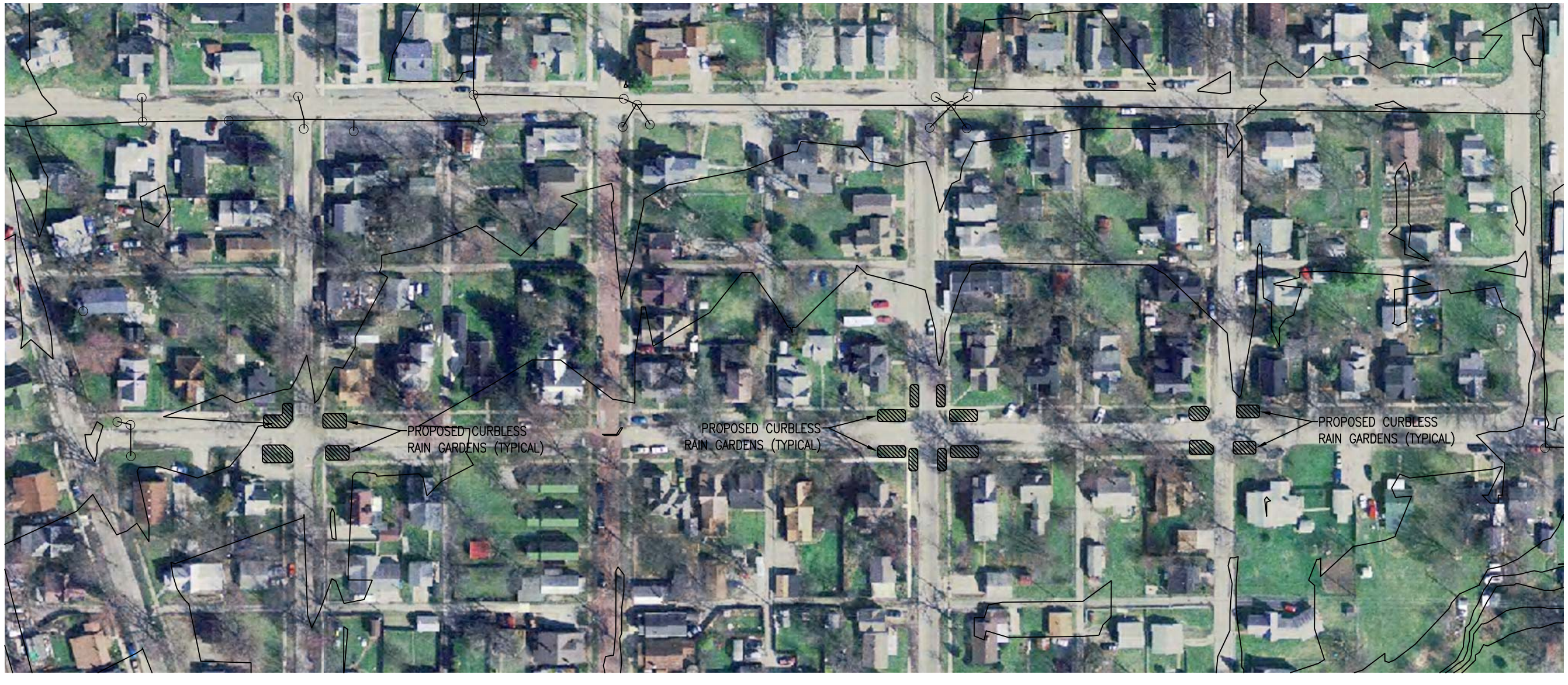
EXISTING CONDITION

PROPOSED RAIN GARDEN

NORTH

0 60 120

(IN FEET)
1 INCH = 120 FT.



CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 100'
DATE:	

KENTUCKY STREET

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
09
SHEET OF

NORTH

0 25 50
(IN FEET)
1 INCH = 50 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

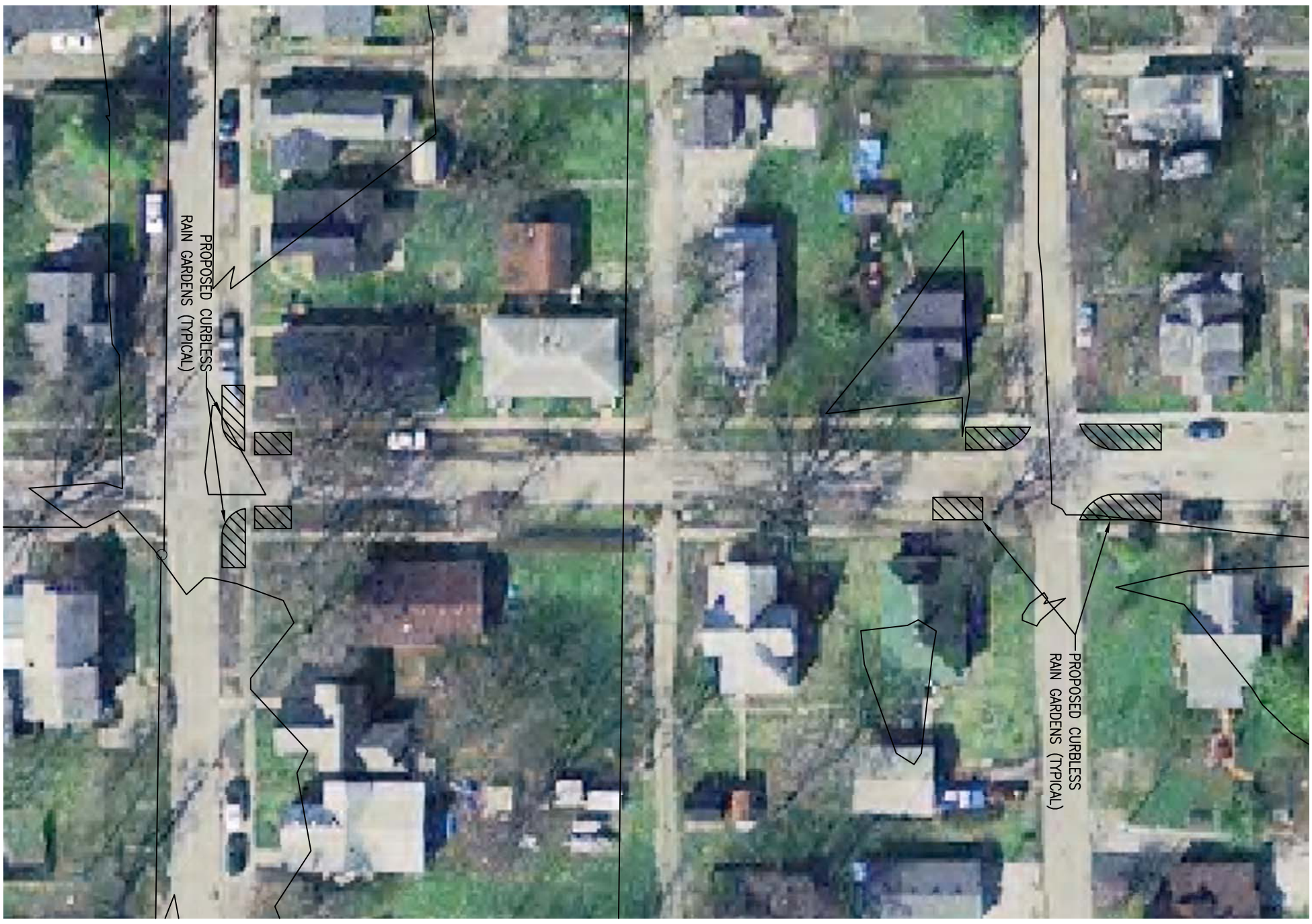
OTT STREET AND OHIO STREET

DWN BY:
CHKD. BY:
SCALE: 1" = 50'
DATE:

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
10
SHEET OF

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696



NORTH

0 25 50
(IN FEET)
1 INCH = 50 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

YOUNG STREET - ONE WAY SOUTH

OHIO STREET TO OYLER STREET

DWN BY:
CHKD. BY:
SCALE: 1" = 50'
DATE:

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
11
SHEET OF

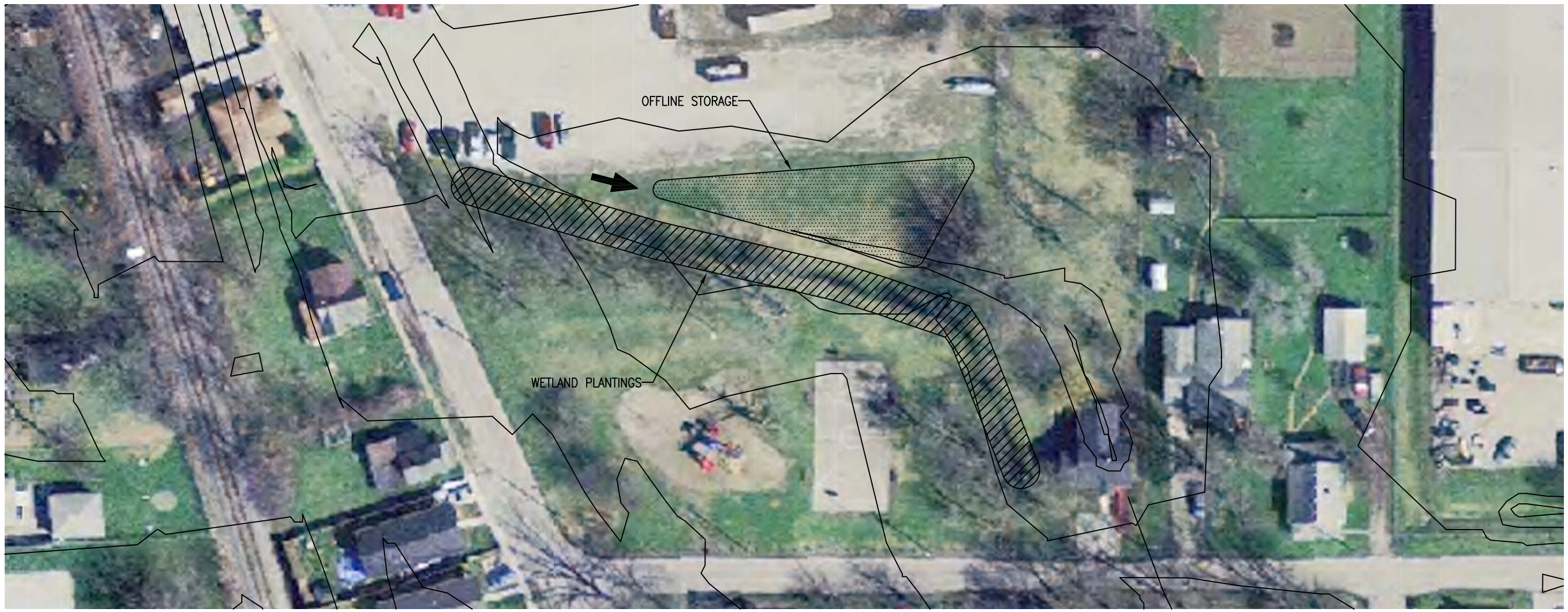
EXISTING CONDITION

PROPOSED BIORETENTION SWALE

NORTH

0 30 60

(IN FEET)
1 INCH = 60 FT.



CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 60'
DATE:	

MEMORIAL PARK

AT JOHNSON AVENUE AND HAMILTON AVENUE

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
12
SHEET OF

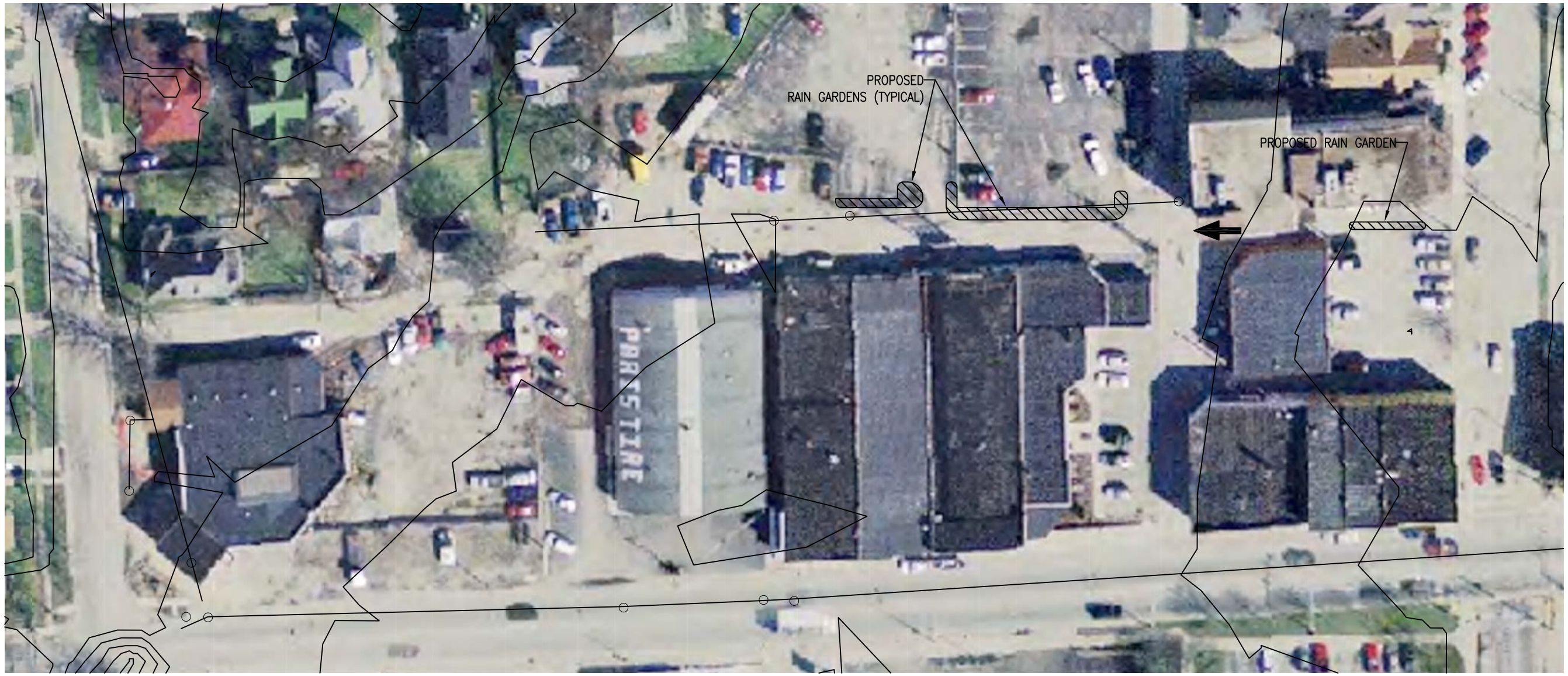
EXISTING CONDITION

PROPOSED RAIN GARDEN

NORTH

0 30 60

(IN FEET)
1 INCH = 60 FT.



CITY OF FRANKLIN

FRANKLIN, IN 46131

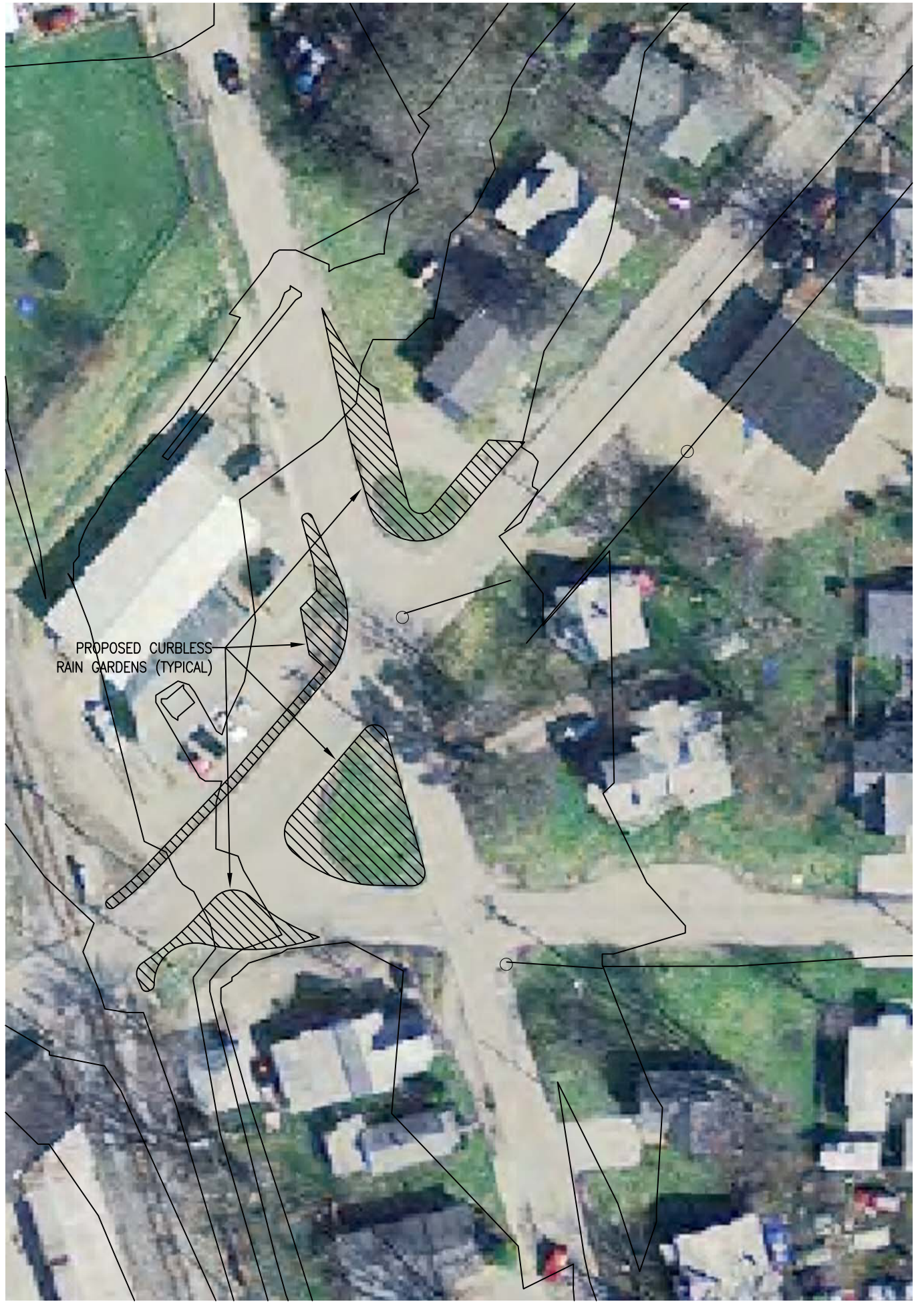
WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 60'
DATE:	

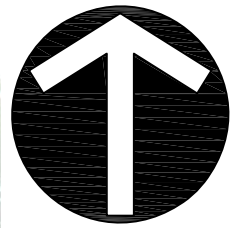
ALLEY NORTH OF JEFFERSON
BETWEEN JACKSON STREET AND WALNUT STREET

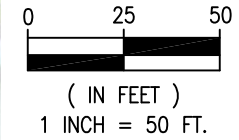
PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
13
SHEET OF



EXISTING CONDITION





CITY OF FRANKLIN

FRANKLIN, IN 46131

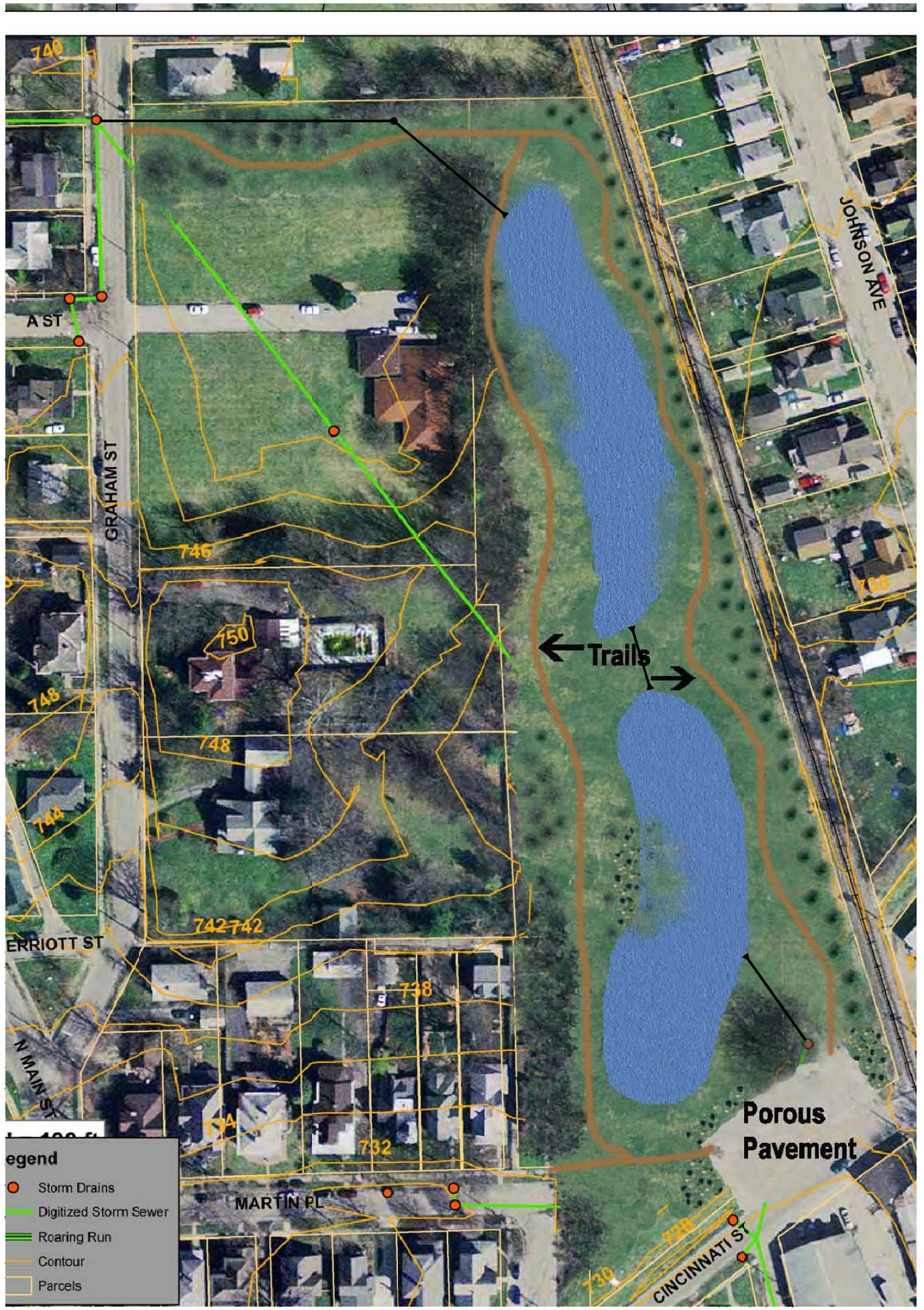
WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 50'
DATE:	

CINCINNATI STREET - JOHNSON AVENUE - OHIO STREET

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
15
SHEET OF



NORTH

0 50 100

(IN FEET)
1 INCH = 100 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

DWN BY:	
CHKD. BY:	
SCALE:	1" = 100'
DATE:	

WATER STREET

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
16
SHEET OF

NORTH

0 50 100
(IN FEET)
1 INCH = 100 FT.

CITY OF FRANKLIN

FRANKLIN, IN 46131

TEMPLE PARK

STORMWATER DEPRESSIONAL STORAGE EXPANSION

DWN BY:
CHKD. BY:
SCALE: 1" = 100'
DATE:

PROJECT NUMBER
01.0255.A.1

DRAWING NUMBER
17
SHEET OF

WILLIAMS CREEK CONSULTING, INC.
919 NORTH EAST STREET
INDIANAPOLIS, INDIANA 46202
Ph: (317) 423-0690 Fax: (317) 423-0696

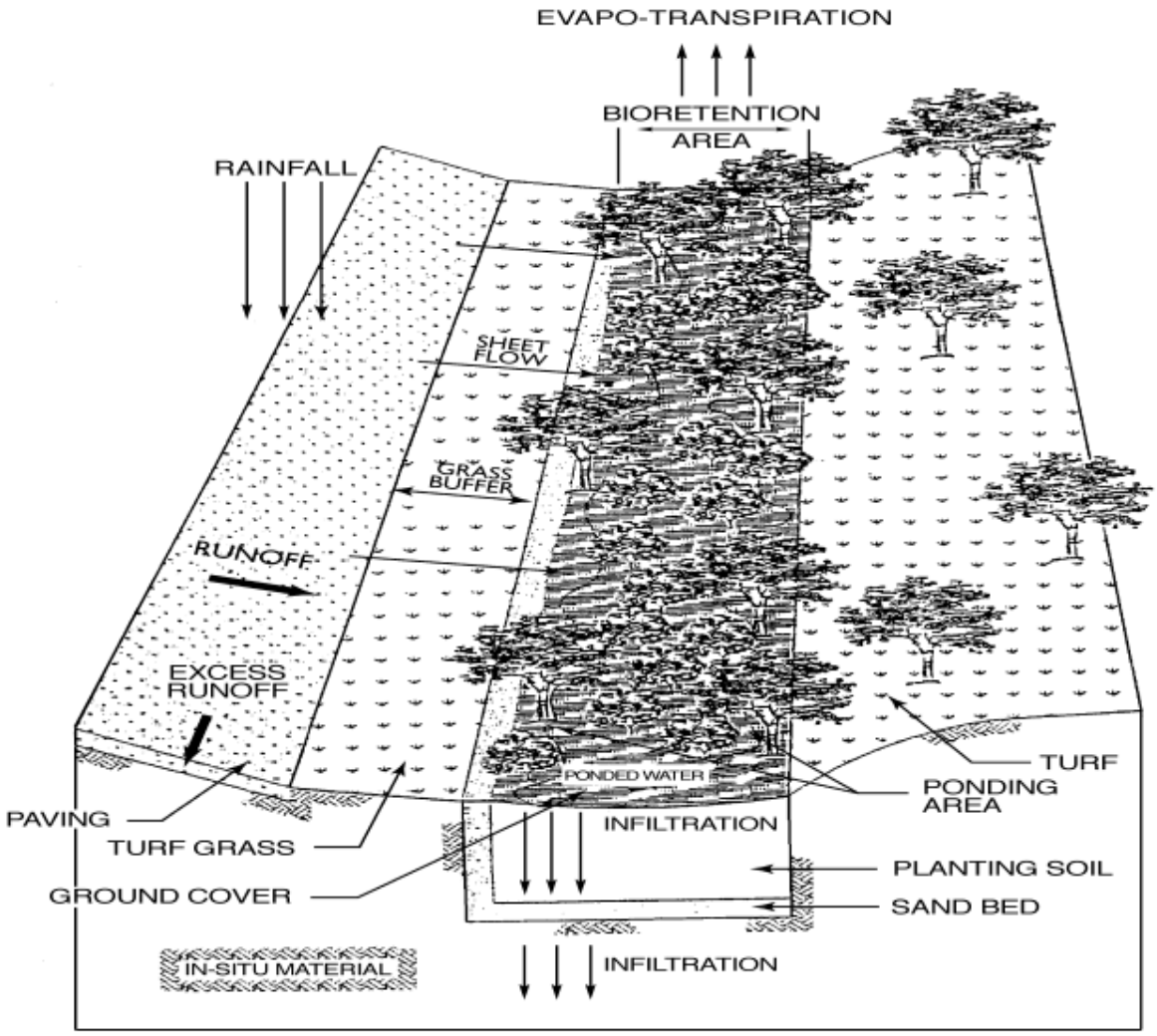


Figure 3.2.A: Typical Bioretention Swale Configuration[1]

[1] USEPA 832-F-99-019 September 1999

Figure 3.2.B: Bioretention in Largo, Maryland[2]

Benefits:

- Removes sediment, heavy metals, organic pollutants, hydrocarbons
- Controls peak discharges by reducing runoff velocity and promoting infiltration
- Provides some groundwater recharge if design and location allow adequate infiltration
- Good option for residential or institutional areas of moderate to high density
- Enhances quality of downstream water bodies
- Rapidly dewaters minimizing mosquito issues
- Provide heat island reducing shade
- Improves aesthetic value of site
-

Limitations:

- If designed or installed improperly, it will not effectively remove sediment and pollutants
- Individual bioretention can treat only a small area
- If soil freezes in the winter, runoff may be prevented from infiltrating soil

[2] Bioretention Applications. USEPA 841-B-00-005A. http://www.epa.gov/owow/nps/bioretention.pdf

APPENDIX C
Cost Analysis Data

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 1
SITE: Monroe Street from Main Street to Home Avenue

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	2200	sf	$2.50	$5,500
4	Pavement Removal and Disposal	13200	sf	$2.67	$35,244
5	Concrete Curb	1100	lf	$12.47	$13,717
6	Concrete Sidewalk	100	lf	$12.00	$1,200
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	3300	sf	$5.30	$17,490
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	3300	sf	$0.50	$1,650
13	Infiltration Trench	1100	lf	$17.00	$18,700
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	100	lf	$65.00	$6,500
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	7	ea	$1,500.00	$10,500
18	6" Perforated Underdrain with fabric sock & granular	500	lf	$30.00	$15,000
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$125,501
	ENGINEERING/ SURVEYING (15%)				$18,825
	20% CONTINGENCY				$28,865
	TOTAL				**$154,366**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 2
SITE: Jefferson Street from W. Court Street to E. Court Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	500	sf	$2.50	$1,250
4	Pavement Removal and Disposal	2500	sf	$2.67	$6,675
5	Concrete Curb	300	lf	$12.47	$3,741
6	Concrete Sidewalk	50	lf	$12.00	$600
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	2500	sf	$5.30	$13,250
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	2500	sf	$0.50	$1,250
13	Infiltration Trench	100	lf	$17.00	$1,700
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	60	lf	$65.00	$3,900
16	Storm Manhole	3	ea	$2,000.00	$6,000
17	Storm Catch Basin	4	ea	$1,500.00	$6,000
18	6" Perforated Underdrain with fabric sock & granular	200	lf	$30.00	$6,000
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$50,366
	ENGINEERING/ SURVEYING (15%)				$7,555
	20% CONTINGENCY				$11,584
	TOTAL				**$61,950**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 3
SITE: Province Street from Duane Street to Hurricane Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	500	sf	$2.50	$1,250
4	Pavement Removal and Disposal	500	sf	$2.67	$1,335
5	Concrete Curb	100	lf	$12.47	$1,247
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	250	lf	$25.00	$6,250
8	Rain Garden	5400	sf	$5.30	$28,620
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	1000	lf	$17.00	$17,000
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	25	lf	$65.00	$1,625
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	3	ea	$1,500.00	$4,500
18	6" Perforated Underdrain with fabric sock & granular	50	lf	$30.00	$1,500
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$63,327
	ENGINEERING/ SURVEYING (15%)				$9,499
	20% CONTINGENCY				$14,565
	TOTAL				**$77,892**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 4
SITE: Graham Street & Highland Avenue

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	100	sf	$2.50	$250
4	Pavement Removal and Disposal	100	sf	$2.67	$267
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	50	lf	$12.00	$600
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	2000	sf	$5.30	$10,600
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	200	lf	$17.00	$3,400
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	25	lf	$65.00	$1,625
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	3	ea	$1,500.00	$4,500
18	6" Perforated Underdrain with fabric sock & granular	50	lf	$30.00	$1,500
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$22,742
	ENGINEERING/ SURVEYING (15%)				$3,411
	20% CONTINGENCY				$5,231
	TOTAL				**$27,973**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 5
SITE: Younce Street & Highland Avenue

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	100	sf	$2.50	$250
4	Pavement Removal and Disposal	100	sf	$2.67	$267
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	50	lf	$12.00	$600
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	2000	sf	$5.30	$10,600
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	200	lf	$17.00	$3,400
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	25	lf	$65.00	$1,625
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	4	ea	$1,500.00	$6,000
18	6" Perforated Underdrain with fabric sock & granular	350	lf	$30.00	$10,500
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$33,242
	ENGINEERING/ SURVEYING (15%)				$4,986
	20% CONTINGENCY				$7,646
	TOTAL				**$40,888**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 6
SITE: Walnut Street from Banta Street to King Street
Includes 1050 LF of storm pipe for capacity re-allocation

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	375	sf	$2.50	$938
4	Pavement Removal and Disposal	375	sf	$2.67	$1,001
5	Concrete Curb	140	lf	$12.47	$1,746
6	Concrete Sidewalk	350	lf	$12.00	$4,200
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	3500	sf	$5.30	$18,550
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	350	lf	$17.00	$5,950
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	2025	lf	$65.00	$131,625
16	Storm Manhole	1	ea	$2,000.00	$2,000
17	Storm Catch Basin	14	ea	$1,500.00	$21,000
18	6" Perforated Underdrain with fabric sock & granular	1200	lf	$30.00	$36,000
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$223,010
	ENGINEERING/ SURVEYING (15%)				$33,451
	20% CONTINGENCY				$51,292
	TOTAL				**$274,302**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 7
SITE: Home Avenue South of Monroe Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	1000	sf	$2.50	$2,500
4	Pavement Removal and Disposal	1000	sf	$2.67	$2,670
5	Concrete Curb	500	lf	$12.47	$6,235
6	Concrete Sidewalk	50	lf	$12.00	$600
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	4000	sf	$5.30	$21,200
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	4000	lf	$17.00	$68,000
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	350	lf	$65.00	$22,750
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	4	ea	$1,500.00	$6,000
18	6" Perforated Underdrain with fabric sock & granular	75	lf	$30.00	$2,250
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$132,205
	ENGINEERING/ SURVEYING (15%)				$19,831
	20% CONTINGENCY				$30,407
	TOTAL				**$162,612**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 8
SITE: Hurricane Street from Madison Street to Ohio Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	1000	sf	$2.50	$2,500
4	Pavement Removal and Disposal	1000	sf	$2.67	$2,670
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	400	lf	$12.00	$4,800
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	7000	sf	$5.30	$37,100
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	700	lf	$17.00	$11,900
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	0	lf	$65.00	$0
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	16	ea	$1,500.00	$24,000
18	6" Perforated Underdrain with fabric sock & granular	550	lf	$30.00	$16,500
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$99,470
	ENGINEERING/ SURVEYING (15%)				$14,921
	20% CONTINGENCY				$22,878
	TOTAL				**$122,348**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 9
SITE: Kentucky Street from Johnson Avenue to Ott Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	1000	sf	$2.50	$2,500
4	Pavement Removal and Disposal	1000	sf	$2.67	$2,670
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	4000	sf	$5.30	$21,200
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	400	lf	$17.00	$6,800
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	300	lf	$65.00	$19,500
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	12	ea	$1,500.00	$18,000
18	6" Perforated Underdrain with fabric sock & granular	325	lf	$30.00	$9,750
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$80,420
	ENGINEERING/ SURVEYING (15%)				$12,063
	20% CONTINGENCY				$18,497
	TOTAL				**$98,917**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 10
SITE: Ott Street & Ohio Street
Includes 1750 LF of storm pipe for capacity re-allocation

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	750	sf	$2.50	$1,875
4	Pavement Removal and Disposal	750	sf	$2.67	$2,003
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	4500	sf	$5.30	$23,850
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	450	lf	$17.00	$7,650
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	1750	lf	$65.00	$113,750
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	3	ea	$1,500.00	$4,500
18	6" Perforated Underdrain with fabric sock & granular	75	lf	$30.00	$2,250
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$155,878
	ENGINEERING/ SURVEYING (15%)				$23,382
	20% CONTINGENCY				$35,852
	TOTAL				**$191,729**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 11
SITE: Young Street from Ohio Street to Oyler Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	0	sf	$2.50	$0
4	Pavement Removal and Disposal	0	sf	$2.67	$0
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	200	lf	$12.00	$2,400
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	2000	sf	$5.30	$10,600
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	200	lf	$17.00	$3,400
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	360	lf	$65.00	$23,400
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	8	ea	$1,500.00	$12,000
18	6" Perforated Underdrain with fabric sock & granular	150	lf	$30.00	$4,500
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$56,300
	ENGINEERING/ SURVEYING (15%)				$8,445
	20% CONTINGENCY				$12,949
	TOTAL				**$69,249**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 12
SITE: Memorial Park at Johnson Avenue & Hamilton Avenue

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	0	sf	$2.50	$0
4	Pavement Removal and Disposal	0	sf	$2.67	$0
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk w/Casting	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	0	sf	$5.30	$0
9	Stormwater Wetland	21600	sf	$1.50	$32,400
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	0	lf	$17.00	$0
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	0	lf	$65.00	$0
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	0	ea	$1,500.00	$0
18	6" Perforated Underdrain with fabric sock & granular	0	lf	$30.00	$0
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$32,400
	ENGINEERING/ SURVEYING (15%)				$4,860
	20% CONTINGENCY				$7,452
	TOTAL				**$39,852**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 13
SITE: Alley north of Jefferson Street from Jackson Street to Walnut Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	750	sf	$2.50	$1,875
4	Pavement Removal and Disposal	1500	sf	$2.67	$4,005
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	1500	sf	$5.30	$7,950
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	1500	sf	$0.50	$750
13	Infiltration Trench	150	lf	$17.00	$2,550
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	25	lf	$65.00	$1,625
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	2	ea	$1,500.00	$3,000
18	6" Perforated Underdrain with fabric sock & granular	50	lf	$30.00	$1,500
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$23,255
	ENGINEERING/ SURVEYING (15%)				$3,488
	20% CONTINGENCY				$5,349
	TOTAL				**$28,604**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 15
SITE: Circle Drive east of Main Street
Includes 2050 LF of storm pipe for capacity re-allocation

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	100	sf	$2.50	$250
4	Pavement Removal and Disposal	100	sf	$2.67	$267
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	1500	sf	$5.30	$7,950
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	150	lf	$17.00	$2,550
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	2050	lf	$65.00	$133,250
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	0	ea	$1,500.00	$0
18	6" Perforated Underdrain with fabric sock & granular	25	lf	$30.00	$750
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$145,017
	ENGINEERING/ SURVEYING (15%)				$21,753
	20% CONTINGENCY				$33,354
	TOTAL				**$178,371**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 16
SITE: Cincinnati Street-Johnson Avenue-Ohio Street

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	250	sf	$2.50	$625
4	Pavement Removal and Disposal	250	sf	$2.67	$668
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	11400	sf	$5.30	$60,420
9	Stormwater Wetland	0	sf	$1.50	$0
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	100	lf	$17.00	$1,700
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	0	lf	$65.00	$0
16	Storm Manhole	0	ea	$2,000.00	$0
17	Storm Catch Basin	0	ea	$1,500.00	$0
18	6" Perforated Underdrain with fabric sock & granular	25	lf	$30.00	$750
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$64,163
	ENGINEERING/ SURVEYING (15%)				$9,624
	20% CONTINGENCY				$14,757
	TOTAL				**$78,920**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 17
SITE: Cincinnati Street/ Martin Place Stormwater Wetland Nature Park

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	0	sf	$2.50	$0
4	Pavement Removal and Disposal	0	sf	$2.67	$0
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk w/Casting	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	0	sf	$5.30	$0
9	Stormwater Wetland	162150	sf	$1.50	$243,225
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	0	lf	$17.00	$0
14	8' Wood Boardwalk	2150	lf	$10.00	$21,500
15	Storm Pipe	400	lf	$65.00	$26,000
16	Storm Manhole	1	ea	$2,000.00	$2,000
17	Storm Catch Basin	0	ea	$1,500.00	$0
18	6" Perforated Underdrain with fabric sock & granular	0	ea	$30.00	$0
19	Land Acquisition	4	ac	$25,000.00	$100,000
	SUBTOTAL				$392,725
	ENGINEERING/ SURVEYING (15%)				$58,909
	20% CONTINGENCY				$90,327
	TOTAL				**$483,052**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.

YOUNG'S CREEK BASIN DRAINAGE ANALYSIS PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

SITE #: 18
SITE: Temple Park Stormwater Wetland Expansion

PREPARED BY: JMR
CHECKED BY:
DATE: 7/1/2009

ITEM #	DESCRIPTION	QUANTITY	UNIT	UNIT COST INSTALLED	TOTAL COST
1	Pervious Concrete	0	sf	$8.00	$0
2	Grass Paver	0	sf	$11.00	$0
3	Standard Bituminous	0	sf	$2.50	$0
4	Pavement Removal and Disposal	0	sf	$2.67	$0
5	Concrete Curb	0	lf	$12.47	$0
6	Concrete Sidewalk	0	lf	$12.00	$0
7	Street Trench Drain	0	lf	$25.00	$0
8	Rain Garden	0	sf	$5.30	$0
9	Stormwater Wetland	32400	sf	$1.50	$48,600
10	Vegetated Filter Strip	0	sf	$3.78	$0
11	Vegetated Swale	0	sf	$5.00	$0
12	Subsoiling	0	sf	$0.50	$0
13	Infiltration Trench	0	lf	$17.00	$0
14	8' Wood Boardwalk	0	lf	$10.00	$0
15	Storm Pipe	0	lf	$65.00	$0
16	Storm Manhole	1	ea	$2,000.00	$2,000
17	Storm Catch Basin	0	ea	$1,500.00	$0
18	6" Perforated Underdrain with fabric sock & granular	0	ea	$30.00	$0
19	Land Acquisition	0	ac	$25,000.00	$0
	SUBTOTAL				$50,600
	ENGINEERING/ SURVEYING (15%)				$7,590
	20% CONTINGENCY				$11,638
	TOTAL				**$62,238**

STATEMENTS OF PROBABLE CONSTRUCTION COST AND DETAILED COST ESTIMATES PREPARED BY THE ENGINEER REPRESENTS HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. IT IS RECOGNIZED, HOWEVER, THAT THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHODS OF DETERMINING BID PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. ACCORDINGLY, THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT BIDS WILL NOT VARY FROM ANY STATEMENT OF PROBABLE CONSTRUCTION COST OR OTHER COST ESTIMATES PREPARED BY HIM.