

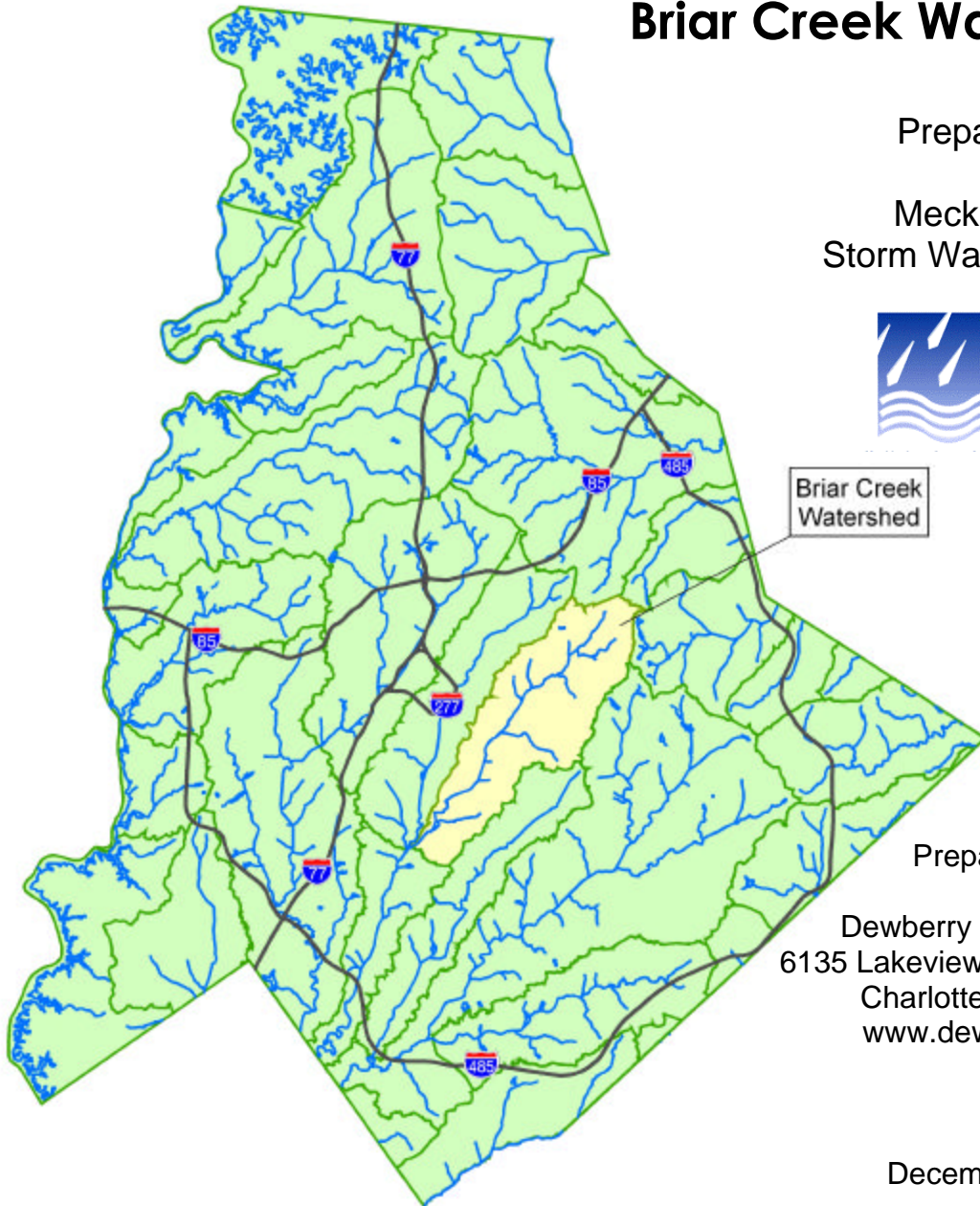
PRELIMINARY ENGINEERING REPORT

Watershed Study No. 7

Briar Creek Watershed

Prepared for

Mecklenburg
Storm Water Services



Briar Creek
Watershed

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December 2003

**MECKLENBURG COUNTY
STORM WATER SERVICES**

**PRELIMINARY ENGINEERING REPORT
FOR
WATERSHED STUDY No. 7**

BRIAR CREEK WATERSHED

ACKNOWLEDGEMENT

The project staff of Dewberry would like to express our sincere appreciation to Mecklenburg County Storm Water Services (MCSWS) for its assistance and support during this project.

DISCLAIMER

This watershed-wide study is for planning purposes only. These study results and recommendations are preliminary and should not be used for construction without additional detailed engineering design analysis.

CERTIFICATION

I hereby certify that this Preliminary Engineering Report for Watershed Study No. 7, Briar Creek Watershed, for Mecklenburg County was prepared by me or under my direct supervision.

Signed, sealed, and dated this 4 day of December 2003.

By: _____
Neal Banerjee, PE
Project Engineer

(SEAL)

**MECKLENBURG COUNTY
STORM WATER SERVICES
PRELIMINARY ENGINEERING REPORT
FOR
WATERSHED STUDY NO. 7**

BRIAR CREEK WATERSHED

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GLOSSARY

1% Annual Chance Flood:	The 1% annual chance flood is the flood that has a 1% chance of being equaled or exceeded in any given year, which is referred to as the “100-year flood,” in general.
Base Flood Elevation (BFE):	Water surface elevation based on the 1% annual chance flood (100-year flood).
Best Management Practice (BMP):	A structural (e.g. buffer strip) or non-structural (e.g. regulatory) measure that is implemented to improve water quality.
Future Condition Floodplain (FCF):	Floodplain delineated for the 1% chance of flood event in any given year using future land use condition. It is currently defined as Floodplain Land Use Map (FLUM) in Mecklenburg County.
Community Encroachment Floodway	The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the community base flood, without cumulatively increasing the water surface elevation more than 0.1 feet. No structure or fill may be added without special permit.
Existing Condition Floodplain:	Floodplain delineated for the 1% chance of flood event in any given year using current land use condition. It is defined as the same as within the Flood Insurance Rate Map (FIRM).
FEMA	Federal Emergency Management Agency
FEMA Floodway	The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the FEMA base flood, without cumulatively increasing the water surface elevation more than 0.5 feet.
MCSWS	Mecklenburg County Storm Water Services Department
WSE	Water surface elevation
WWTP	Waste water treatment plant

EXECUTIVE SUMMARY

BRIAR CREEK WATERSHED

This Preliminary Engineering Report (PER) summarizes the methods, findings, and recommendations from a flood hazard mitigation and environmental restoration planning study for the Briar Creek Watershed. The primary focus of this preliminary report was to conduct a review of pertinent stream/watershed information, assess flood damages, and investigate flood hazard mitigation alternatives within the regulated future condition floodplains (FCFs) in the Briar Creek Watershed. A secondary focus was to provide a broad-level characterization of environmental quality in the Watershed and to offer general recommendations for environmental restoration. Per the context of this study, environmental restoration opportunities were typically only identified in conjunction with flood hazard mitigation improvement alternatives. It is important to note that the conclusions and recommendations provided in this report are based on broad planning level analysis, and thus should not be used for construction without additional detailed engineering analysis.

The Briar Creek Watershed encompasses a 21.6 square mile urban area in the east-central portion of Mecklenburg County, North Carolina. The Watershed contains four County-regulated streams with FCFs that were included in this study – Briar Creek, Edwards Branch, Briar Creek Tributary #1, and Briar Creek Tributary #2.

Flood Hazard Mitigation

There are 897 structures within the FCF boundaries in the Briar Creek Watershed. Comparison of flood information with building elevation certificates revealed that 367 of the 897 structures have their lowest finished floor below the predicted water surface elevation (WSE) of the FCF, and thus are considered “flooding” structures. Flood damages for these 367 buildings were estimated using the FEMA Full Riverine Benefit:Cost model (FEMA BC), and totaled to over \$399 million (2003 dollars). Figure E-1 shows an overall map of the Briar Creek Watershed and displays problem areas identified in the study.

Several alternatives were developed to mitigate flood damages for problem areas identified along the study streams. For general project ranking purposes, a benefit:cost (BC) economic analysis was performed to evaluate cost-effectiveness of the alternatives at each problem area. The alternatives were then compared for their economic, technical, and social feasibility, from which a recommended mitigation strategy was developed for each problem area. If no improvement alternatives were identified as being cost effective or technically feasible, no action was recommended (i.e. leave building as-is).

The alternative evaluation indicated that it is cost-effective (or otherwise pertinent) to provide flood protection for 244 of the 367 flooding buildings. The estimated benefits (i.e. damages reduced) and improvement costs are approximately \$393.9 million and \$47.1 million respectively. This indicates that roughly 66% of the buildings are receiving approximately 99% of the flood damages, and that focusing mitigation efforts on these buildings will provide the most return for mitigation dollars spent.

It should be noted that per direction of Mecklenburg County Storm Water Services (MCSWS), all structures within the community encroachment (0.1 foot) floodway were recommended for acquisition, regardless of their cost-effectiveness (i.e. B:C ratio). Public safety (the floodway is considered an especially hazardous area due to high velocities and potential debris hazards) and the fact that local floodplain regulations greatly restrict potential construction/re-construction in the floodway, were the primary considerations for the decision to recommend acquisition for all structures in the community encroachment floodway. In the Briar Creek Watershed, there were a total of 221 buildings recommended

for acquisition. The analysis conducted in this study estimated that 89 (40%) of these buildings are not cost-effective for acquisition. For the 155 buildings that were identified as being cost-effective for flood mitigation (=244 – 89), the estimated benefits and costs were \$388.6 million and \$29.7 million, yielding a B:C ratio of 13.1. Figures E-2 through E-10 show the recommended mitigation improvements within the Briar Creek Watershed.

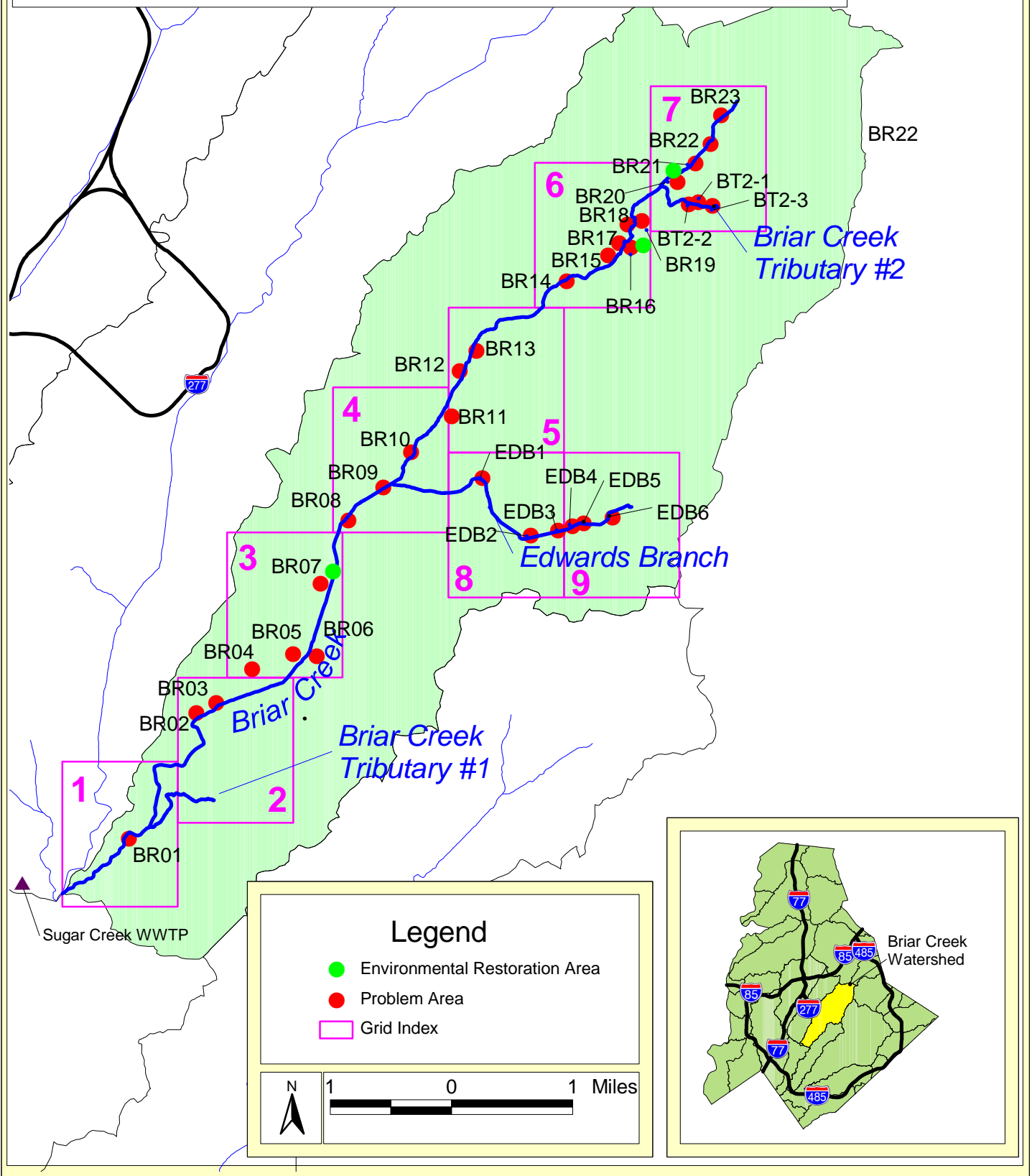
Environmental Characterization

The Briar Creek Watershed is located in an established, highly urbanized area within the City of Charlotte. Land use is predominately residential (> 85%), but also includes limited commercial, industrial, vacant, and other uses. The streams in the Watershed have been modified (e.g. straightened, widened, armored, etc.) to accommodate urbanization, and thus do not exhibit natural, healthy stream characteristics. Reference to local water/biological monitoring data indicates that overall conditions are “good to excellent” and have been improving over the last several years. However, benthic sample readings in the Watershed have consistently been classified as “poor” at several sites.

The County has completed several environmental restoration related projects (discussed in Section 1.2). In addition, the County owns and has been actively purchasing significant portions of vacant land adjacent to the study streams within the Briar Creek Watershed. This land will likely be used for proposed greenways along the Creek, which in turn will likely incorporate water quality and/or environmental restoration features.

The majority of environmental analysis included in this PER are broad in nature, however, several locations were identified for potential environmental restoration within the Watershed (Figures E-2 through E-10). In addition, it is recommended that more detailed analysis be conducted at a smaller scale level to investigate other environmental restoration opportunities.

Figure E-1. Briar Creek Watershed

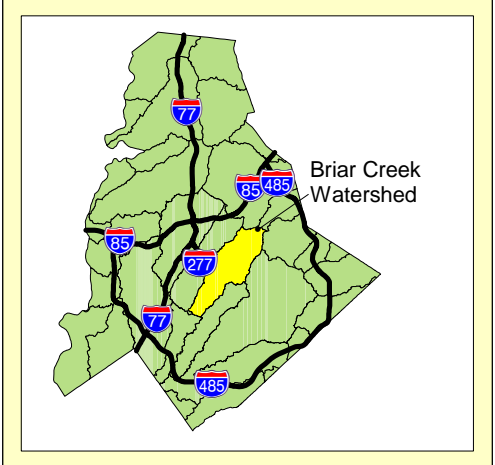


Legend

- Environmental Restoration Area
- Problem Area
- Grid Index

N

1 0 1 Miles



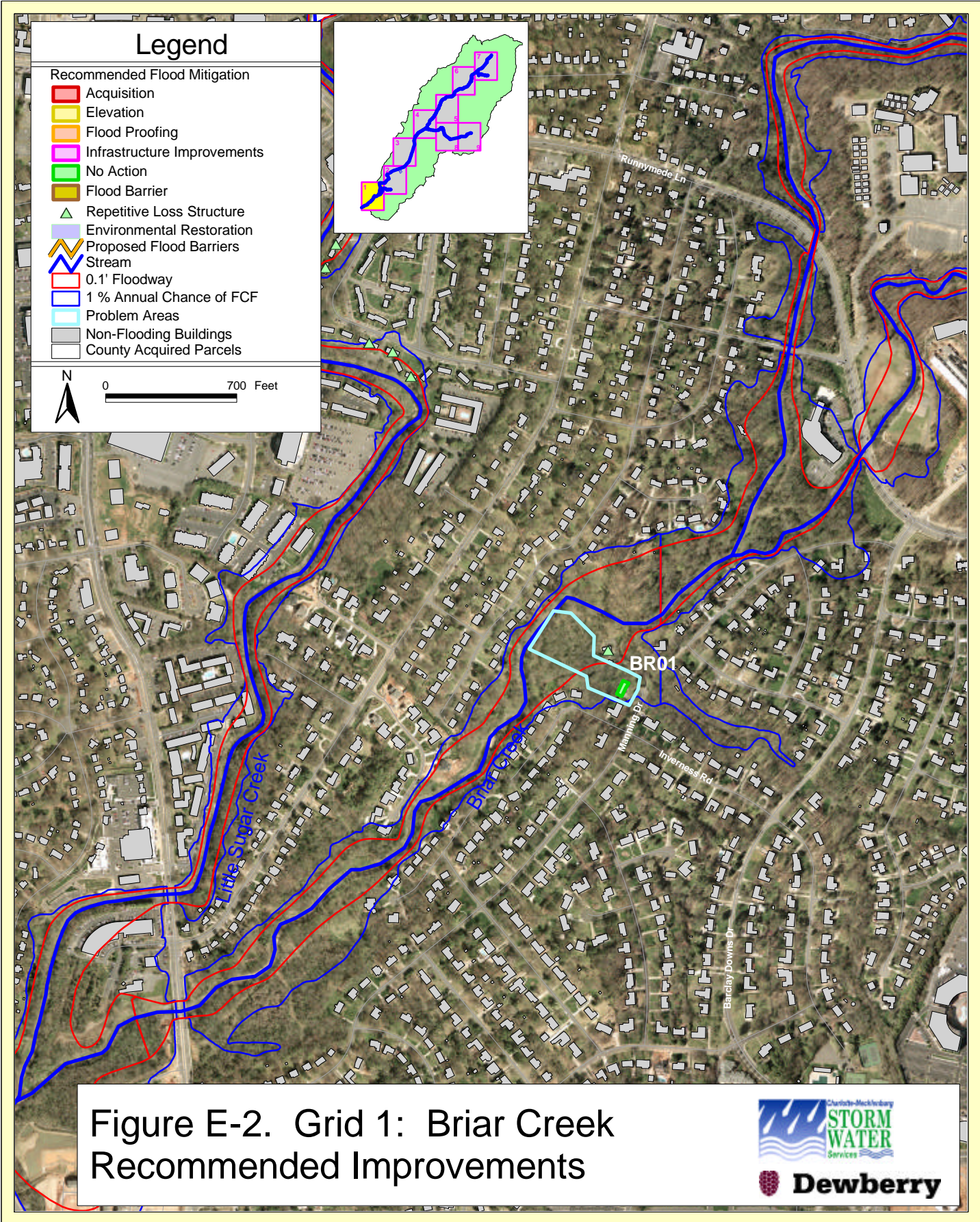


Figure E-2. Grid 1: Briar Creek Recommended Improvements



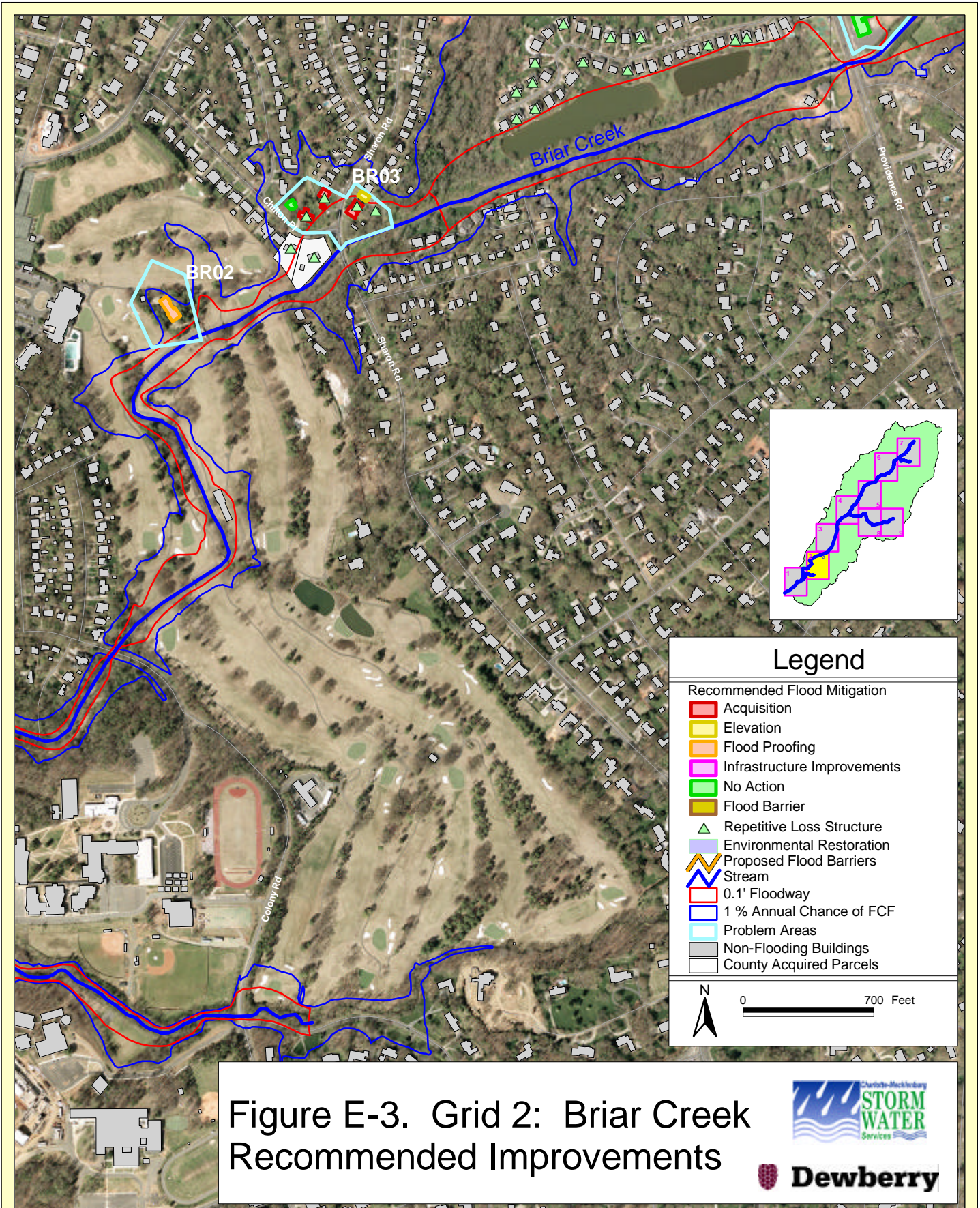


Figure E-3. Grid 2: Briar Creek Recommended Improvements



Figure E-4. Grid 3: Briar Creek Recommended Improvements



Legend

- Recommended Flood Mitigation**
- Acquisition
 - Elevation
 - Flood Proofing
 - Infrastructure Improvements
 - No Action
 - Flood Barrier
 - ▲ Repetitive Loss Structure
 - Environmental Restoration
 - ▲ Proposed Flood Barriers
 - ▲ Stream
 - ▭ 0.1' Floodway
 - ▭ 1% Annual Chance of FCF
 - ▭ Problem Areas
 - ▭ Non-Flooding Buildings
 - ▭ County Acquired Parcels

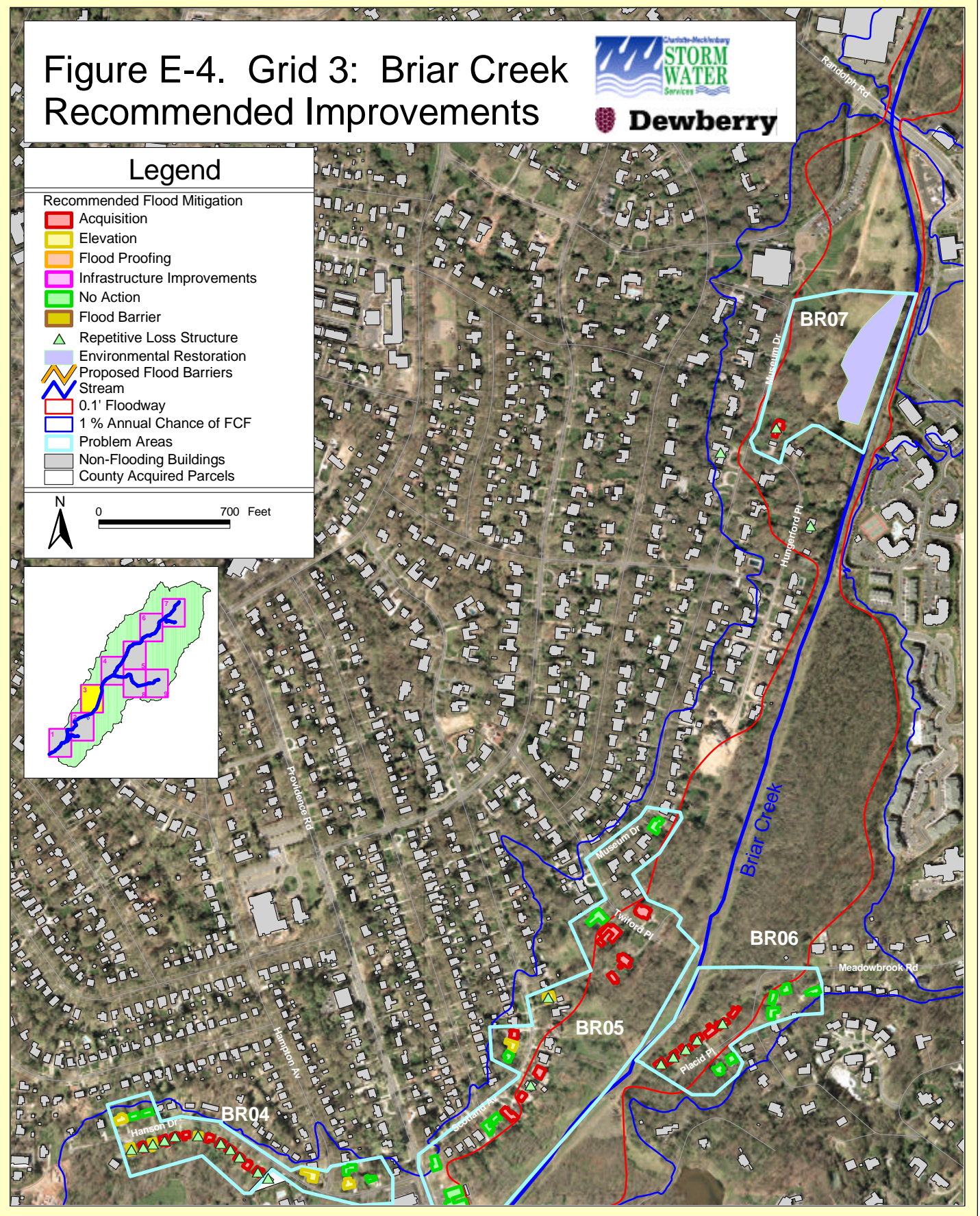
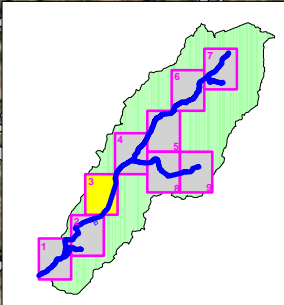
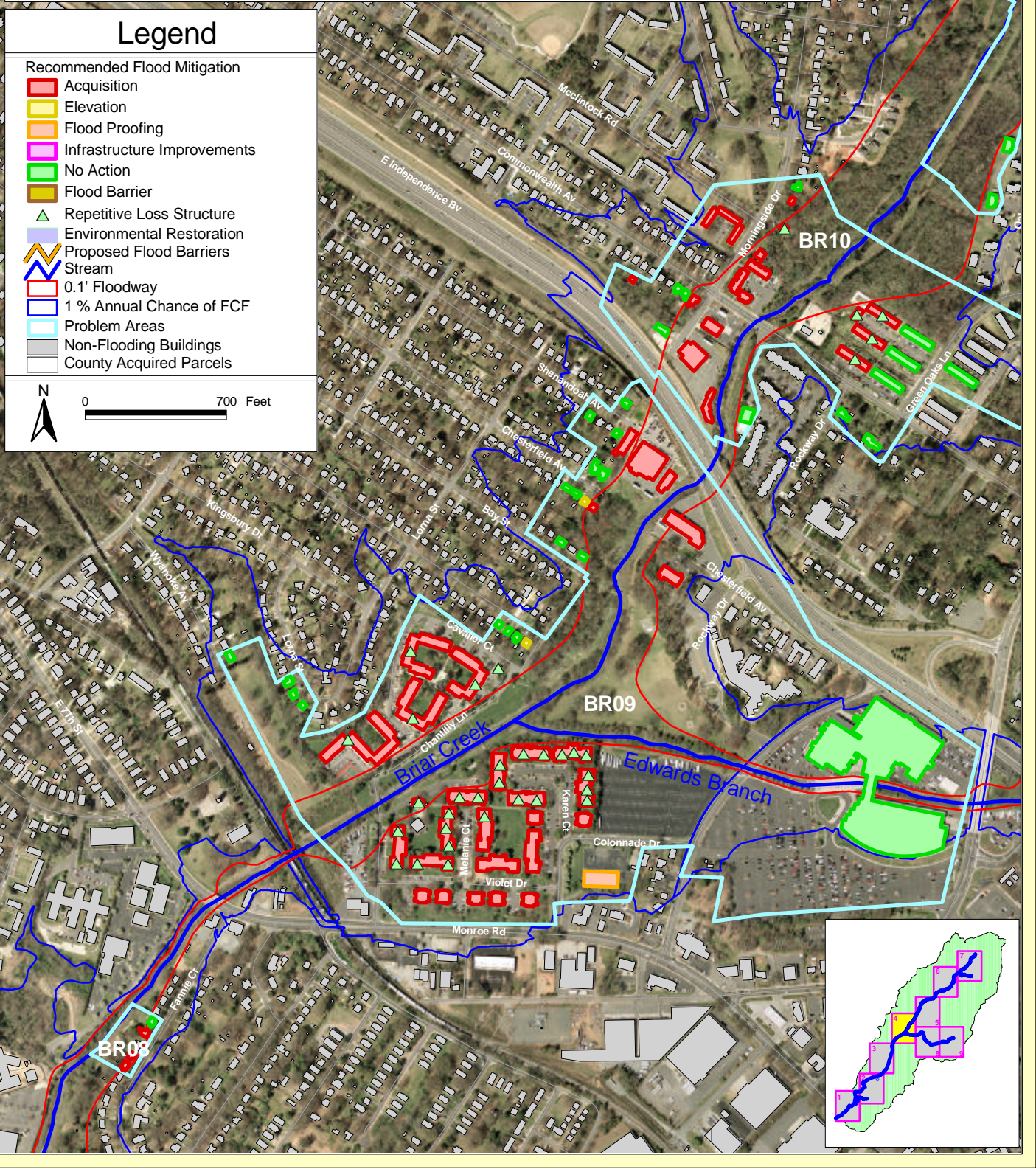
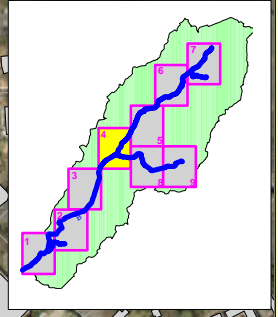
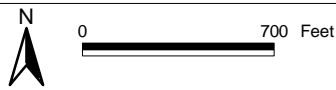


Figure E-5. Grid 4: Briar Creek Recommended Improvements



Legend

- Recommended Flood Mitigation
 - Acquisition
 - Elevation
 - Flood Proofing
 - Infrastructure Improvements
 - No Action
 - Flood Barrier
- Repetitive Loss Structure
- Environmental Restoration
- Proposed Flood Barriers
- Stream
- 0.1' Floodway
- 1% Annual Chance of FCF
- Problem Areas
- Non-Flooding Buildings
- County Acquired Parcels



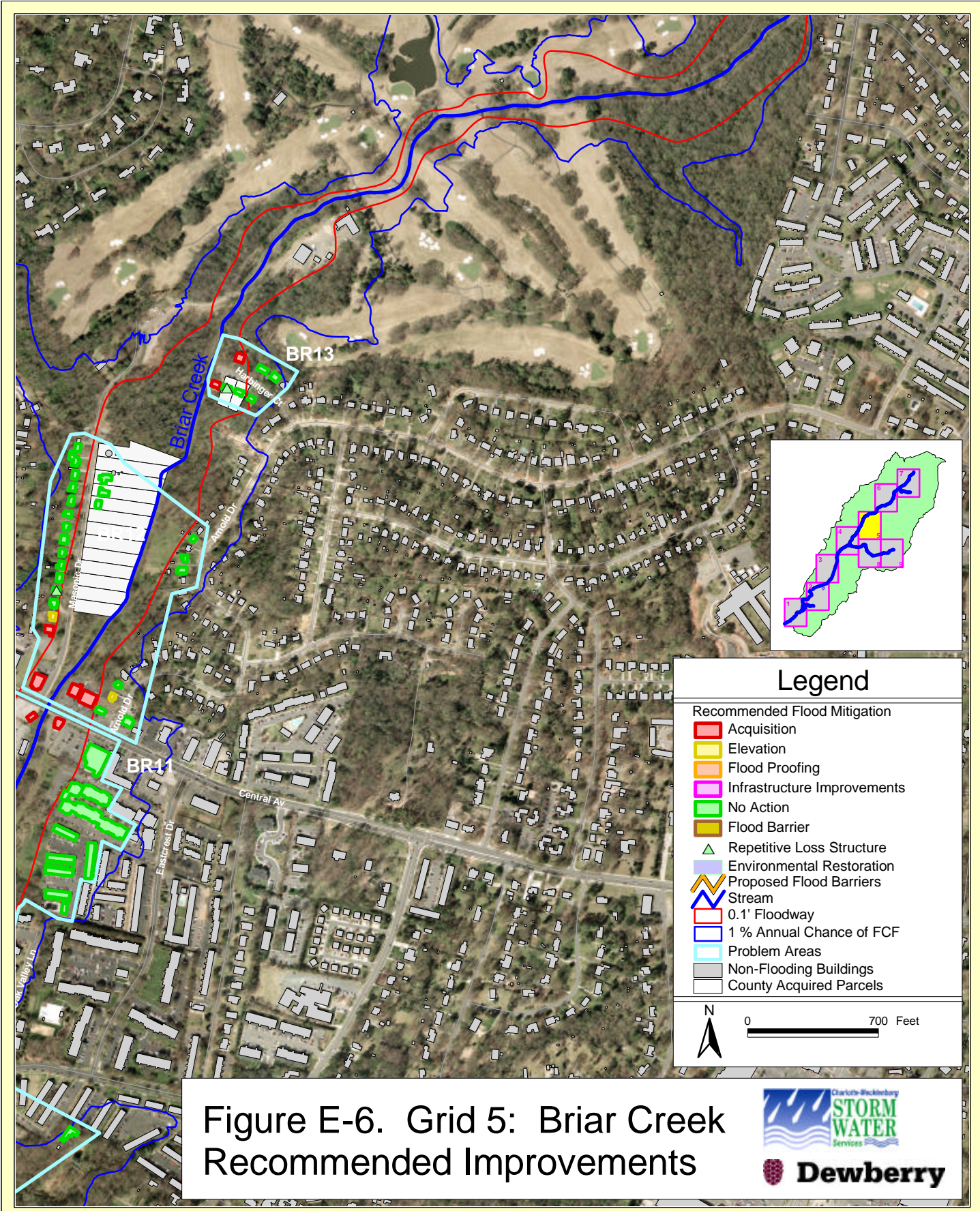


Figure E-7. Grid 6: Briar Creek Recommended Improvements



Legend

- Recommended Flood Mitigation
- Acquisition
 - Elevation
 - Flood Proofing
 - Infrastructure Improvements
 - No Action
 - Flood Barrier
 - Repetitive Loss Structure
 - Environmental Restoration
 - Proposed Flood Barriers
 - Stream
 - 0.1' Floodway
 - 1 % Annual Chance of FCF
 - Problem Areas
 - Non-Flooding Buildings
 - County Acquired Parcels

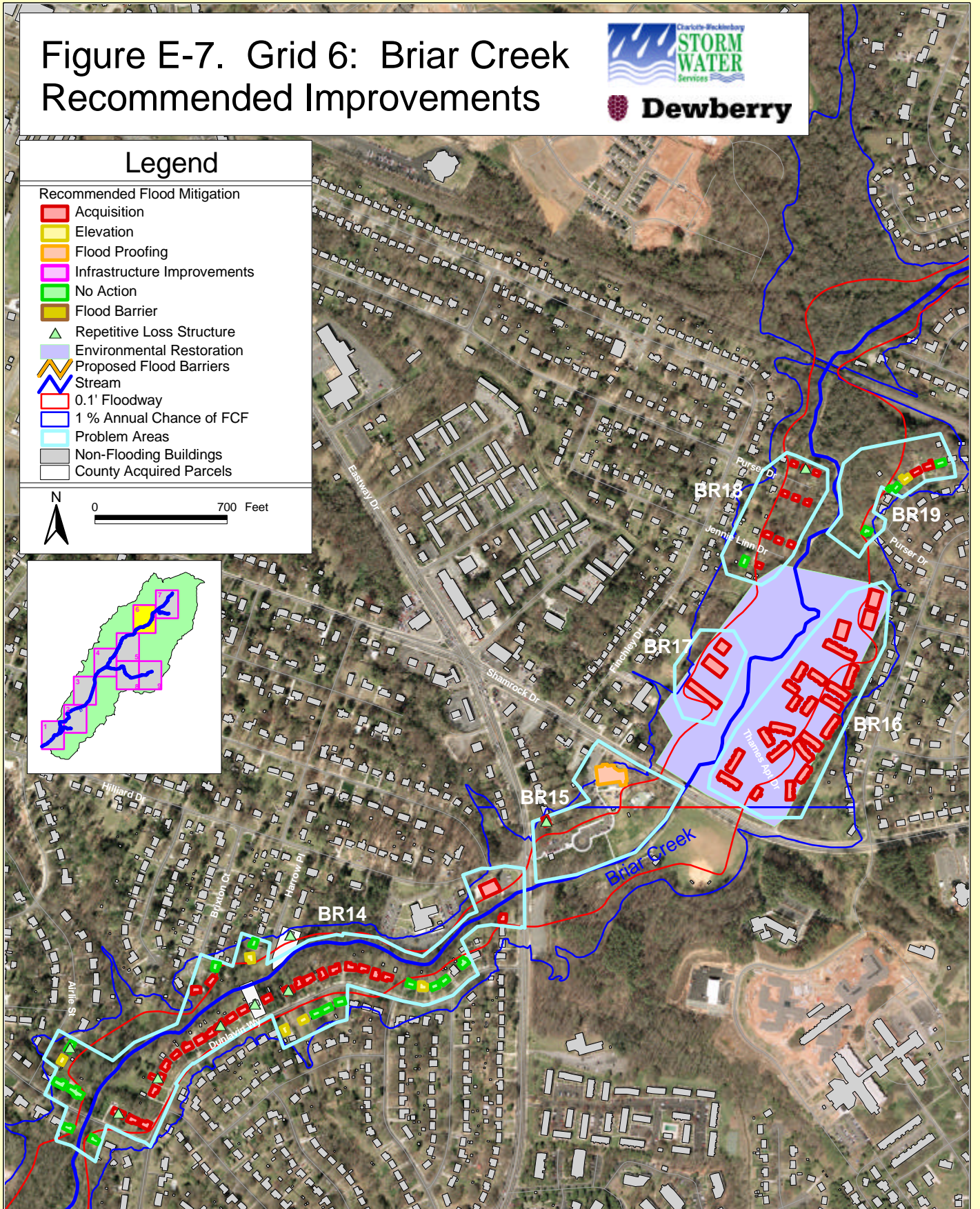
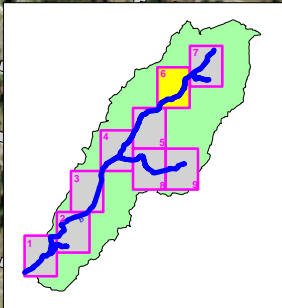


Figure E-8. Grid 7: Briar Creek Recommended Improvements



Legend

Recommended Flood Mitigation

- Acquisition
- Elevation
- Flood Proofing
- Infrastructure Improvements
- No Action
- Flood Barrier
- ▲ Repetitive Loss Structure
- Environmental Restoration
- ▾ Proposed Flood Barriers
- ▬ Stream
- ▬ 0.1' Floodway
- ▬ 1 % Annual Chance of FCF
- ▬ Problem Areas
- Non-Flooding Buildings
- County Acquired Parcels

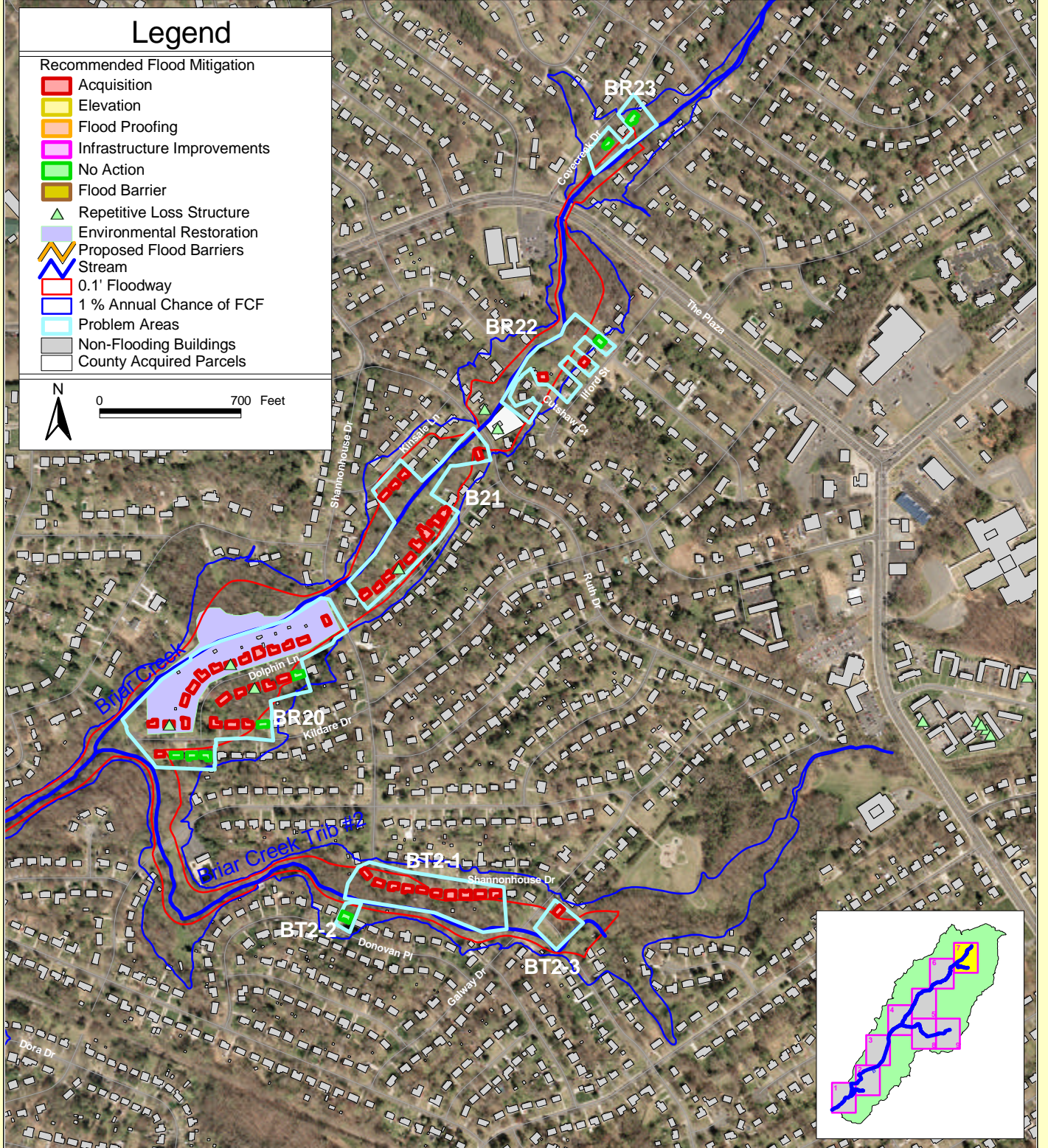
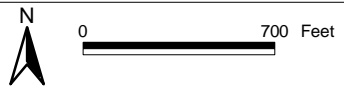
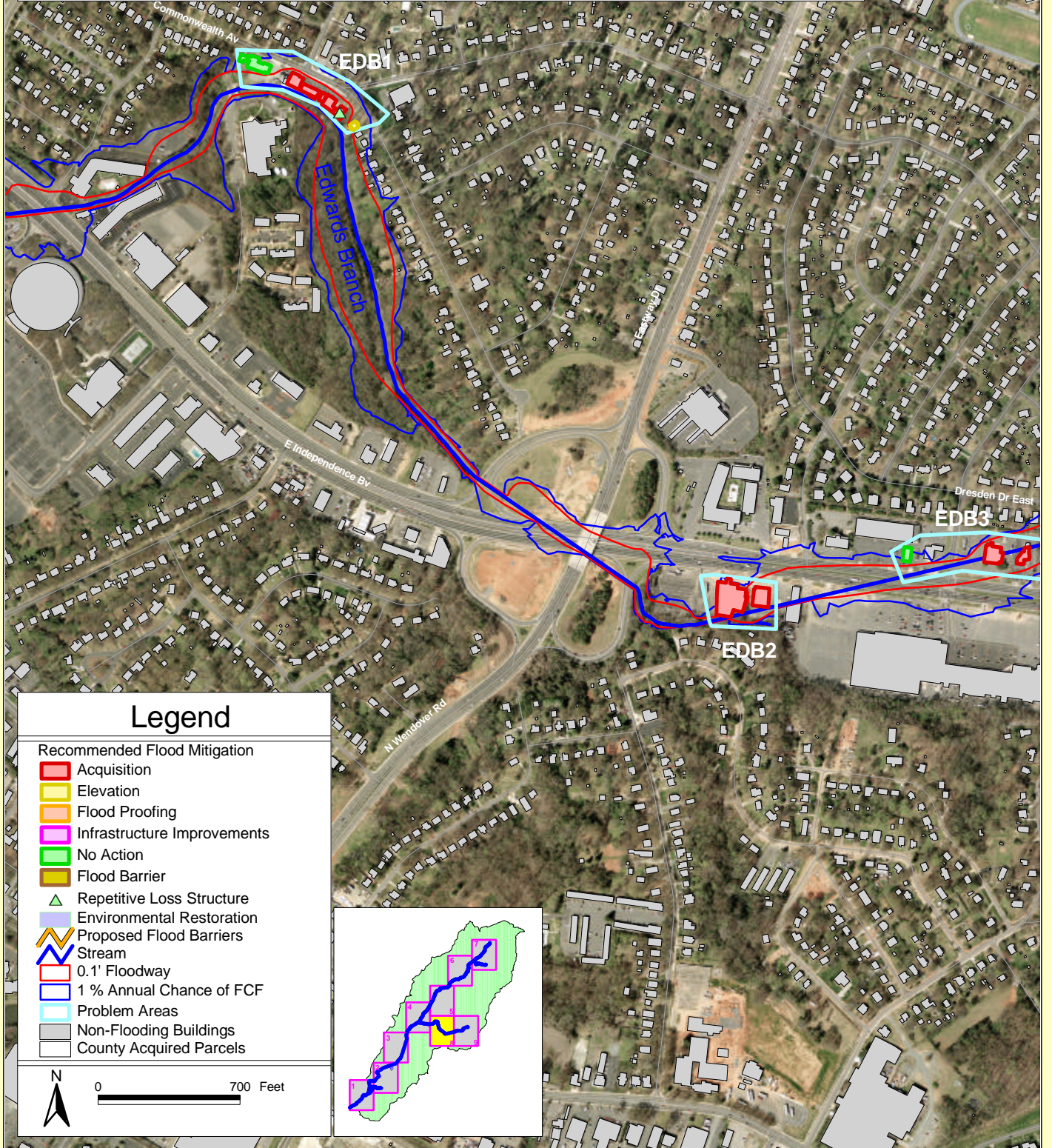


Figure E-9. Grid 8: Briar Creek Recommended Improvements



Legend

- Recommended Flood Mitigation**
- Acquisition
- Elevation
- Flood Proofing
- Infrastructure Improvements
- No Action
- Flood Barrier
- Repetitive Loss Structure
- Environmental Restoration
- Proposed Flood Barriers
- Stream
- 0.1' Floodway
- 1 % Annual Chance of FCF
- Problem Areas
- Non-Flooding Buildings
- County Acquired Parcels



0 700 Feet

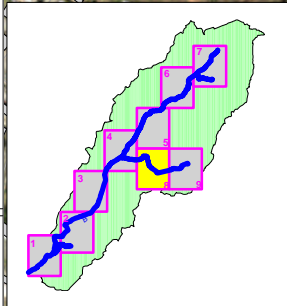
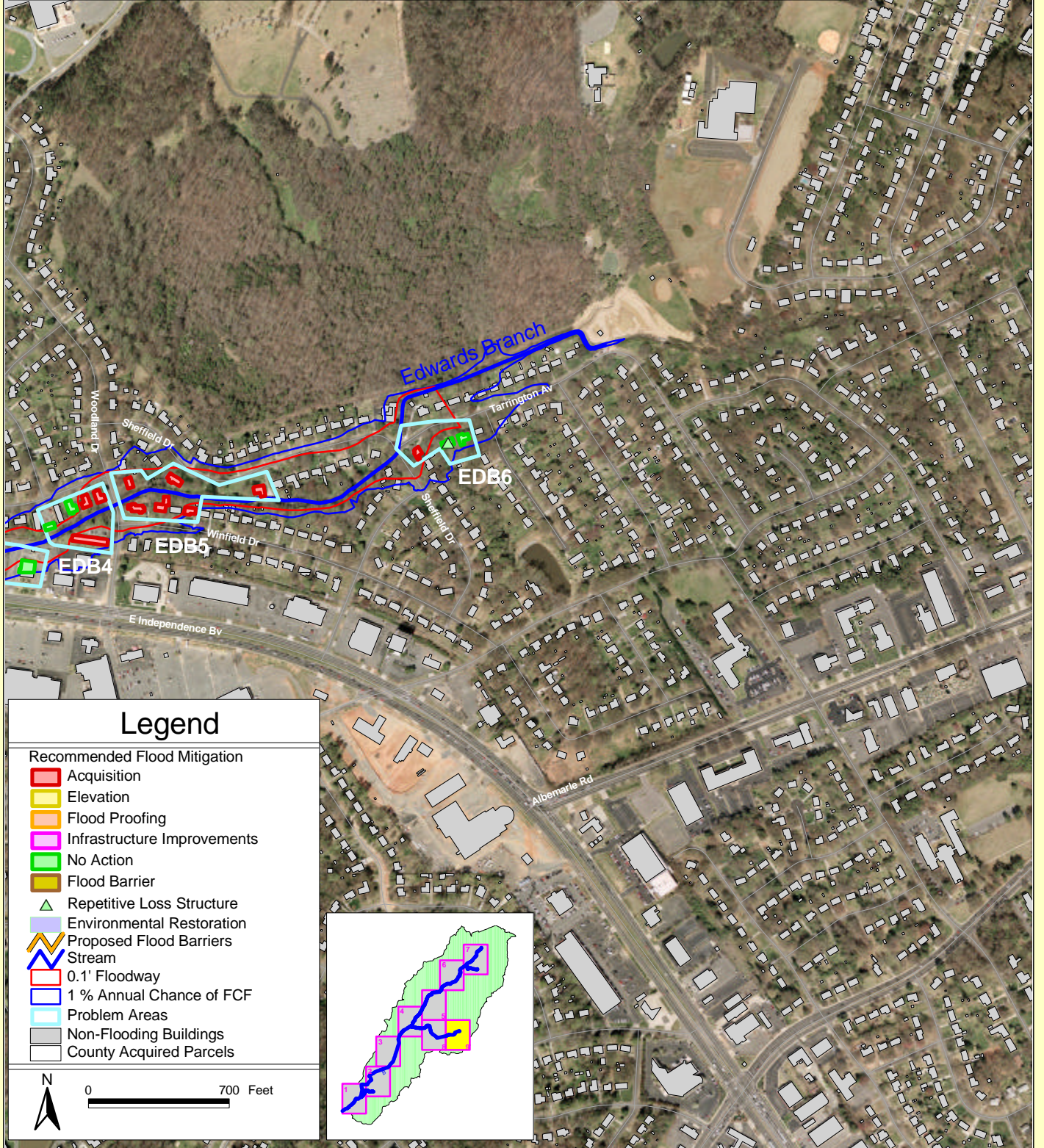


Figure E-10. Grid 9: Briar Creek Recommended Improvements



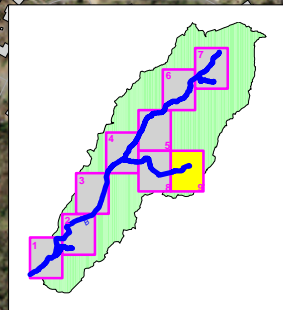
Legend

Recommended Flood Mitigation

- Acquisition
- Elevation
- Flood Proofing
- Infrastructure Improvements
- No Action
- Flood Barrier
- ▲ Repetitive Loss Structure
- Environmental Restoration
- ▬ Proposed Flood Barriers
- ▬ Stream
- 0.1' Floodway
- 1 % Annual Chance of FCF
- Problem Areas
- Non-Flooding Buildings
- County Acquired Parcels



0 700 Feet



1. GENERAL WATERSHED CONDITIONS

1.1. Watershed Characteristics

Briar Creek Watershed encompasses a 21.6 square mile urban area in the east-central portion of the Mecklenburg County, North Carolina. The Watershed is one of thirty-three major watersheds in the County and drains in a southwestern direction towards the Catawba River. Briar Creek Watershed is located entirely within the City of Charlotte municipal limits, and is generally bounded by Grier Road to the northeast, Tyvola Road to the southwest, Sharon Amity to the southeast, and The Plaza to the northwest.

The topography of the Briar Creek Watershed is generally characterized by relatively steep upland slopes and well-defined drainage features, as are typical of Piedmont areas. Soils in the Watershed are predominately NRCS Hydrologic Group B soils, which have relatively low runoff potential.

The Briar Creek Watershed contains four streams that have mapped, future condition floodplains (FCFs, also referred to as FLUM floodplains) - Briar Creek, Edwards Branch, and two unnamed tributaries to Briar Creek, hereafter referred to as Briar Creek Tributary 1 and Briar Creek Tributary 2. These streams and their associated FCFs were analyzed in this Preliminary Engineering Report (PER) for developing potential flood hazard mitigation and environmental restoration alternatives, and are described below.

Briar Creek

Briar Creek flows in a southwestern direction from upstream of The Plaza to its confluence with Little Sugar Creek just upstream of Tyvola Road - a distance of approximately 9.9 miles. The Creek runs through highly residential areas for almost its entire length, with the exception of two golf courses (Charlotte County Club and Myers Park Country Club), and a commercial area in the vicinity of Independence Boulevard.

The Briar Creek main channel exhibits different characteristics along its length, but can be generally described as a straight, relatively wide, trapezoidal channel with steep banks and a relatively shallow normal flow depth. The upper reaches tend to exhibit narrower banks and steeper channel slopes, whereas, the lower reaches have wider banks, milder slopes, and finer bed materials. Sand and silt bed material characterizes a majority of the stream length, however, there are a few locations, such as a reach near Myers Park High School, where significant bedrock is present. Although the Briar Creek Watershed is highly urbanized, a riparian zone exists for most of the channel. This zone offers significant tree cover along the immediate channel overbanks.

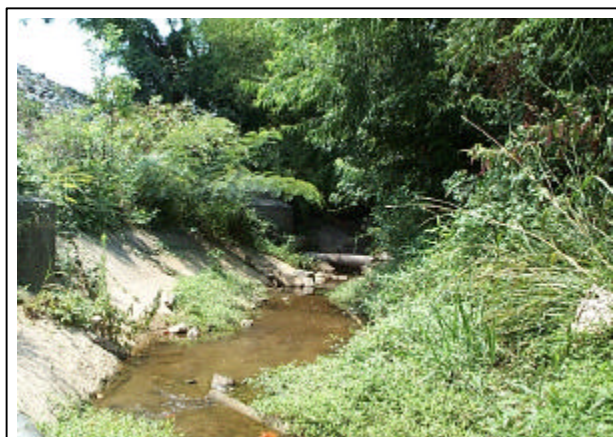


Figure 1. Briar Creek – Looking upstream from Central Avenue.

Significant bank erosion and corresponding heavy sediment loading has been observed by MCSWS (see Figures 2 and 3) and others at several locations along the Creek. To address this issue, MCSWS has coordinated several studies and stream enhancement projects in recent years, most notably, a stream bank stabilization and habitat enhancement project completed in February 2002. The project utilized bio-engineering techniques to stabilize eroded banks, and the installation of in-stream structures to enhance aquatic habitat, on a 1.5 mile section of Briar Creek between Michael Baker Place and Tyvola Road.



Figure 2. Briar Creek – Moncure Drive area before stabilization (provided by MCSWS).



Figure 3. Briar Creek – Moncure Drive area after stabilization (provided by MCSWS).

Edwards Branch

The Edwards Branch study reach (Edwards Branch) is located in the middle portion of the Briar Creek Watershed. It flows in a western direction from upstream of Sheffield Drive to its confluence with Briar Creek, for a distance of approximately 2.5 miles. Unlike the other tributaries in the Briar Creek Watershed, much of Edwards Branch flows through a heavy commercial/transportation area, and thus has undergone major modifications such as straightening, piping, and lining. The tributary crosses under several major thoroughfares (e.g. Independence Boulevard, Eastway Drive, etc.) through long culverts (i.e. > 1000 feet) and is lined with concrete or riprap for significant lengths. The channel bed material, shape, and vegetation characteristics vary throughout the tributary.



Figure 4. Edwards Branch – Looking downstream from Eastway Drive.

Briar Creek Tributary 1

The Briar Creek Tributary 1 study reach (Briar Creek Tributary 1) is located in the lower portion of the Briar Creek Watershed. It flows in a southwestern direction from just upstream of Colony Road to its confluence with Briar Creek, for a distance of approximately 0.8 miles. The tributary flows through a relatively uniform channel within a well established riparian zone along the South edge of Myers Park High School for much of its length. The channel bed is comprised of primarily sandy-silty material with limited cobble and rock.

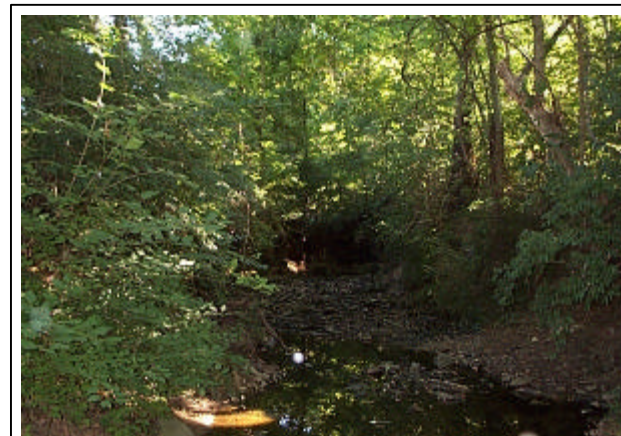


Figure 5. Briar Creek Tributary 1 – Looking upstream from Runnymede Lane.

Briar Creek Tributary 2

The Briar Creek Tributary 2 study reach (Briar Creek Tributary 2) is the upper-most tributary in the Briar Creek Watershed. It flows in a western direction from just upstream of Slagle Drive to its confluence with Briar Creek, for a distance of approximately 0.7 miles. The tributary begins as a small silt-bed channel in an open, grassed area. It transitions to a more cobble bed, tree-line channel downstream of Galway Drive, where it flows along the back of residential properties to its outlet at Briar Creek.

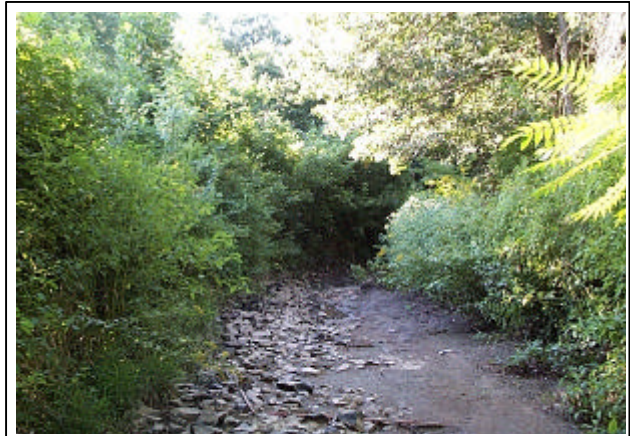


Figure 6. Briar Creek Tributary 2 – Looking downstream from Grafton Drive.

1.2. Development in the Watershed

Identifying existing and future development conditions and activities is an important part of watershed-wide planning. Many of these issues can have a direct or indirect impact in evaluating the feasibility of potential flood mitigation and environmental restoration measures. Examples of pertinent development issues include: land development patterns, land use characteristics, proposed new development, existing proposed utilities, and proposed capital improvement projects (CIPs). These issues are further discussed in the following paragraphs.

As noted in the previous section, the Briar Creek Watershed is one of the most centralized and urbanized watersheds in Mecklenburg County, thus much of the Watershed is at, or near, built-out land use conditions. New development and re-development on a watershed-wide basis has steadily decreased over the last half century, however, limited new development is still planned. Mecklenburg County GIS (2002) shows preliminary plans for new development at three locations within the Briar Creek Watershed:

- a 29 lot single family residential development located to the north of St. Johns Church Road (in the uppermost portion of the Watershed)
- a 174 lot multi-family residential development located near the intersection of Randolph Road and Wenwood Road
- a 6 lot multi-family residential development located at the intersection of Matheson Avenue and East Ford Road.

Land use in the Briar Creek Watershed is predominately residential (>85%), with scattered pockets of commercial, office, industrial, and open/vacant land. The majority of residential land use is medium-high density (i.e. ¼ acre lot size), single-family properties located within established neighborhood districts (e.g. Plaza-Midwood, Myers Park, Grier Heights, etc.). Commercial/Industrial land uses are generally concentrated along the major thoroughfares – Independence Boulevard, Monroe Road, Eastway Drive, and The Plaza. Open/vacant areas such as parks, undisturbed parcels, and school lands are scattered throughout the Watershed. A summary of development patterns and current land use conditions is provided in Table 1 below.

Table 1. Development in the Briar Creek Watershed

	Year Developed					Vacant/ Unclassified	Total
	Before 1961	1961-1970	1971-1980	1981-1990	1991-2000		
Parcels	12,878	6,577	2,513	2,322	1,101	1,770	27,161
Percentage	46.4%	24.2%	9.3%	8.5%	4.1%	6.5%	100%

	Land Use as of 2002					Total
	Single Family	Other Residential	Non-Residential	Vacant/ Unclassified		
Parcels	19,304	4,089	1,998	1,770		27,161
Percentage	71.1%	15.1%	7.4%	6.5%		100.0%

Note: Includes entire Briar Creek Watershed, including all tributaries (21.6 sq. miles)

Being an urbanized area, infrastructure utilities are present throughout the Briar Creek Watershed. Sanitary sewers are typically the most pertinent utility in relation to stream projects since they often run adjacent to stream channels and may have several crossings. Sanitary sewers are present along Briar Creek and several tributaries. A major interceptor generally runs along the west overbank of Briar Creek that collects sewage from the smaller system components and transports it to the Sugar Creek Treatment Plant, just downstream of Tyvola Road (in the Lower Sugar Creek Watershed). The Charlotte-Mecklenburg Utilities (CMU) 5-year capital improvement project map indicates a proposed sanitary sewer relief project for the interceptor along Briar Creek.

Storm sewers are another significant consideration in flood mitigation, since they exist throughout the Briar Creek Watershed, and discharge to the study creeks at numerous locations. City SWS currently has nine active CIP projects, as well as several pending planning/design projects (Figure 7). In addition, MCSWS has recently completed a number of studies within the Watershed and has several current/future projects. Several notable recent/existing projects include:

- Four mitigation reach studies along Briar Creek (completed 2001).
- Edwards Branch Water Quality Project (completed 2001).
- Automated flood warning system station on Briar Creek near Monroe Road

The reader is referred to MCSWS (www.stormwaterservices.com) for more detailed information on existing and future projects in the Briar Creek Watershed.

Other utilities (water, power, phone, etc.) are scattered throughout the Briar Creek Watershed, as well. Waterlines and gaslines cross the creeks in the watershed along several of the thoroughfares. Mecklenburg County GIS does not indicate any major transmission lines in the vicinity of Briar Creek or its tributaries, however, power lines and utilities poles are present at many locations.

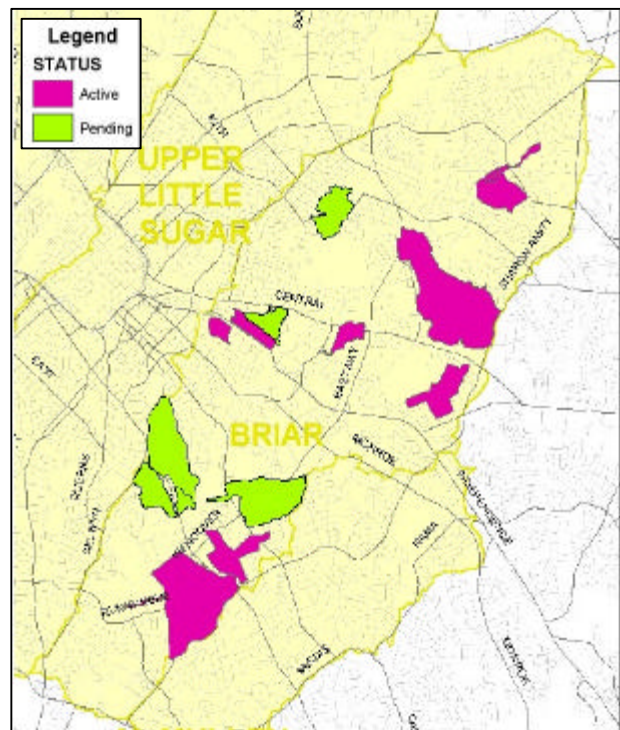
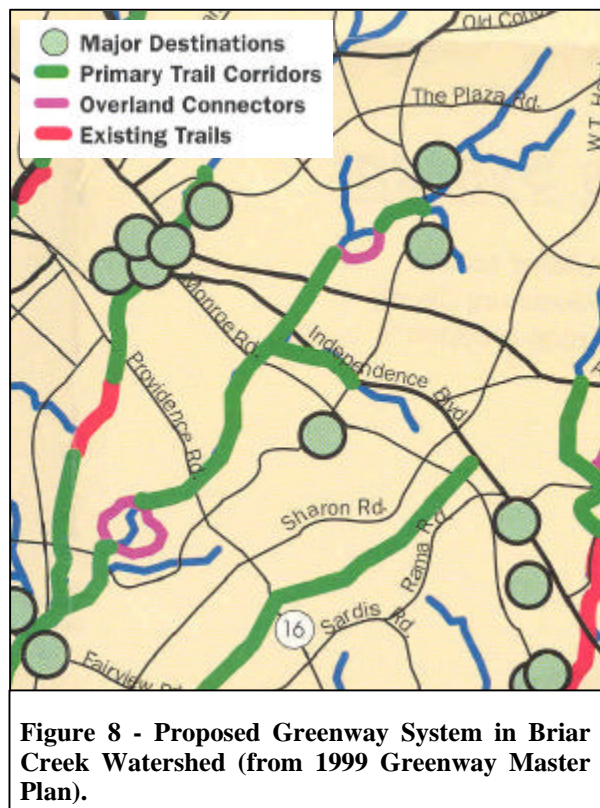


Figure 7. City of Charlotte Storm Water Services Capital Improvement Projects (CIPs)

Although there are no existing greenways within the Briar Creek Watershed, the 1999 Mecklenburg County Greenway Master Plan recommends that the greenway system be expanded as a floodplain management buffer and water quality program to include almost all creeks and streams throughout the County. Future plans include three segments of greenway totaling 5.3 miles along Briar Creek, and a 2.3 mile greenway along Edwards Branch. Overland connectors would be used to connect all the segments to form a continuous path. Figure 8 depicts the future greenway system proposed in the Master Plan within the Briar Creek Watershed.



1.3. Aquatic Habitat and Environmental Monitoring

When available, monitoring data can be one of the best sources of information for evaluating site environmental conditions in a watershed. In addition to providing specific information on existing conditions, monitoring data may provide insight to patterns over time. Patterns identified in the monitoring data can be coupled with records of development and/or other activities to help develop a cause-effect relationship between activities in the watershed and environmental stressors (problems) that currently exist, or are likely to develop, based on current watershed patterns. Although a full environmental watershed assessment and data analysis is beyond the scope of this planning project, available monitoring data is identified and summarized below.

Mecklenburg County has a water quality program which maintains a system of approximately 49 water quality monitoring stations throughout the County. There are three basic types of environmental monitoring conducted at the stations:

- 1) Benthic macroinvertebrate sampling (i.e. taxa richness (EPT method))
- 2) Fish sampling (i.e. North Carolina Index of Biotic Integrity (NCIBI))
- 3) Ambient sampling (e.g. dissolved oxygen, nitrates, metals, oils, etc. – reported as composite Water Quality Index (WQI)).

Biological (fish and macroinvertebrate) sampling is used to assess a streams ability to support abundant and diverse populations of aquatic life, and thus, is a direct measure of the aquatic health of a stream. Generally biological sampling protocols are based on the presence or non-presence of indicator species sensitive to pollutants or environmental stressors. A principal advantage of biological sampling is that it is generally less sensitive to short-term environmental changes, and represents a more composite, longer-term view of aquatic health. A limitation of biological sampling is that although it answers the direct question of “how/what” is the aquatic health of the stream, it does not indicate “why” it is such.

Ambient sampling is used to assess the chemical and physical properties of the stream flow, and to indirectly assess the aquatic health of a stream. When coupled with the biological sampling, ambient data can help answer the question to as “why” the aquatic health of a stream is the status that it is. Ambient sampling is also helpful in evaluating whether the water meets water quality standards (e.g. enough dissolved oxygen, appropriate temperature, etc.), as well as, identifying the presence of potential pollutants that may hinder healthy conditions (e.g. excess metals, oil, etc.). One limitation of ambient sampling is that since it is representative of in-stream conditions at a given point(s) in time, it is highly variable – constituent levels are often sensitive and are affected by changes in environmental conditions (e.g. diurnal and seasonal patterns, wet versus dry weather, etc.). To help assess the data from the many sampled constituents, Mecklenburg County uses a “Water Quality Index” (WQI). The WQI integrates samples from the individual constituent samples to provide a composite or overall rating of the ambient water quality.

Organized monitoring of the stations began in the late 1980’s and continues today. The frequency of monitoring at each station is dependent on purpose of the station (i.e. project specific or general) and the type of information collected (i.e. chemical versus biological). Ambient chemical water quality data is generally collected every quarter, whereas macroinvertebrate is sampled annually. Fish sampling for the entire County was collected on a “one-time” basis between 1995 and 1999. However, the County has started conducting a new round of fish sampling that is expected to finish in the near future.

Mecklenburg County Water Quality Program (MCWQP) maintains four monitoring stations in the Briar Creek Watershed - two ambient water quality stations on Briar Creek, one ambient station on Edwards branch, and one bio-monitoring station on Edwards Branch. Macroinvertebrate Taxa Richness sampling has produced “Poor” rankings for all sites since 1994 with the exception of Briar Creek at the Park Road location (MC31) in July of 2001. This site received a “Fair” rating which indicates some improvements may have occurred.

Fish sampling from 1995, 1996, and 2001 produced rankings ranging from “Poor” to “Fair/Good”. The site on Edwards Branch at the Sheffield Drive site (MC30A) received the worst rating with a “Poor” mark in July 2001. Although, further downstream on Edwards Branch at the Briar Creek Road site (MC30) the rating is slightly better with a “Fair” mark in July of 1996. The Central Avenue site (MC30B) on Briar Creek received a “Fair/Good” rating in July 1996, while the Park Road site (MC31) received the same rating in October 1995.

Ambient water quality sampling along Briar Creek (MC30B and MC31) have indicated relatively good (and steadily improving) water quality ratings despite the low macroinvertebrate and fish rankings. Water quality indices have improved from “Fair/Good” water quality index ratings to “Good/Excellent” in 2001. Detailed analysis (beyond the scope of this study) is needed to better assess the reason for the conflicting water quality ratings. One possible hypothesis is that although the WQI, which is a composite ambient water quality rating, is good, one or more ambient constituents that are important for healthy aquatic life are at unsuitable levels. Table 2 summarizes the MCWQP monitoring data.

Table 2. MCDEP Water Quality Monitoring Summary

NC Piedmont Macroinvertebrate Taxa Richness											
		Aug-94		Jun-98		Aug-99		Sep-00		Jul-01	
Site	Location	S _{EPT}	WQ Rating	S _{EPT}	WQ Rating	S _{EPT}	WQ Rating	S _{EPT}	WQ Rating	S _{EPT}	WQ Rating
MC30A	Edwards Branch – Sheffield Drive	-	-	-	-	-	-	-	-	3	Poor
MC30	Edwards Branch – Briar Creek Road	2	Poor	3	Poor	-	-	-	-	-	-
MC30B	Briar Creek – Central Avenue	4	Poor	3	Poor	4	Poor	4	Poor	5	Poor
MC31	Briar Creek – Park Road	5	Poor	3	Poor	6	Poor	5	Poor	7	Fair

Fish Bioassessment											
		Oct-95		Jul-96		Aug-99		Jul-01		Oct-01	
Site	Location	NCIB I	WQ Rating	NCIB I	WQ Rating	NCIB I	WQ Rating	NCIB I	WQ Rating	NCIB I	WQ Rating
MC30A	Edwards Branch – Sheffield Drive	-	-	-	-	-	-	30	Poor	-	-
MC30	Edwards Branch – Briar Creek Road	-	-	42	Fair	-	-	-	-	-	-
MC30B	Briar Creek – Central Avenue	-	-	46	Fair/Good	-	-	-	-	42	Fair
MC31	Briar Creek – Park Road	46	Fair/Good	-	-	-	-	-	-	44	Fair

Water Quality Index											
		Jun-97		Jun-98		Apr-99		May-00		Apr-01	
Site	Location	WQI	WQI Rating	WQI	WQI Rating	WQI	WQI Rating	WQI	WQI Rating	WQI	WQI Rating
MC30A	Edwards Branch – Sheffield Drive	-	-	-	-	-	-	-	-	-	-
MC30	Edwards Branch – Briar Creek Road	-	-	-	-	-	-	-	-	-	-
MC30B	Briar Creek – Central Avenue	59	Fair/Good	61.72	Fair/Good	70.17	Good	69.3	Good	76.41	Good/Exc.
MC31	Briar Creek – Park Road	61.9	Fair/Good	67.95	Good	80.37	Good/Exc.	66.77	Good	77.67	Good/Exc.

In addition to the MCWQP monitoring stations, there are two USGS flow stations and three rain gages within the Briar Creek Watershed. A list of these stations and gages are provided below for general reference.

Table 3. USGS Stations and Mecklenburg County Rain Gages

Station/Gage ID	Type	Location
0214642825	USGS (flow)	Briar Creek above Shamrock Drive
0214645022	USGS (flow)	Briar Creek above Colony Road
351229080460245	County (rainfall)	Winterfield Elementary School
351229080480145	County (rainfall)	Chantilly Elementary School
351414080463245	County (rainfall)	Fire Station #15 off Frontenac Avenue

1.4. Rosgen Stream Morphology Assessment

Stream classification is a process where subject streams are analyzed and are grouped into discrete categories based on similar characteristics. Classification is beneficial and often used in stream restoration projects since it provides a consistent baseline for organizing, comparing, and managing streams. In addition, classification can offer insight on existing behavior and future trends of the stream.

There are several types of stream classification systems that categorize streams using different parameters (e.g. channel stability, sediment transport, etc.). This study utilized the Rosgen Stream Classification System, which is a hierarchical classification system (Levels I – IV) based on increasingly detailed morphological information. For the purposes of watershed-wide planning, the Level I (i.e. the most generalized classification) classification is appropriate. Detailed planning and/or design generally merit a Level II assessment or above.

A Rosgen Level I Assessment was conducted on the study streams within the Briar Creek Watershed to obtain a coarse geomorphic characterization for each study stream. The Rosgen Assessment qualitatively classifies a stream based on broad-scale quantitative assessments of basin relief, landform, and valley morphology characteristics. For this Level I analysis, topographic data, aerial photos, and HEC-RAS models were used to calculate stream sinuosity (i.e. a measure of how much a stream meanders) and channel slope for each study stream. These calculated values are presented below in the table below.

Table 4. Rosgen Level 1 Assessment: Geomorphic Characterization				
	Channel Length (mi)	Valley Length (mi)	Channel Sinuosity	Channel Slope (percent)
Briar Creek	9.92	8.83	1.12	0.14
Briar Creek Tributary #1	0.83	0.76	1.14	0.62
Edwards Branch	2.46	2.39	1.03	0.49
Briar Creek Tributary #2	0.66	0.62	1.06	0.57

The information presented above and several previous more detailed studies indicate that the main stem of Briar Creek can be classified as a Type E channel (although less steep and sinuous). Type E channels are generally characterized by slight entrenchment, low width to depth ratios, and relatively high sinuosity within a broad valley. A natural Type E stream is generally considered to be very efficient and stable, although in the case of Briar Creek there are many exceptions to this generalization.

The tributaries to Briar Creek are generally less sinuous and more steeply sloped than the main stem, and thus may be classified as Type G channels (again, less steep and sinuous). Type G channels are generally characterized by a low sinuosity, mild slopes, and a low bankfull width/depth ratio. These conditions often lend to undesirable high bank erosion rates, and channel instability. This is consistent with the fact that the creek banks have been armored along numerous sections with riprap to reduce bank erosion.

It is important to note that the urban development of Charlotte has significantly altered the natural stream system (i.e. straightening, widening, armoring, etc), which has diminished the influence that the general geomorphic information (used in a Level 1 analysis) has on channel morphology. In addition, stream morphology can vary considerably between different reaches, especially in urban areas. These factors can complicate classifying streams, since the calculated numbers may not fit perfectly into any one distinct category (as was the case for the study streams). In this situation, judgment and/or further study is used to approximate the “best fit”.

1.5. Bank Stability Problem Identification

Channel bank stability is an important issue in urban floodplain/storm water management, since it can have a significant impact on the quality of a stream for both localized areas and as a whole. Unstable channels with eroding banks destroy valuable property, expose and/or weaken existing infrastructure (e.g. utilities), and lessen the efficiency of ponds and reservoirs. In addition, the increased sedimentation can cause significant water quality problems. Sediment in streams negatively impacts aquatic life by burying and suffocating aquatic habitat, and providing a host for harmful bacteria and other pollutants to attach to.

Channel instability problems typically fall into two general categories: isolated areas of bank erosion and long-term equilibrium adjustments to changes in the watershed and stream system. The former may be caused by rapid inflow from tributaries, unstable banks, or encroachment of development. The latter is related to larger scale changes in the land use of the watershed and flows in the stream, which manifest in the form of changes to the channel bottom level.

As indicated above in Section 1.1, MCSWS and others have identified a number of bank stability problems in the Watershed - many of which have been corrected/improved through stabilization projects. cursory bank stability assessment for this study did identify both localized scour and the presence of mid-channel sand bars (which indicate long-term equilibrium adjustments) at several locations. However, since most visible channel bank areas near road crossings have been armored, no major problems were identified. Other problem areas may exist at areas not visible from road crossings.

2. BENEFIT:COST ECONOMIC ANALYSIS

2.1. Benefit:Cost Analysis Overview

The benefit:cost (B:C) analysis is an economic based analysis that is commonly used in mitigation projects to evaluate the cost-effectiveness of one or more proposed improvement alternatives. The B:C analysis compares the benefits (in dollars) obtained by a proposed improvement versus the cost to implement the improvement.

In the context of flood hazard mitigation, the benefits are primarily comprised of the estimated flood damages that are avoided by implementing an improvement. For example, if a proposed improvement project (e.g. elevating a building above the floodplain) protects (i.e. eliminates flood damages) a floodprone building that incurs an average of \$1,000/yr in flood damages, the \$1,000/yr is considered the benefit. The cost equals the cost to implement (and maintain) the alternative.

The results of the B:C analysis is typically expressed in a simple ratio of the benefits over the costs – referred to as the B:C ratio. A B:C ratio of greater than 1.0 implies that the benefit of implementing a proposed project is greater than the cost to implement the project. Thus, the given alternative is considered an economically feasible solution. Subsequently, a B:C ratio of less than 1.0 indicates that the costs associated with a proposed alternative are more than its benefits, so the alternative is not cost-effective. It should be noted that the B:C ratio is based solely on economic considerations, whereas in reality, there are often many other considerations that cannot be directly quantified (for both benefits and costs). Examples of other considerations include: water quality benefit, aesthetic benefit, public safety issues, political environment, disruptions in traffic patterns, and others. For this reason, it can be acceptable to implement an alternative with a benefit/cost ratio of less than 1.0. In this study, per direction of MCSWS, buildings in the community encroachment (0.1 foot) floodway were in almost all cases recommended for acquisition (regardless of their B:C ratio) due to potential public safety issues and regulatory requirements.

2.2. Flood Damage Assessment Model

The FEMA “Riverine Flood, Full Data Module (Version 5.2.3, 1999)” Benefit:Cost model, hereafter referred to as FEMA BC, was used for estimating flood damages in this study. The FEMA BC is an EXCEL spreadsheet-based program that has built-in functions to compute probability based damages, given user-entered information, such as economic and physical building information, and flood information. As noted in the previous section, the estimated damages represent the benefit in the B:C analysis. To increase efficiency and accuracy in inputting data into the FEMA BC model, a custom import application was developed in Visual Basic for Applications (VBA). This import application took data that had been compiled into tables, and automatically created FEMA BC models. Appendix A presents the import tables used to create the FEMA BC models. As indicated previously, the damage estimates presented in this report are for planning and general ranking purposes only. A more detailed B:C analysis should be performed before further mitigation action is taken.

2.3. Building Data

The amount of damage incurred by a flooded building is a function of the economic and physical characteristics of the building. A brief description of the building parameters used by the FEMA BC program for the flood damage assessment is provided below. The reader is referred to the FEMA BC User’s Guide for a more detailed description.

Building Type: The building type provides physical style information (i.e. number of stories, presence of basements, etc.) for a building. FEMA BC categorizes building types into six

general building types. Each building type has a unique, built-in, flood depth to damage relationship that the program uses to estimate the damages to a given building (e.g. a house with a basement incurs damage at a higher rate than an identical house without a basement).

Building Value: The building value refers to the economic value of the building. It is required by FEMA BC since flood damages are a function of the economic value of the building. Building values were estimated from Mecklenburg County tax parcel data and were assumed to equal %125 of the “improvement value” (i.e. TOT_IMP_VA field). This assumption is consistent with the six previous watershed-wide studies completed in 2001.

Content Value: Content value is the estimated value of the contents in a building. Damages to building contents often represent a significant portion of total flood damage for a given structure. In large-scale studies such as this, the content value is often expressed as a percentage of the building value (e.g. contents in a residence are worth 25% of building value). For this study, flooded buildings were grouped into five categories based on their use (i.e. residential, commercial, etc.). Content to building value percentages were then developed for each category and used in the FEMA BC model. It should be noted that this methodology differs from that used in the previous six watershed studies completed in 2001, which used a content to building value of 25% for all structures.

Floor Elevation: Floor elevation refers to the elevation of the lowest finished floor. The model uses this to determine the elevation at which flood damage commences. Floor elevations were obtained from surveyed elevation certificates obtained from Mecklenburg County. Elevation certificates were surveyed/created for buildings not having existing ones.

Displacement Cost: The displacement cost represents the cost that is incurred when occupants of a building are displaced and thus must live/operate in a temporary location while damage is being repaired. Flat displacement costs of \$5,250/month for single-family residential buildings and \$12,000/month for multi-family residential buildings were used in this study. These estimates were based on per diem information provided by the NC Department of Emergency Management. Non-residential buildings were assumed to have a \$0 displacement cost. Costs related to being displaced were assumed to be accounted for in lost revenue estimates discussed below. It should be noted that this methodology differs from that used in the previous six watershed studies completed in 2001, which used a single flat displacement cost (\$5,250/month) for all structures.

Business Loss Cost: The business loss cost is an estimate of the amount of loss revenue incurred by a business when normal operations are disturbed (or halted) due to a flood. Business costs are highly building specific and difficult to estimate. However, for the purposes of the watershed-wide planning study losses of \$10,000, \$18,800, and \$37,500 per month were used for general commercial, warehouse, and offices, respectively. Residential properties were given a business loss of \$0. These estimates were developed from economic information obtained the Charlotte Chamber of Commerce and internet business sites. It should be noted that this methodology differs from that used in the previous six watershed studies completed in 2001, which did not account for business loss cost.

2.4. Hydraulic Data

Hydraulic data specifies the frequency and magnitude of flooding at a given building. It is used in conjunction with physical building data to assess flood depths and subsequent flood damages for a given building. FEMA BC requires water surface elevations (WSEs) from four storm events: 10%, 2%, 1%, and 0.2% annual chance flood events, which are typically defined as 10-, 50-, 100-, and 500-year storm events, respectively.

This study used future condition WSEs in the FEMA BC program for each of the storm events. The 100-yr WSEs were previously developed in HEC-RAS (Version 2.2) for the County by Watershed Concepts. The previously developed 100-yr WSEs were used in this study, with the exception of the portion of Briar Creek downstream of Monroe Road. For this area, Dewberry used a significantly lower flow in HEC-RAS to calculate WSEs than was previously used (i.e. 6182 cfs versus 8670 cfs). The flow was adjusted to reflect the flows calculated in the County HEC-1 hydrologic model for Briar and Little Sugar Creek. The need for the flow reduction is also noted in a previous study (HDR, 2001(d)). The County used the higher flow in the original model to simulate a worst-case scenario.

Since the County's HEC-RAS models did not have future condition WSEs for the other storm events (i.e. 10-, 50-, and 500-yr), they were created separately. First, future condition flows were developed by applying the previously developed built-out land use conditions to the 10-, 50-, and 500-yr HEC-1 hydrology models. The future condition WSEs were then calculated by running the future condition flows through the HEC-RAS models. WSEs were calculated at each floodprone building by applying a station to each building and then interpolating the HEC-RAS output to obtain a WSE for the station of the building.

2.5. Modeling Process

The FEMA BC model utilizes the above information to produce an estimated annual cost of flood damage. This expected annual damage cost takes into account damages from all frequency storms inputted into the model, and is calculated in a multiple-step process. First, raw damages for building, contents, displacement, and business losses are computed. Building and content damages are estimated by comparing flood depths associated with each storm event with built-in (or user specified) depth-damage functions (DDFs). Building and content DDFs used in this study are given in Appendix C. Displacement and business costs are estimated by using built-in (or user specified) curves to assess the amount of time the structure is unusable for a given flood depth, and then multiplying this "downtime" by monthly displacement/business loss costs. Next, a probability-based curve is developed from user-entered discharges and WSEs that accounts for probability of each storm event. Lastly, the raw damage functions (DDFs) are compared with the probability curve of to calculate the average annual damage. A detailed description of flood damage assessment statistics is beyond the context of this report. The reader is referred to the FEMA BC Users Guide for more information.

The flood damage assessment portion of this study was conducted on buildings located in the 100-yr Future Condition Floodplain (FCF), with finished floor elevations below the predicted 100-yr future condition WSE. It should be noted that since the FEMA BC includes the 500-yr storm event (i.e. the 0.2% chance event), computed damages include damages from storms larger than the 100-yr. However, improvement alternatives were design based on the 100-yr storm event.

2.6. Economic Analysis

Once the floodprone buildings in a study area are identified and their flood related damages assessed, the next step in a benefit:cost analysis is to identify potential mitigation alternatives and then develop a cost

to implement these alternatives. The cost to implement a given improvement alternative represents the “cost” portion of the B:C ratio. Before the B:C ratio is calculated, all benefits and costs must be in the same time reference (e.g. present lump sum cost, annual cost, etc.). As noted above, the FEMA BC calculates damages (i.e. benefits) as an average annual cost. Conversely, cost estimates for improvement alternatives are typically developed as a present worth lump sum (or a combination lump sum and annual cost), as they were in this project. For clarity, all benefits and costs were standardized to present value lump sum terms. The annualized benefits calculated in the FEMA BC were transformed to present value lump sum using standard engineering economic equations with a 50-yr project life and a 7% interest rate.

The final step in the B:C analysis is to make a mitigation recommendation. B:C ratios are calculated for all the proposed improvement alternatives, from which alternatives that are cost-effective (i.e. $B:C > 1.0$) are identified. Any additional, non-quantitative factors are then considered in conjunction with the B:C ratios, to identify a recommended action for the building or group of buildings. If the B:C ratio is less than 1.0 for all improvement alternatives and there are no significant non-quantitative benefits (i.e. water quality, public recreation, etc.), then a “no-action” option is recommended.

2.7. Improvements

A number of flood damage mitigation improvement alternatives were considered for each flooded building or group of flooded buildings. General options for improvement alternatives included: property acquisition, structure elevation, flood proofing, construction of floodwalls/levees, channel improvements, infrastructure improvements, detention, and a no action option.

Costs and subsequent B:C ratios (as described above) were developed for each improvement alternative that was deemed as a feasible alternative. More detailed information on the improvements investigated in this study and the economic analysis results are presented in Sections 3.5.1 and 3.5.2, respectively.

3. FLOOD HAZARD MITIGATION

3.1. Storm Water Service Requests

Mecklenburg County and the City of Charlotte maintain a joint City/County storm water service request hotline where residents can call and request service for storm water related issues/problems. Requests can be made for any storm water related issues (e.g. pipe repair, inoperable structure, yard flooding, etc.), and are thus typically associated with localized issues (which are not addressed in this study), rather than stream overbank flooding. However, presenting this information can be useful for identifying chronic problems.

Information provided by MCSWS indicates that there have been two recent storm water service requests. The requests are for properties along Briar Creek, however, neither of the requests were for buildings that were identified as flooding in the 100-yr FCF (i.e. included in the B:C analysis). The addresses of the outstanding requests are provided below for general reference:

- 2826 Arcadia Avenue
- 3928 Selwyn Avenue

3.2. Repetitive Loss Structures

A repetitive loss structure is defined as any structure that has had two or more flood-related insurance claims during a 10-year period. Repetitive loss structures are of special interest in local mitigation planning since they are being targeted by FEMA for mitigation assistance, and thus are generally the most eligible for federal funding.

Information provided by MCSWS (current as of 8/2003) indicates that there are 104 repetitive loss properties within the Briar Creek Watershed. A total of 277 claims amounting to approximately \$7,344,160 have been paid to these properties between 1978 and 2003. Similarly to the storm water service requests, repetitive loss structure claims may be the result of localized issues as well as, stream overbank flooding. Seventy (70) of the 104 repetitive loss structures were identified as flooding in the 100-yr FCF, and thus were included in the B:C analysis. Several of the repetitive loss properties have been acquired by MCSWS for flood hazard mitigation. The reader is directed to the figures in the executive summary which show both repetitive loss structures and properties that have been acquired by the County. The addresses of the repetitive loss structures within the Briar Creek Watershed are provided in Appendix B.

3.3. Permanent Storm Water Easements

Based on GIS database information obtained from City SWS, there are approximately 29 permanent storm water easements in the Briar Creek Watershed that provide access to the study streams in this report. The addresses are:

- | | | |
|----------------------|----------------------|----------------------|
| • 6101 Channing Ct. | • 6242 Covecreek Dr. | • 2002 Pinewood Cr. |
| • 6109 Channing Ct. | • 6248 Covecreek Dr. | • 5621 Rupert Ln. |
| • 6117 Channing Ct. | • 6132 Covecreek Dr. | • 5620 Rupert Ln. |
| • 6201 Channing Ct. | • 6224 Covecreek Dr. | • 5616 Rupert Ln. |
| • 6209 Channing Ct. | • 6339 Kelsey Dr. | • 5721 The Plaza |
| • 6144 Covecreek Dr. | • 6347 Kelsey Dr. | • 3445 Windsor Dr. |
| • 6108 Covecreek Dr. | • 6333 Kelsey Dr. | • 3439 Windsor Dr. |
| • 6126 Covecreek Dr. | • 6323 Kelsey Dr. | • Parcel ID 15901604 |
| • 6138 Covecreek Dr. | • 6317 Kelsey Dr. | • Parcel ID 1010210 |
| • 6236 Covecreek Dr. | • 1930 Pinewood Cr. | |

3.4. Roadway Overtopping Problem Locations

Roadway overtopping refers to the situation where the calculated WSE in a stream is above the top of the roadway surface or other stream crossing. Although this study focused on the mitigation of floodprone buildings, overtopping depths were identified at each road crossing, since overtopping can represent a significant hazard during large storm events. For example, motor vehicles can be swept away in as little as 24 inches of flood flow depths over a road.

Roadway culverts/bridges are typically designed to pass a certain frequency storm event without overtopping, based on their level of service. For example a residential road is often designed to be protected from a 10-yr and smaller storm events, whereas an interstate may be designed to be protected from a 100-yr and smaller storm events. Storms larger than the design frequency are “allowed” to overtop the road, and thus not considered to be a problem. However, it is considered a problem if a storm event equal to or smaller than the design frequency overtops the roadway (ex. a 2-yr or 10-yr event overtops a residential roadway).

Roadway overtopping depths were identified within the Briar Creek Watershed by comparing results of the HEC-RAS models to roadway geometry. Evaluating the level of service and an appropriate “designed” capacity for road crossings was beyond the scope of this study, therefore roadway overtopping “problems” were not specifically identified. However, since public roads are designed for a 10-yr event or greater, any roadway which is overtopped in the 10-yr event can be considered as problematic. Overtopping depths for the future condition 10-, 50-, and 100-yr storms at all study crossings (including roadways and private crossings), are presented in Table 5 below. Crossings are listed from upstream to downstream.

Table 5. Roadway Overtopping Depths

Briar Creek	Crossing Structure Type/Size	FC 100-yr WSE (FT. NAVD)	FC 10-yr Overtopping Depth (FT)	FC 50-yr Overtopping Depth (FT)	FC 100-yr Overtopping Depth (FT)
Plaza Road	3-10'x9' Box	706.9	-6.2	-4.6	-4.1
Ruth Drive	2-8'x6.3' Box	700.3	0.8	0.9	0.8
Shannonhouse Road	2-8'x6.3' Box	696.4	1.4	1.5	1.5
Norfolk Southern Railroad	Bridge	690.0	-17.1	-15.2	-14.5
Unnamed Stream Crossing	Bridge	685.7	4.3	4.8	5.0
Shamrock Drive	3-12'x11' Box	683.8	1.6	3.2	3.6
Unnamed Stream Crossing	Bridge	683.2	5.5	7.3	7.6
Unnamed Stream Crossing	Bridge	682.8	5.6	7.3	7.7
Eastway Drive	3-12'x11' Box	682.3	1.3	2.8	3.2
Country Club Drive	2-16'x9' RCPE	675.7	2.0	4.1	4.7
Unnamed Stream Crossing	Bridge	672.2	7.0	9.3	10.1
Unnamed Stream Crossing	Bridge	670.8	4.3	6.3	7.0
Unnamed Stream Crossing	Bridge	670.0	2.8	4.4	5.2
Unnamed Stream Crossing	Bridge	669.6	5.4	7.0	8.1
Unnamed Stream Crossing	Bridge	668.6	3.7	5.1	6.3
Unnamed Stream Crossing	Bridge	667.9	-0.6	1.4	4.3
Unnamed Stream Crossing	Bridge	662.9	1.2	3.6	4.2
Unnamed Stream Crossing	6-2' RCP	661.1	9.4	11.1	12.5
Central Avenue	3-12'x9.5' Box	659.4	0.7	3.1	5.1
Commonwealth Avenue	3-12'x12' Box	659.1	-1.0	2.7	5.0
Independence Boulevard	3-12'x15' Box	659.0	0.7	5.7	8.0
East of Bay Street	Bridge	659.0	8.0	14.1	16.4
Unnamed Stream Crossing	Bridge	659.0	10.1	16.2	18.5
Bramlet Road	Bridge	658.9	6.4	12.5	14.8
CSX Railroad	1-12.1'x15' Box & 1-10' RCP	658.8	-9.7	-3.5	-1.2
Monroe Road	Bridge	638.4	-5.1	-3.1	-1.9
Randolph Road	Bridge	633.8	-4.5	-3.3	-2.0
Providence Road	2-9.5'x15' Box & 2-11'x15' Box	626.0	-2.2	-0.5	0.0
Sharon Road	4-11.5'x12' Box	624.3	1.6	2.9	3.6
Golf Course Crossing	Bridge	623.4	3.4	4.7	5.3
Golf Course Crossing	Bridge	622.0	3.9	5.1	5.7
Golf Course Crossing	Bridge	621.4	1.6	3.1	3.8
Golf Course Crossing	Bridge	619.6	2.8	4.0	4.7
Golf Course Crossing	Bridge	618.3	4.2	5.5	6.2
Golf Course Crossing	Bridge	617.8	2.5	4.1	5.2
Golf Course Crossing	Bridge	617.6	4.3	5.9	7.1
Golf Course Crossing	Bridge	617.1	3.8	5.6	6.9

Colony Road	1-34'x20.4' CMPA	616.2	-8.2	-5.9	-4.6
Runnymede Lane	4-12'x15' Box	599.3	-14.9	-13.2	-12.2
Michael Baker Place	Bridge	597.0	-9.3	-8.0	-7.4
Park Road *	Bridge	594.4	-7.3	-4.1	-1.6
Edwards Branch	Crossing Structure Type/Size	FC 100-yr WSE (FT. NAVD)	FC 10-yr Overtopping Depth (FT)	FC 50-yr Overtopping Depth (FT)	FC 100-yr Overtopping Depth (FT)
Sheffield Drive	1-9'x6.5' CMPA	698.3	1.2	1.6	1.8
Woodland Drive	1-12.5'x7.5' CMPA	692.8	3.1	4.3	4.6
Service Road	2-7'x7' Box	692.6	2.1	3.3	3.5
Eastway Drive	3-7'x9' Box	676.2	0.3	2.2	2.5
Commonwealth Avenue	3-10' RCP	665.9	1.0	3.6	4.1
Independence Boulevard**	2-9'x10' RCPE	663.2	0.0	2.0	2.4
New Briar Creek Road**	Bridge	659.0	-25.4	-22.5	-22.1
Parking Driveway**	Bridge	659.0	-5.2	-2.3	0.0
Footbridge**	Bridge	659.0	-3.2	1.2	3.5
Parking Deck**	Bridge	659.0	-4.4	1.0	3.3
Footbridge**	Bridge	659.0	-3.2	2.9	5.2
Old Briar Creek Road**	Bridge	659.0	0.7	6.8	9.2
Briar Creek Tributary 1					
Colony Road	1-16.6'x6.7' CMPA	617.7	1.3	2.4	2.9
Unnamed Stream Crossing	Bridge	603.1	3.8	5.8	6.2
Unnamed Stream Crossing	Bridge	603.0	4.1	6.2	6.5
Runnymede Lane	1-10'x9' Box	603.0	-1.6	1.0	1.4
Briar Creek Tributary 2					
Galway Drive	3-7'x5' Box	707.0	1.1	1.9	2.5
Grafton Drive	2-7.5'x8' Box	697.5	1.6	2.2	2.4

* Flooding from Upper Little Sugar Creek backwater, WSEs from Sta 49351 in County RAS model

** Flooding from Briar Creek mainstem backwater, WSEs influenced from Sta 26814 in County RAS model

For those roadways which do indicate significant overtopping the following general items may wish to be considered for future action:

- Consider the feasibility/effectiveness of signage of roadway overtopping warning for avoiding road crossing during flood event.
- Coordination with Police Dept. and Fire Dept. for special attention during flood event.
- Routine inspection for bridge/culvert scour and safety conditions, such as a lack of guardrail (or handrail). Guardrail post would give indication of the edge of the structure when inundated during flood flows.

3.5. Flood Mitigation Improvement Analysis

The flood damage assessment, discussed in Section 2, identified a total of 897 floodprone buildings (i.e. buildings whose footprint intersects the 100-yr FCF) within the Briar Creek Watershed. This figure excludes miscellaneous accessory buildings such as garages, sheds, park shelters, and similar. Further analysis, survey, and comparison with existing County elevation certificates, revealed that 367 (40%) of these 897 buildings have a finished floor elevation below the predicted 100-yr future condition WSE, and thus are expected to incur flood damage. Figure 9 provides a conceptual illustration of the floodprone and flooding buildings.

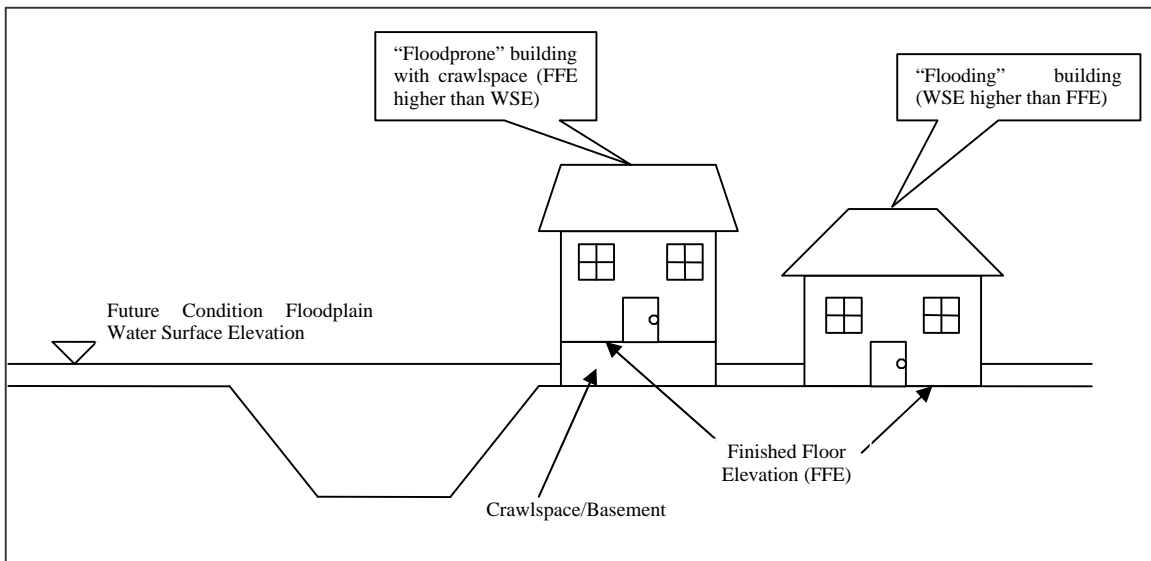


Figure 9. “Floodprone” versus “Flooding” Building Concept Illustration

Since local flood mitigation efforts are often undertaken with the goal of receiving financial assistance from FEMA, additional information was organized to facilitate receiving funding. FEMA considers a number of criteria in evaluating flood mitigation assistance (FMA) and Hazard Mitigation Grant Fund (HMGP) requests. One such criterion – repetitive loss structure information, was previously discussed in this section. Another FMA criterion that is used, relates to whether or not floodprone structures were built before Flood Insurance Rate Maps (FIRMs) were available. Buildings constructed prior to available FIRM maps are termed as “pre-FIRM” structures – those built after firm maps are termed “post-FIRM” structures. FIRM maps for Mecklenburg County were first produced in 1978. In addition to FMA, pre- and post-FIRM information is also used in the Community Rating System (CRS) evaluation, which can provide additional assistance to municipalities and property owners. Table 6 provides a summary of floodprone building and pre-/post-FIRM information for the study streams in the Briar Creek Watershed.

Table 6. Flooding Structures Summary

Stream Name	Floodprone Buildings*			Flooding Buildings**		
	Pre-FIRM	Post-FIRM	Sub-Total	Pre-FIRM	Post-FIRM	Sub-Total
Briar Creek	663	140	803	311	17	328
Briar Creek Tributary #2	31	0	31	12	0	12
Edwards Branch	62	1	63	27	0	27
Briar Creek Tributary #1	0	0	0	0	0	0
WATERSHED TOTALS	756	141	897	350	17	367

* Buildings that are within the 100-yr future condition floodplain

** Buildings with a finished floor elevation below the 100-yr future condition water surface elevation

Note: Pre-FIRM structures were constructed before 1978; Post-FIRM structures were constructed in 1978 or later.

Flood mitigation of buildings predicted to incur flood damage is the primary focus of this report. Thus, mitigation improvement alternatives were investigated for these 367 “flooding” buildings, and are discussed in the following sub-sections.

3.5.1. Overview of Mitigation Improvement Alternatives

Several potential improvement alternatives were evaluated to eliminate/reduce flooding damage along the study streams. These alternatives were generally evaluated for flood reduction capability, constructability, social/environmental impact, downstream impact, and economic feasibility. The evaluation was a planning level evaluation only - no design calculations, survey, or detailed analysis were used. The alternatives evaluated included: “no action”, property acquisition, structure elevation, flood proofing, construction of levees/floodwalls, infrastructure modification, channel modification, and upstream detention. An overview and preliminary evaluation of each alternative is discussed below.

Alternative 1 – No Action

In any flood mitigation study, where public safety or other concern is not a critical issue, there is the “no action” alternative (i.e. leaving the flooding situation as it is). This is the default alternative that is used when there is no other feasible option, or when the damages associated with periodic flooding do not justify the costs associated with implementing any of the other alternatives (i.e. B:C < 1.0 for all other alternatives). The “no action” option was considered as a feasible alternative, and is further discussed in the evaluation of specific problem areas in the next sub-section.

Alternative 2 – Property Acquisition

Property acquisition is a process in which flood-prone properties are purchased and converted to wetland detention, park area, or some other open space which would allow flood waters to naturally expand. Acquisition is a simple and practical solution since it physically removes the structure from the floodplain, rather than trying to engineer a solution, which always has risk associated with it. In addition, this method provides environmental and aesthetic benefits, and downstream flooding relief.

Another advantage of property acquisition is that Mecklenburg County has significant experience with it for flood mitigation. The County has acquired over 130 floodprone properties for other projects, and thus gone through the many aspects associated with buyout (i.e. funding, real estate, technical, etc.). The County has used the acquired land for water quality enhancements, stream restoration, and other beneficial uses.

The primary constraints of property acquisition are economic feasibility and social impacts. The cost of acquisition is often high in urban areas, and thus economics may favor other improvement alternatives. In addition, sometimes flood-prone areas have historical, sentimental, or other significance that generates strong public opposition.

For the purposes of this planning study, property acquisition was assumed to consist of property buyout and building demolition. The cost associated with property buyout, for each parcel, was obtained from the County tax database (2002). A unit cost for demolition of \$0.25 per cubic foot of building was added to the market value to estimate total property acquisition costs. Property acquisition was considered as a feasible alternative at appropriate locations, and is further discussed in the evaluation of specific problem areas in the next sub-section.

Alternative 3 – Structure Elevation

Structure elevation is a mitigation alternative in which a floodprone structure is physically elevated above the predicted flood elevations. Standard practice is to elevate a structure to one foot (1-ft) above the 100-yr WSE (i.e. 1-ft freeboard). This is typically accomplished on existing structures by extending foundation walls, or using piles, columns, or fill to elevate the structure.

One benefit of structure elevation is that there is minimal change in natural of flood flows. Although, it is possible to elevate almost any structure, it is most appropriate for smaller structures (e.g. residential buildings), especially those with crawlspaces or basements. A limitation of elevation is that although the living area of the structure is protected during a flood event, the surrounding area is inundated, and thus evacuation of the structure may be necessary.

Structure elevation costs were estimated from unit costs provided in FEMA Publication 259 (2001). The original unit costs were adjusted to reflect current economic conditions (i.e. ENR Construction Index) and geographic conditions (i.e. locality adjustment). Adjusted unit costs ranged from \$14 to \$39 per square foot, depending on building conditions (i.e. wood vs. brick, built on crawl space vs. slab, etc.). A 20% contingency was applied to all unit costs to derive final elevation costs. Structure elevation was considered as a feasible alternative at appropriate locations, and is further discussed in the evaluation of specific problem areas in the next sub-section.

Alternative 4 – Flood Proofing

Flood proofing can refer to several flood damage reduction techniques, however, in this context flood proofing refers to watertight reconstruction of buildings, or “dry” flood proofing. Watertight construction can include sealing building walls with waterproof substances and using flood shields or doors to protect building openings from floodwaters. Flood proofing is generally only applicable for flood depths less than 3 feet, as depths greater than 3 feet generally require structural reinforcement due to the increased hydrostatic and uplift forces caused by the floodwaters (USACE, 1993).

Similar to structure elevation, flood proofing can be implemented on most types of structures, however, it is most appropriate for masonry buildings built with slab-on-grade construction (e.g. warehouses, industrial/commercial buildings, etc.). Generally, these types of structures are sturdy and are more capable of withstanding greater forces associated with floodwaters. In addition, flood-proofing construction, such as watertight doors and flood shields are generally less aesthetically obtrusive on industrial buildings.

The costs associated with flood proofing are a function of the number/type of openings a building has, construction materials, and properties of the buildings utilities. Since this information is very building specific, a flat cost of \$50,000 per structure was assumed for this project. This estimate is based on previous flood proofing experience in Mecklenburg County. A 20% contingency was applied to the flat rate to estimate final costs for flood proofing. Flood proofing was considered as a feasible alternative at appropriate locations, and is further discussed in the evaluation of specific problem areas in the next sub-section.

Alternative 5 – Construction of Levees/Floodwalls

Floodwalls and levees are constructed to create a physical barrier between floodwaters and low-lying structures. The primary difference between a levee and a floodwall is that a levee is an earthen embankment with sloped sides, whereas, a floodwall is a concrete or brick wall with vertical sides. Unlike the alternatives mentioned above, floodwalls and levees usually provide protection on a general area, rather than on individual structures.

Floodwalls are often preferred in urban settings because they are thinner, occupy less space, and generally require less maintenance than levees. The primary drawback of floodwalls and levees is that they can greatly constrict the natural flow of water. This constriction can subsequently increase stream velocities, remove natural storage, and increase upstream and downstream water surface elevations. High velocities can increase erosion potential, as well as have adverse environmental effects. The removal of natural storage and the increase in downstream water surface elevations can create increased

flooding conditions downstream. In addition, levees also impede the path of natural drainage to a creek, thus requiring an additional drainage system to be constructed.

Costs for constructing levees and floodwalls are highly project dependent, since there are many site specific factors in design (i.e. soils, conflicts with utilities, local permitting, etc.). For purposes of this planning study, costs for levees/floodwalls were estimated from unit costs provided in FEMA Publication 259 (2001). The original unit costs were adjusted to reflect current economic conditions (i.e. ENR Construction Index) and geographic conditions (i.e. locality adjustment). Adjusted unit costs ranged from \$31 to \$370 per linear foot, depending on the height and type of structure (i.e. levee vs. floodwall). A 30% contingency was applied to all unit costs to estimate final construction costs. Construction of levees/floodwalls was considered as a feasible alternative at appropriate locations, and is further discussed in the evaluation of specific problem areas in the next sub-section.

Alternative 6 – Infrastructure Modification

Infrastructure modification refers to making adjustments to bridges, culvert, and/or roadways to protect floodprone structures and/or to eliminate roadway overtopping. Inadequately sized bridges/roadways are often a cause of many urban drainage problems. When hydraulic capacity of a bridge/roadway is exceeded, flood waters can build up behind the abutments and cause upstream flooding. The potential effectiveness of increasing the capacity of bridges/roadways can be seen by examining the flood profile. The flood profile displays the difference in the water surface elevation between the downstream and upstream sides. If the profile shows a large difference in upstream and downstream water surface elevations, increasing the size of the pipe or culvert will reduce the backwater effect. However, if there is little difference in the water surface elevations, the significance of enlarging the pipe or culvert will have little effect. It is important to consider the potential downstream impact for any infrastructure modification in order to ensure that increasing flow capacity in one location will not create or worsen flood hazards downstream.

Costs for infrastructure modification are highly project dependent, since they depend on the type and magnitude of improvements being made (e.g. upsizing culverts, raising roadways, adding bridges, etc.). Due to the wide variety of modifications, costs were developed using general estimating procedures and state bid tables. Infrastructure modification was considered as a feasible alternative at appropriate locations, and is further discussed in the evaluation of specific problem areas in the next sub-section.

Alternative 7 – Channel Modification

Modifications to an existing channel can provide a means of reducing flooding, and can include: widening channel banks, clearing of channel sections, lowering channel inverts and cutting back side slopes. The basic mechanism for these improvements is increasing channel conveyance, thus allowing more water flow through the channel boundaries. Channel improvements are generally more applicable to controlling higher frequency, smaller magnitude storms, rather than providing protection against larger magnitude storms, as is the case in this study. This is because flow in the higher magnitude storms is generally spread out in the floodplain area, rather than contained within the channel. In addition, improvements to the channel in highly urban areas are more complex, due to the numerous roadway decks, small work area, and the presence of a stream junction.

Channel modification for flood control has become less popular in recent years due to adverse environmental and aesthetic effects that modification can cause. Examples of adverse effects include an increase in flow velocities, erosion potential, sedimentation, habitat degradation, and downstream flooding. Channel modification for flood control is indeed contradictory to many of the recent efforts of Mecklenburg County to restore previously modified streams to a more natural, healthy state (e.g. Freedom Park Stream Restoration Project). Due to these factors, channel modification will not be further evaluated in this report.

Alternative 8 – Upstream Detention

Upstream detention is another option for mitigating floodprone areas. Unlike the previous alternatives which involve modifications directly in the floodprone area, detention is generally implemented upstream of the problem location, where there may or may not be any flooding problems. The basic idea of a detention facility is to reduce peak flood flows (and thus reduce peak WSEs) by temporarily storing the flood flows, and releasing them at a designed rate. The impact of detention is typically an attenuation or “flattening” of the flood hydrograph. Similar to channel improvements, detention is often used for smaller magnitude storms, and in new land development. Detention can be used for large magnitude floods, but the amount of land required for holding the larger volume of floodwater is often a limiting factor, especially in highly urban areas such as the study watershed. Detention ponds can have adverse environmental effects as well as bring opposition from the public. Due to these factors, detention will not be further evaluated in this report.

3.5.2. Problem Area Evaluation

As previously noted in this section (Table 6), there were a total of 367 buildings identified within the Briar Creek Watershed for which potential mitigation alternatives were investigated. For clarity in analysis and presentation, the identified buildings were categorized into flood problem areas based on study stream, geographic proximity, and cause/magnitude of flooding. A total of 328 buildings along Briar Creek were grouped into 23 individual flood problem areas (BR1 – BR23). Twelve (12) flooding buildings along Briar Creek Tributary #2 were grouped into three flood problem areas (BT2-1 – BT2-3). Twenty-seven (27) buildings along Edwards Branch were grouped into six flood problem areas (EDB1 – EDB6). No flooding buildings were identified on Briar Creek Tributary #1.

B:C ratios were calculated for each building and for each problem area as a whole. In general, alternatives that produced a B:C ratio greater than 1.0 were considered for recommendation. It is common in benefit-cost analyses to recommend the alternative that produces the highest B:C. However, per direction from MCSWS, this study gave a greater emphasis on acquisition. As indicated in Section 2.1, building structures that were located within the community encroachment (0.1 foot) floodway were in almost all cases recommended for acquisition (regardless of B:C ratio). In addition, for buildings in the floodplain fringe, acquisition was generally recommended over other mitigation alternatives, as long as it had a B:C greater than or equal to 1.0. For example, if mitigation of a residential structure produced a B:C ratio of 1.3 for acquisition and 2.5 for elevation, generally acquisition would be recommended. If all alternatives produced a B:C ratio of less than 1.0, the “no-action” option was recommended.

Results of the mitigation improvement alternative analysis for the individual flood problem areas are summarized below. Figure E-1 is an overall map that shows locations of the problem areas. Figures E-2 through E-10 illustrate the specific location of recommended improvements for each problem area. All E-figures are located in the Executive Summary. In addition, a summary of the B:C analysis, which includes addresses and parcel identification numbers for each individual structure, is presented in Appendix C.

BR01– Manning Drive (Figure E-2)

Problem area BR01 includes one (1) split-level residential house off the end of Manning Drive within the floodplain fringe of Briar Creek. The future conditions 100-yr storm flooding depth is 0.1 ft. Three alternatives were evaluated for BR01 – no action, property acquisition, and structure elevation. Due to the predicted low flood depth, B:C ratios for all investigated improvement alternatives are 0.1 or less. The recommendation for BR01 is “no action” for one house.

Table 7. Problem Area BR01 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	1	0.1	0.1	\$10,447	No Action	0	-	-	-
Totals	1	0.1	0.1	\$10,447	No Action	0	-	-	-

BR02– Myers Park Country Club (Figure E-3)

Problem area BR02 includes one (1) Country Club service building within the Myers Park County Club golf course (off Roswell Avenue). The building is located within the floodplain fringe area of Briar Creek. The future conditions 100-yr storm flooding depth is 2.1 ft. Four alternatives were evaluated for BR02 – no action, property acquisition, structure elevation, and flood proofing. All three of the mitigation alternatives yielded B:C ratios greater than 1.0. The B:C ratio for flood proofing is 11.4, over five times the B:C value for property acquisition. It is unlikely the County would acquire a small portion of the golf course, therefore the recommendation for BR02 is flood proofing of one building.

Table 7. Problem Area BR02 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	1	2.1	2.1	\$683,454	Flood Proofing	1	\$683,454	\$60,000	11.4
Totals	1	2.1	2.1	\$683,454	Flood Proofing	1	\$683,454	\$60,000	11.4

BR03– Sharon Road/Chilton Place (Figure E-3)

Problem area BR03 includes six (6) houses on Sharon Road and Chilton Place, along Briar Creek. Three houses are repetitive loss structures. Two houses (one of which is a repetitive loss structure) lie within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 1.8 ft to 5.1 ft, with an average depth of 2.9 ft. Three alternatives were evaluated for BR03 – no action, property acquisition, and structure elevation. Four houses have B:C ratios ranging from 1.0 to 5.1 for property acquisition. The house on Parcel ID 15310519 has a B:C ratio for structure elevation of 2.1. The remaining house has B:C ratios less than 1.0 for the evaluated mitigation alternatives. The recommendation for BR03 is property acquisition for four houses, structure elevation for one house, and “no action” for one house.

Table 8. Problem Area BR03 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	2	2.9	3.2	\$463,967	Acquisition	2	\$463,967	\$315,707	1.5
Non-Floodway	4	3.0	5.1	\$1,425,120	Acquisition/ Elevation/ No Action	3	\$1,369,006	\$446,970	3.1
Totals	6	2.9	5.1	\$1,889,088	Acquisition/ Elevation/ No Action	5	\$1,832,974	\$762,677	2.4

BR04– Hanson Drive/Hampton Avenue (Figure E-4)

Problem area BR04 includes twenty (20) residential homes on Hanson Drive and Hampton Avenue, within the floodplain fringe area of Briar Creek. Ten of the houses are repetitive loss structures. Flooding depths in the future conditions 100-yr storm range from 0.1 ft to 3.5 ft, with an average depth of 2.3 ft. Three alternatives were evaluated for BR04 – no action, property acquisition, and structure elevation. A levee/floodwall/wetland option was initially considered since it was the recommended improvement option in a previous study (HDR, 2001(a)). However, the levee/floodwall option was dismissed in this study for several factors:

1. There are approximately forty houses along Myers Park Drive that are located between the houses in this problem area and Briar Creek. These houses were purposely constructed to have elevated finished floors, and are not considered as flooding structures (i.e. their FFE is higher than the FCF 100-yr WSE). Constructing a levee to protect only the “flooding” buildings would be difficult due to these houses along Myers Park Drive, as well as challenges associated with constructing the levee/floodwall so that it would not block roadway access. If the levee were constructed as proposed in the previous study (10+ feet high along the Creek), it would require extensive channel dredging and overbank excavation to account for lost flood storage.
2. The computed damages in this study likely do not justify the expected cost of the levee/floodwall/wetland. The previous study used different flood damage estimate methodology and made several assumptions due to lack of data. This study used updated methodology and more complete data. The previous study estimated a much higher damage value (approximately \$10.5 million versus \$3.4 million in this study). The improvement cost in the previous study was estimated approximately \$3.5 million, however, due to the complexity and magnitude of the previously recommended project, the actual cost would likely be even higher.
3. Issues associated with permitting and regulatory compliance would likely be very difficult for such a project. In addition to significant FEMA regulatory issues and permitting, numerous other local, state, and federal agencies/permits would likely be necessary for many aspects (e.g. dredging/filling wetlands, local SWIM buffer requirements, on-line “treatment”, NCDENR water quality and land quality permits, etc.).
4. There are other simpler and safer flood mitigation improvements which are cost-effective. This study estimates that acquisition and elevation are cost-effective solutions for almost all of the flooding properties (16 of 20 houses). As stated previously, for simplicity reasons and per direction of MCSWS, this study generally recommended acquisition over other alternatives if it produced a B:C ratio of 1.0 or greater.

The reader is referred to the study report (HDR, 2001(a)) for more information on the levee/floodwall/wetland option proposed in the previous study.

Of the four houses on Hampton Avenue, two houses have B:C values greater than 1.0 for structure elevation (1.2 and 2.6). The other two houses have B:C ratios less than 1.0 for both property acquisition and structure elevation. An additional two houses have B:C ratios less than 1.0 on Hanson Drive for both property acquisition and structure elevation. The remaining fourteen houses have B:C values ranging

from 1.1 to 15.3. Ten of the houses have property acquisition B:C ratios greater than 1.0. The recommendation for BR04 is property acquisition for ten houses, structure elevation for six houses, and “no action” for the remaining four houses.

Table 9. Problem Area BR04 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	20	2.3	3.5	\$3,395,342	Acquisition/ Elevation/ No Action	16	\$3,348,889	\$1,720,507	1.9
Totals	20	2.3	3.5	\$3,395,342	Acquisition/ Elevation/ No Action	16	\$3,348,889	\$1,720,507	1.9

BR05– Scotland Avenue/Twiford Place/Museum Drive/Providence Road (Figure E-4)

Problem area BR05 includes fifteen (15) single family homes, one (1) multi-family home, and a one (1) institutional building (Dore Academy) on Scotland Avenue, Twiford Place, Museum Drive, and Providence Road. The academy and one house on Scotland Avenue are repetitive loss structures. Four of the houses on Twiford Place and two houses on Scotland Avenue are within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.1 ft to 3.1 ft, with an average depth of 1.3 ft. Three alternatives were evaluated for BR05 – no action, property acquisition, and structure elevation. Two houses on Scotland Avenue (Parcel ID’s 15512226 and 15512311) have B:C ratios for acquisition of 1.0 and 1.8. Six additional houses are recommended for acquisition since they are located in the 0.1 foot floodway. Two other houses on Scotland Avenue (Parcel IDs 15512320 and 15512225) have structure elevation B:C ratios greater than 1.0. The remaining buildings have B:C ratios less than 1.0 for the evaluated alternatives. The recommendation for BR05 is property acquisition for eight houses, structure elevation for two houses, and “no action” for the remaining seven buildings.

Table 10. Problem Area BR05 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	6	0.9	1.8	\$477,602	Acquisition*	6	\$477,602	\$3,605,459	0.1
Non-Floodway	11	1.5	3.1	\$2,807,624	Acquisition/ Elevation/ No Action	4	\$2,460,852	\$1,705,129	1.4
Totals	17	1.3	3.1	\$3,285,226	Acquisition/ Elevation/ No Action	10	\$2,938,455	\$5,310,588	0.6

* all of the buildings have a B:C ratio less than 1.0

BR06– Meadowbrook Road/Placid Place (Figure E-4)

Problem area BR06 includes thirteen (13) houses on Meadowbrook Road and Placid Place, along Briar Creek. Seven houses on Placid Place are located within the community encroachment (0.1 foot) floodway, five of which are repetitive loss structures. Flooding depths in the future conditions 100-yr storm range from 0.2 ft to 3.5 ft, with an average depth of 1.9 ft. Three alternatives were evaluated for BR06 – no action, property acquisition, and structure elevation. Five houses on Placid Place have acquisition B:C ratios ranging from 1.0 to 2.4. Two additional houses on Placid Place are recommended

for acquisition since they are in the floodway, despite having acquisition B:C ratios of less than 1.0. The remaining six houses on Meadowbrook Road and Placid Place have B:C values less than 1.0 for all investigated alternatives. The recommendation for BR06 is property acquisition for seven houses and “no action” for the remaining six houses.

Table 11. Problem Area BR06 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	7	3.0	3.5	\$1,552,101	Acquisition*	7	\$1,552,101	\$1,125,328	1.4
Non-Floodway	6	0.5	1.0	\$77,119	No Action	0	-	-	-
Totals	13	1.9	3.5	\$1,641,820	Acquisition/ No Action	7	\$1,552,101	\$1,125,328	1.4

* 2 of the 7 buildings have a B:C ratio less than 1.0

BR07– Museum Drive (Figure E-4)

Problem area BR07 includes one (1) residential house on Museum Drive, along Briar Creek. The house is a repetitive loss structure and is located within the community encroachment (0.1 foot) floodway. The flooding depth in the future conditions 100-yr storm is 0.9 ft. Three alternatives were evaluated for BR07 – no action, property acquisition, and structure elevation. The B:C ratios for acquisition and structure elevation are 0.1 and 0.6, respectively. However, since the house is located within the floodway, it is recommended for acquisition.

In addition, there is an area just north of the flooded house (vacant portion of institutional property) that may be suitable for potential environmental restoration/water quality enhancements. There are several incoming tributaries, the area is flat, and the site is on poorly drained soils (Monacan soils with Arents). The recommendation for the BR07 problem area is acquisition of one house and further investigation of water quality enhancements along the for the vacant portion of PID 18262500 (see Executive summary figures for aerial map).

Table 12. Problem Area BR07 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	1	0.9	0.9	\$90,340	Acquisition*	1	\$90,340	\$802,475	0.1
Non-Floodway	0	-	-	-	-	0	-	-	-
Totals	1	0.9	0.9	\$90,340	Acquisition/ Water Quality Enhancements	1	\$90,340	\$802,475	0.1

*building has a B:C ratio less than 1.0

BR08– Fannie Circle (Figure E-5)

Problem area BR08 includes four (4) residential houses on Fannie Circle, along Briar Creek. Three of the houses are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.1 ft to 0.4 ft, with an average depth of 0.2 ft. Three alternatives were evaluated for BR08 – no action, property acquisition, and structure elevation. B:C ratios for BR08 range from 0.1 to 0.2 for all investigated alternatives, however acquisition is

recommended for the three houses in the floodway. The recommendation for BR08 is acquisition of three houses and “no action” for the remaining house.

Table 13. Problem Area BR08 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	3	0.3	0.4	\$11,579	Acquisition*	3	\$11,579	\$141,312	0.1
Non-Floodway	1	0.2	0.2	\$3,878	No Action	0	-	-	-
Totals	4	0.2	0.4	\$15,457	Acquisition/ No Action	3	\$11,579	\$141,312	0.1

* all of the buildings have a B:C ratio less than 1.0

BR09 – Monroe Road to Independence Boulevard (Figure E-5)

Problem area BR09 includes fifty (50) flooded buildings – 24 apartment buildings, 19 residential homes, 4 commercial buildings, a commercial/office center (Merchandise Mart), an office building, and a church, between Monroe Road and Independence Boulevard. The problem area is in the vicinity of the confluence of Edwards Branch with Briar Creek. The Merchandise Mart is actually located on Edwards Branch, however, it is included in this problem area since it is flooded by backwater effects from Briar Creek. This problem area, which includes the Cavalier and Doral Apartment complexes, is a known high flood hazard area that has experienced severe flooding in recent times. There are 15 repetitive loss structures in the problem area. Five buildings are within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.1 ft to 16.4 ft, with an average depth of 8.0 ft. Four alternatives were evaluated for BR09 – no action, property acquisition, structure elevation, and infrastructure improvements.

The primary cause of severe flooding is the CSX railroad culvert (just upstream of Monroe Road) which greatly limits the flow capacity of the floodplain. The culvert causes the flood water to pond behind the railroad embankment – backing water up for approximately 1.5 miles (to an area upstream past Central Avenue) in the future conditions 100-yr storm event. Since the railroad culvert has such a tremendous effect on flood elevations, increasing the capacity of the existing culvert (i.e. infrastructure improvements) was the first mitigation alternative investigated. Based on recommendations from a previous study conducted in 2001 (HDR, 2001(d)) and subsequent investigation, it appears that adding an additional 10-foot diameter corrugated metal pipe to supplement the existing culvert system would greatly reduce (but not eliminate) flooding in the area. Evaluation of the additional 10-foot pipe in HEC-RAS revealed significant decreases in flood elevations for a significant distance along the stream. Predicted WSEs in the future condition 100-yr event dropped by more than 6 feet between the railroad culvert and Independence Boulevard, which includes the entire BR09 problem area. Reductions in 100-yr FC WSEs continued upstream, tapering off from 5+ feet just upstream of Independence Boulevard to less than a foot upstream of Central Avenue.

Although the potential infrastructure improvements described in the previous paragraph would be cost-effective and technically feasible, they were removed from consideration due to regulatory constraints. MCSWS recently completed (October 2003) an independent study which investigated infrastructure improvement alternatives for the CSX railroad (CDM, 2003). The study conferred that infrastructure improvements to the CSX railroad would significantly reduce water surface elevations upstream of the railroad culvert. However, the study indicated that infrastructure improvements would also cause a slight increase in water surface elevations (and subsequent flooding) of building structures downstream of the railroad culvert. Increasing flood elevations on existing structures is in violation with floodplain regulations (44 CFR, Chapter 1, Sec 65.12), therefore, infrastructure improvements were removed from consideration.

Based on the analysis, 26 buildings have B:C ratios greater than 1.0 for acquisition. Almost all (24 of 26) of these buildings are within the Doral and Cavalier apartment/condo complexes. Acquisition is also recommended for the one building in the Doral complex with a B:C of less than 1.0 for practical considerations. Three additional buildings with low acquisition B:C ratios are recommended for acquisition since they are in the floodway. Two residential houses on Chesterfield Avenue and Laburnum Avenue have elevation B:C ratios of 1.5 and 4.7 respectively. The office building at 616 Colonade Drive has a B:C ratio of 2.7 for flood proofing. The remaining 17 buildings have B:C ratios below 1.0 for all investigated improvement alternatives.

The recommendation for BR09 is property acquisition of the 30 buildings, structure elevation of two houses, flood proofing of one office building, and “no action” for the remaining 17 structures.

Table 14. Problem Area BR09 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	5	7.2	10.5	\$629,052	Acquisition*	5	\$629,052	\$1,938,624	0.3
Non-Floodway	45	8.0	16.4	\$315,821,647	Acquisition/ Elevation/ Flood Proofing/ No Action	28	\$314,467,462	\$12,179,595	25.8
Totals	50	8.0	16.4	\$316,450,698	Acquisition/ Elevation/ Flood Proofing/ No Action	33	\$315,096,514	\$14,118,219	22.3

* 3 of the 5 buildings have a B:C ratio less than 1.0

BR10– Commonwealth Avenue/Morningside Drive Area (Figure E-5)

Problem area BR10 includes eleven (11) apartment buildings, seven (7) single family homes, three (3) multi-family residential buildings, four (4) commercial buildings, and two (2) office buildings in the area near Commonwealth Avenue and Morningside Drive, along a 1300 foot reach of Briar Creek. Four of the apartment buildings and one single family house are repetitive loss structures. Eight buildings are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.6 ft to 9.6 ft, with an average depth of 4.8 ft. Four alternatives were evaluated for BR10 – no action, property acquisition, structure elevation, and flood proofing.

Seven buildings (including the four repetitive loss apartment buildings) have acquisition B:C ratios greater than 1.0 – ranging from 1.3 to 9.5. In addition eight other buildings with acquisition B:C ratios ranging from 0.1 to 0.8 are recommended for acquisition since they are within the floodway. The remaining 12 buildings have B:C ratios less than 1.0 for all investigated improvement alternatives. The recommendation for BR10 is acquisition of 15 buildings and “no action” for the remaining 12 structures.

Table 15. Problem Area BR10 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	8	5.1	6.9	\$1,182,269	Acquisition*	8	\$1,182,269	\$2,126,875	0.6
Non-Floodway	19	4.6	9.6	\$3,921,606	Acquisition/ No Action	7	\$3,138,442	\$1,436,156	2.2
Totals	27	4.8	9.6	\$5,103,875	Acquisition/ No Action	15	\$4,320,710	\$3,563,031	27

* all of the buildings have a B:C ratio less than 1.0

BR11– Commonwealth Avenue to Central Avenue (Figures E-5/E-6)

Problem area BR11 includes nine (9) apartment buildings, four (4) commercial buildings, two (2) warehouses, and one (1) residential house along a 1500 foot reach of Briar Creek between Commonwealth Avenue and Central Avenue. Three buildings are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from less than 0.1 ft to 6.0 ft, with an average depth of 2.6 ft.

Four alternatives were evaluated for BR13 – no action, property acquisition, structure elevation, and flood proofing. One warehouse had a flood proofing B:C ratio of 1.6, however, it is recommended for acquisition since it is in the floodway. The other buildings have B:C ratios less than 1.0 (i.e. 0.1 – 0.7) for all investigated improvement alternatives. However, acquisition is recommended for the two additional buildings in the floodway. The recommendation for BR11 is acquisition of three buildings and “no action” for the remaining 13 buildings.

Table 16. Problem Area BR11 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	3	5.2	6.0	\$191,472	Acquisition*	3	\$191,472	\$452,259	0.4
Non-Floodway	13	2.0	3.4	\$839,969	No Action	0	-	-	-
Totals	16	2.6	6.0	\$1,031,440	Acquisition/ No Action	3	\$191,472	\$452,259	0.4

*all of the buildings have a B:C ratio less than 1.0

BR12– Central Avenue/Arnold Drive/Masonic Drive (Figure E-6)

Problem area BR12 includes twenty-three (23) residential homes on Arnold Drive and Masonic Drive, and five (5) commercial buildings on Central Avenue, along a 1300 foot reach of Briar Creek. There is one repetitive loss structure (Parcel ID 09509324) on Masonic Drive. Six buildings are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.5 ft to 5.1 ft, with an average depth of 2.5 ft. The County has recently acquired three of the buildings in the floodway for future greenway/environmental restoration. The buildings still exist at the time of this report, however, since it is anticipated that they will be demolished in the future, they are recommended for no action.

Three alternatives were evaluated for BR12 – no action, property acquisition, and structure elevation. Two buildings (Parcel IDs 09509321 and 09509321) have acquisition B:C ratios greater than 1.0. Two other buildings on Central Avenue with acquisition B:C ratios of 0.2 and 0.7 are recommended for acquisition as well, since they are in the floodway. Two residential houses on Mason Drive and Arnold Drive have elevation B:C ratios of 1.4 and 1.7, respectively. The remaining 19 (not including the County owned) buildings have B:C ratios less than 1.0 for all investigated alternatives. The recommendation for BR12 is acquisition of four buildings, elevation of two houses, and “no action” for the remaining 22 buildings.

Table 17. Problem Area BR12 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	6	3.1	5.1	\$566,383	Acquisition*/ No Action	3	\$435,952	\$718,487	0.6
Non-Floodway	22	2.3	4.2	\$579,148	Acquisition/ Elevation/ No Action	3	\$151,408	\$117,455	1.3
Totals	28	2.5	5.1	\$1,145,531	Acquisition/ Elevation/ No Action	6	\$587,360	\$835,942	0.7

* 2 of the 3 buildings have a B:C ratio less than 1.0

BR13– Harbinger Court (Figure E-6)

Problem area BR13 includes seven (7) residential homes on Harbinger Court, along Briar Creek. The house at 3008 Harbinger Court is a repetitive loss structure. Four houses (including the repetitive loss structure) are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.7 ft to 4.2 ft, with an average depth of 2.6 ft. The County has recently acquired two of the buildings in the floodway for future greenway/environmental restoration. The buildings still exist at the time of this report, however, since it is anticipated that they will be demolished in the future, they are recommended for no action.

Three alternatives were evaluated for BR13 – no action, property acquisition, and structure elevation. A floodwall was initially considered for this problem area, but was dismissed due to the close proximity of the creek to the houses. The house at 3000 Harbinger Court has an acquisition B:C ratio of 1.2. The house at 3007 Harbinger Court is also recommended for acquisition despite a B:C ratio of 0.2, since it is in the floodway. The remaining 3 (not including the County owned) buildings have B:C ratios less than 1.0 for all investigated alternatives. The recommendation for BR13 is acquisition of two houses and “no action” for the remaining 5 houses.

Table 18. Problem Area BR13 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	4	3.3	4.2	\$427,878	Acquisition*/ No Action	2	\$121,253	\$186,492	0.7
Non-Floodway	3	1.7	2.3	\$66,092	No Action	0	-	-	-
Totals	7	2.6	4.2	\$493,970	Acquisition/ No Action	2	\$121,253	\$186,492	0.7

* 1 of the 2 buildings has a B:C ratio less than 1.0

BR14– Eastway Drive/Dunlavin Way/Harrow Place/Brixton Court/Country Club Drive/Airlie Street (Figure E-7)

Problem area BR14 includes forty-five (42) residential houses and one (1) day care facility between the Eastway Drive and Country Club Drive stream crossings, along Briar Creek. Five houses are repetitive loss structures. Twenty-four houses are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.1 ft to 5.9 ft, with an average depth of 2.3 ft.

Three alternatives were evaluated for BR14 – no action, property acquisition, and structure elevation. Ten houses and the day care have cost-effective acquisition B:C ratios, ranging from 1.0 to 8.3. Sixteen

other houses with B:C ratios less than 1.0 are recommended for acquisition since they are in the floodway. Five houses have elevation B:C ratios greater than 1.0. B:C ratios for the remaining 14 buildings are less than 1.0 for all investigated alternatives. The recommendation for BR14 is property acquisition for 26 houses and the daycare facility, structure elevation for five houses, and “no action” for the remaining 14 houses.

Table 19. Problem Area BR14 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	24	2.6	5.6	\$3,479,624	Acquisition*	24	\$3,479,624	\$2,045,770	1.7
Non-Floodway	22	2.0	5.9	\$3,150,283	Acquisition/ Elevation/ No Action	8	\$2,793,616	\$688,578	4.1
Totals	46	2.3	5.9	\$6,629,906	Acquisition/ Elevation/ No Action	32	\$6,273,240	\$2,734,348	2.3

* 16 of the 24 buildings have a B:C ratio less than 1.0

BR15– Shamrock Drive/Eastway Drive (Figure E-7)

Problem area BR15 includes one (1) recreation center on Shamrock Drive and one (1) residential house on Eastway Drive within the floodplain fringe area of Briar Creek. The house (Parcel ID 10101117) is a repetitive loss structure. The future condition 100-yr storm flood depths range from 1.3 ft. to 3.1 ft., with an average depth of 2.2 ft. Four alternatives were evaluated for BR15 – no action, property acquisition, structure elevation, and flood proofing. The house has an acquisition B:C ratio of 3.4 and the recreation center has B:C ratio of 2.8 for flood proofing. MCSWS may want to consider the recreation building for a flood proofing demonstration project since it is owned by the County. The recommendation for BR15 is acquisition of one house and flood proofing of one recreation center.

Table 20. Problem Area BR15 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	2	2.2	3.1	\$410,200	Acquisition/ Flood Proofing	2	\$410,200	\$132,370	3.1
Totals	2	2.2	3.1	\$410,200	Acquisition/ Flood Proofing	2	\$410,200	\$132,370	3.1

BR16– Shamrock Drive/Thames Apartment Drive (Figure E-7)

Problem area BR16 includes twenty-three (23) buildings in a residential apartment complex on Thames Apartment Drive off of Shamrock Drive, along Briar Creek. Twelve of the buildings are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future condition 100-yr storm range from 2.4 ft to 5.5 ft, with an average depth of 3.1 ft. Three alternatives were evaluated for BR16 – no action, property acquisition, and structure elevation. Initially a floodwall/wetland was considered, however, it was removed from consideration due to anticipated complications with existing property, utilities, and roadways. In addition, since many of the buildings are within the floodway, the construction of the levee may violate the County’s Levee Policy as well as floodplain restrictions.

All 23 buildings have cost-effective acquisition B:C ratios, ranging from 1.3 to near 30. The primary cause for the high B:C ratios is that all the buildings are predicted to incur flooding in the 10-year, as

well as the larger storm events (the 10-year event is often an indicator whether or not mitigation will be cost-effective for mitigation). Similar to what the County has done for other buyout project areas (e.g. Whitehurst, Westfield, etc.) the vacant land resulting from acquisition could be used for streamside water quality enhancements, such as pocket wetlands, vegetative buffers, and/or storm water best management practices (BMPs). The recommendation for BR16 is acquisition of 23 buildings and further investigation of water quality enhancements.

Table 21. Problem Area BR16 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	12	3.1	4.4	\$20,598,166	Acquisition/ Water Quality Enhancements	12	\$20,598,166	\$2,665,525	7.7
Non-Floodway	11	3.2	5.5	\$17,356,729	Acquisition/ Water Quality Enhancements	11	\$17,356,729	\$2,791,382	6.2
Totals	23	3.1	5.5	\$37,954,895	Acquisition/ Water Quality Enhancements	23	\$37,954,895	\$5,456,907	7.0

BR17– Thames Apartment Drive (Figure E-7)

Problem area BR17 includes three additional buildings in the residential apartment complex on Thames Apartment Drive (described in BR16), along Briar Creek. These three buildings are located on the opposite (west) side of the creek from the main apartment complex, and are all located within the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 1.1 ft to 2.3 ft, with an average depth of 1.8 ft. Three different alternatives were evaluated for BR21 – no action, property acquisition, and structure elevation. B:C ratios for property acquisition are greater than 1.0 for all three buildings. Similarly to BR16, the primary cause for the high B:C ratios (despite the relative low flood depths) is that all the buildings are predicted to incur flooding in the 10-year, as well as the larger storm events.

This area also appears to have potential for water quality enhancements – most notably stream restoration and/or wetland creation. The property is relatively large and undeveloped (with the exception of the three buildings). In addition, the water quality enhancements could be coordinated with the enhancements recommended in BR16 for additional water quality and public education benefit. The recommendation for BR16 is acquisition of 3 buildings and further investigation of water quality enhancements.

Table 22. Problem Area BR17 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	3	1.8	2.3	\$4,605,406	Acquisition/ Water Quality Enhancements	3	\$4,605,406	\$807,772	5.7
Non-Floodway	0	-	-	-	-	-	-	-	-
Totals	3	1.8	2.3	\$4,605,406	Acquisition/ Water Quality Enhancements	3	\$4,605,406	\$807,772	5.7

BR18– Purser Drive/Jennie Linn Drive (Figure E-7)

Problem area BR18 includes eleven (11) residential houses on Purser Drive and Jennie Linn Drive, along Briar Creek. One house on Purser Drive (Parcel ID 09906110) is a repetitive loss structure. All of the houses, with the exception of the house at 2218 Jennie Linn Drive, are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future condition 100-yr storm range from 0.4 ft to 3.8 ft, with an average depth of 2.4 ft. Three alternatives were evaluated for BR18 – no action, property acquisition, and structure elevation. Nine of the houses have B:C ratios greater than 1.0 for both property acquisition. One house (Parcel ID 09906212) with an acquisition B:C ratio of 0.3 is recommended for acquisition since it is in the floodway. The remaining two houses have B:C ratios less than 1.0 for all investigation improvement alternatives. The recommendation for the BR18 problem area is property acquisition for 10 houses, and “no action” for the remaining house.

Table 23. Problem Area BR18 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	10	2.6	3.8	\$3,227,884	Acquisition	10	\$3,227,884	\$412,708	7.8
Non-Floodway	1	0.4	0.4	\$9,495	No Action	0	-	-	-
Totals	11	2.4	3.8	\$3,237,379	Acquisition/ No Action	10	\$3,227,884	\$412,708	7.8

* 1 of the 10 buildings has a B:C ratio less than 1.0

BR19– Dora Drive/Purser Drive (Figure E-7)

Problem area BR19 includes five (5) residential houses on Dora Drive and one (1) residential house on Purser Drive, within the floodplain fringe area of Briar Creek. Flooding depths in the future condition 100-yr storm range from 0.1 ft to 1.9 ft, with an average depth of 0.9 ft. Three alternatives were evaluated for BR19 – no action, property acquisition, and structure elevation. Two houses (Parcel ID’s 09906507 and 09906506) on Dora Drive have B:C ratios over 1.0 for property acquisition. A third house has a B:C ratio of 1.1 for structure elevation. The other three houses have B:C ratios ranging from 0.1 to 0.2, for all investigated improvement alternatives. The recommendation for the BR19 problem area is property acquisition of two houses, structure elevation of one house, and “no action” for the remaining three houses.

Table 24. Problem Area BR19 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	6	0.9	1.9	\$298,041	Acquisition/ Elevation/ No Action	3	\$280,045	\$193,805	1.4
Totals	6	0.9	1.9	\$298,041	Acquisition/ Elevation/ No Action	3	\$280,045	\$193,805	1.4

BR20– Dolphin Lane/Kildare Drive/Shannonhouse Drive (Figure E-8)

Problem area BR20 includes twenty-eight (28) residential houses on Dolphin Lane and Kildare Drive, along Briar Creek. Three of the houses are repetitive loss structures. Twenty-three (23) of the 28 are

houses are located within the community encroachment (0.1 foot) floodway. Flooding depths in the future condition 100-yr storm range from less than 0.1 ft to 4.1 ft, with an average depth of 1.8 ft.

Four alternatives were evaluated for BR20 – no action, property acquisition, structure elevation, and a combination levee/wetland. The levee/wetland was recommended in a previous study (HDR, 2001(c)), and would entail acquiring the 16 houses (12 creekside houses along Dolphin Lane and the 4 houses at the end of Kildare Drive), constructing an approximate 6 foot high earthen levee, and constructing/excavating a wetland to account for lost floodplain storage. A planning level cost of approximately \$1.6 million (= \$1.3 million in property acquisition + \$0.3 million for the levee/wetland) was estimated for the levee/wetland. Although, the levee/wetland would mitigate all 28 houses and had a B:C ratio over 1.0, this alternative is not recommended due to its technical and regulatory complexity. In addition, the levee is not consistent with the County’s general approach of acquisition for properties in the floodway.

Six houses have B:C ratios over 1.0 for property acquisition. Seventeen other houses having B:C ratios ranging from 0.3 to 0.8 are recommended for acquisition since they are in the floodway. The remaining five houses have B:C ratios less than 1.0 for all investigated individual improvement alternatives.

Although the combination levee/wetland is not recommended for flood hazard mitigation, the west bank of Briar Creek at this location appears to be a suitable site for a small environmental restoration project. There are several incoming tributaries, the area is flat, and the site is on poorly drained soils (Monacan soils with Arents). There is a vacant piece of property (PID 09908120) that could be purchased for constructing and accessing the proposed restoration project. One potential constraint is the sewer trunk line that runs along the west bank of the Creek. Further investigation is necessary to verify this location.

The recommendation for the BR20 problem area is property acquisition of 23 houses, “no action” for the remaining five houses, and further investigation of water quality enhancements on the opposite (west) stream overbank.

Table 26. Problem Area BR20 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	23	2.0	4.1	\$1,848,665	Acquisition*	23	\$1,848,665	\$1,897,136	1.0
Non-Floodway	5	0.8	1.9	\$86,517	No Action	0	-	-	-
Totals	28	1.8	4.1	\$1,935,182	Acquisition/ No Action	23	\$1,848,665	\$1,897,136	1.0

* 17 of the 23 buildings have a B:C ratio less than 1.0

BR21– Dolphin Lane/Kinsale Lane/Ruth Drive (Figure E-8)

Problem area BR21 includes thirteen (13) residential homes on Dolphin Lane, Kinsale Lane, and Ruth Drive along Briar Creek. One house on Dolphin Lane is a repetitive loss structure. All but one home on Ruth Drive occupy the community encroachment (0.1 foot) floodway. Flooding depths in the future condition 100-yr storm range from 0.2 ft to 2.4 ft, with an average of 0.9 ft. Three alternatives were evaluated for BR21 – no action, property acquisition and structure elevation. Four houses had acquisition B:C ratios greater than 1.0. The remaining nine houses have acquisition B:C ratios ranging from 0.1 to 0.9, however, they are recommended for acquisition since they are in the floodway. The recommendation for the BR21 problem area is acquisition of 14 structures.

Table 27. Problem Area BR21 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	12	0.8	2.4	\$945,613	Acquisition*	12	\$945,613	\$936,872	1.0
Non-Floodway	1	2.3	2.3	\$485,427	Acquisition	1	\$485,427	\$87,282	5.6
Totals	13	0.9	2.4	\$1,431,041	Acquisition	13	\$1,431,041	\$1,024,154	1.4

* 9 of the 12 buildings have a B:C ratio less than 1.0

BR22 – Cutshaw Court/Ilford Street (Figure E-8)

Problem area BR22 includes three (3) residential houses on Cutshaw Court and Ilford Street, along Briar Creek. The home on Cutshaw Court is located within the community encroachment (0.1 foot) floodway. Flooding depths in the future condition 100-yr storm range from 0.1 ft to 1.5 ft, with an average of 0.7 ft.

Three alternatives were evaluated for BR22 – no action, property acquisition, and structure elevation. One house, 5617 Ilford Lane has a acquisition B:C ratio greater than 1.0. The house on Cutshaw is located in the floodway and therefore recommended for acquisition. The remaining house has B:C ratios less than 1.0 and is recommended for “no action.” The recommendation for the BR22 problem area is acquisition of two houses, and “no action” of one house.

Table 28. Problem Area BR22 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	1	0.4	0.4	\$15,664	Acquisition*	1	\$15,664	\$102,066	0.2
Non-Floodway	2	0.8	1.5	\$144,784	Acquisition/ No Action	1	\$137,276	\$88,808	1.6
Totals	3	0.7	1.5	\$160,447	Acquisition/ No Action	2	\$152,940	\$190,874	0.8

* building has a B:C ratio less than 1.0

BR23 – Covecreek Drive (Figure E-8)

Problem area BR23 includes two (2) residential homes on Covecreek Drive, along Briar Creek. The structures are inundated by 0.3 and 1.5 feet of water, respectively in the future condition 100-yr storm. Both of these homes are located outside of the community encroachment (0.1 foot) floodway. Three alternatives were evaluated for BR23 – no action, property acquisition, structure elevation. Both homes have B:C ratios less than 1.0, therefore, recommendation for the BR23 problem area is “no action” for both structures.

Table 29. Problem Area BR23 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	2	0.9	1.5	\$46,053	No Action	0	-	-	-
Totals	2	0.9	1.5	\$46,053	No Action	0	-	-	-

EDB1– Commonwealth Avenue (Figure E-9)

Problem area EDB1 includes six (6) commercial buildings and one (1) residential house on Commonwealth Avenue, along Edwards Branch. One building (Parcel ID 12910149) is a repetitive loss structure. Five of the seven buildings are located in the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 2.7 ft to 4.7 ft, with an average depth of 3.5 ft.

Three alternatives were evaluated for EDB1 – no action, property acquisition, and structure elevation. The single family residential house had a structure elevation B:C ratio of 1.1, while the upstream three commercial buildings (Parcel ID’s 12910151, 12910150, and 12910149) on Commonwealth Avenue had B:C ratios for acquisition ranging from 1.1 to 2.2. Mitigation alternatives for the downstream three commercial buildings produced non cost-effective B:C ratios ranging from 0.2 to 0.8, but two of these buildings are recommended for acquisition since they are in the floodway. The recommendation for EDB1 is property acquisition for five commercial buildings, structure elevation for one house, and “no action” for the remaining commercial building.

Table 30. Problem Area EDB1 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	5	3.8	4.7	\$369,446	Acquisition*	5	\$369,446	\$364,167	1.0
Non-Floodway	2	2.7	2.7	\$100,732	Elevation/ No Action	1	\$50,566	\$45,198	1.1
Totals	7	3.5	4.7	\$470,178	Acquisition/ Elevation/ No Action	6	\$420,012	\$409,365	1.0

* 2 of 5 buildings have a B:C ratio less than 1.0

EDB2– East Independence Boulevard (Figure E-9)

Problem area EDB2 includes a nightclub and a restaurant on East Independence Boulevard, along Edwards Branch. Both buildings are located in the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 2.4 ft to 3.6 ft, with an average depth of 3.0 ft. Three alternatives were evaluated for EDB2 – no action, property acquisition, and structure elevation. B:C ratios for the nightclub and restaurant range from 0.1 to 0.8, however, both structures are recommended for acquisition since they are in the floodway. The recommendation for EDB2 is acquisition of two buildings.

Table 31. Problem Area EDB2 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	2	3.0	3.6	\$350,539	Acquisition*	2	\$350,539	\$1,639,206	0.2
Non-Floodway	0	-	-	-	-	-	-	-	-
Totals	2	3.0	3.6	\$350,539	Acquisition	2	\$350,539	\$1,639,206	0.2

* both buildings have a B:C ratio less than 1.0

EDB3– East Independence Boulevard (Figure E-9 and E-10)

Problem area EDB3 includes four (4) commercial/retail buildings (McDonalds, Arby’s, Shoney’s, etc.) on East Independence Boulevard, along Edwards Branch. Two buildings (Parcel IDs 13109212, 13109211) are located in the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.1 ft to 2.0 ft, with an average depth of 0.9 ft. Three alternatives were evaluated for EDB3 – no action, property acquisition, and structure elevation. B:C ratios range from less than 0.1 to 0.4 for all the buildings. However two buildings are recommended for acquisition since they occupy the floodway. The recommendation for EDB3 is acquisition for two buildings and “no action” for the remaining two buildings.

Table 32. Problem Area EDB3 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	2	1.5	2.0	\$82,101	Acquisition*	2	\$82,101	\$1,130,533	0.1
Non-Floodway	2	0.3	0.4	\$11,123	No Action	0	-	-	-
Totals	4	0.9	2.0	\$93,224	Acquisition/ No Action	2	\$82,101	\$1,130,533	0.1

*both buildings have a B:C ratio less than 1.0

EDB4– Dresden Drive/Woodland Drive (Figure E-10)

Problem area EDB4 includes four (4) multi-family homes on Dresden Drive and one apartment home on Woodland Drive, along Edwards Branch. Two buildings occupy the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 0.5 ft to 2.8 ft, with average depth of 1.5 ft. Three alternatives were evaluated for EDB4 – no action, property acquisition, and structure elevation. The apartment building (Parcel ID 13109214) off of the left bank of Edwards Branch has an acquisition B:C ratio of 3.7. The remaining four buildings have B:C ratios less than 1.0, ranging from 0.1 to 0.9, but two are recommended for acquisition since they are located in the floodway. The recommendation for EDB4 is property acquisition for three buildings, and “no action” for the remaining two buildings.

Table 33. Problem Area EDB4 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	2	1.5	1.5	\$107,811	Acquisition*	2	\$107,811	\$191,940	0.6
Non-Floodway	3	1.5	2.8	\$589,858	Acquisition/ No Action	1	\$536,394	\$146,605	3.7
Totals	5	1.5	2.8	\$697,669	Acquisition/ No Action	3	\$644,205	\$338,545	1.9

* both buildings have a B:C ratio less than 1.0

EDB5– Winfield Drive/Sheffield Drive (Figure E-10)

Problem area EDB5 includes five (5) single family houses and one multi-family home on Winfield Drive and Sheffield Drive, along Edwards Branch. All of these homes occupy the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from less than 0.1 ft to 1.6 ft, with an average depth of 1.1 ft. Three alternatives were evaluated for EDB5 – no action, property acquisition, and structure elevation. B:C ratios for each house are below 1.0, but all houses are recommended for acquisition since they occupy the floodway. The recommendation for EDB5 is property acquisition for all six homes.

Table 34. Problem Area EDB5 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	6	1.1	1.6	\$184,406	Acquisition*	6	\$184,406	\$556,703	0.3
Non-Floodway	0	-	-	-	-	-	-	-	-
Totals	6	1.1	1.6	\$184,406	Acquisition	6	\$184,406	\$556,703	0.3

* all buildings have a B:C ratio less than 1.0

EDB6– Tarrington Avenue/Sheffield Drive (Figure E-10)

Problem area EDB6 includes three (3) houses on Tarrington Avenue and Sheffield Drive, along Edwards Branch. One of the houses on Tarrington Avenue (Parcel ID 13111356) is a repetitive loss structure. The house on Sheffield Drive is located in the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from less than 0.1 ft to 0.8 ft, with an average depth of 0.5 ft. Three alternatives were evaluated for EDB6 – no action, property acquisition, and structure elevation. All three houses have B:C ratios less than 1.0. However, the house on Sheffield Drive will be recommended for acquisition since it is located in the floodway. The recommendation for EDB6 is property acquisition for one house and “no action” for the other two houses.

Table 35. Problem Area EDB6 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	1	0.7	0.7	\$25,380	Acquisition*	1	\$25,380	\$89,389	0.3
Non-Floodway	2	0.4	0.8	\$23,654	No Action	0	-	-	-
Totals	3	0.5	0.8	\$49,034	Acquisition/ No Action	1	\$25,380	\$89,389	0.3

* building has a B:C ratio less than 1.0

BT2-1–Shannonhouse Drive (Figure E-8)

Problem area BT2-1 includes ten (10) houses on Shannonhouse Drive, along Briar Creek Tributary 2. Five of these houses are located in the community encroachment (0.1 foot) floodway. Flooding depths in the future conditions 100-yr storm range from 2.7 ft to 4.4 ft, with an average depth of 3.3 ft. Three alternatives were evaluated for BT2-1 – no action, property acquisition, and structure elevation. B:C ratios for property acquisition ranged from 1.6 to 8.0 for all ten houses. The recommendation for BT2-1 is property acquisition for ten houses.

Table 36. Problem Area BT2-1 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	5	3.0	3.5	\$1,036,477	Acquisition	5	\$1,036,477	\$440,154	2.4
Non-Floodway	5	3.5	4.4	\$2,066,758	Acquisition	5	\$2,066,758	\$459,880	4.5
Totals	10	3.3	4.4	\$3,103,236	Acquisition	10	\$3,103,236	\$900,034	3.5

BT2-2–Donovan Place (Figure E-8)

Problem area BT2-2 includes one (1) house on Donovan Place, along Briar Creek Tributary 2. This house is located outside of the community encroachment (0.1 foot) floodway. The flooding depth in the future conditions 100-yr storm is 1.5 ft. Three alternatives were evaluated for BT2-2 – no action, property acquisition, and structure elevation. B:C ratios are 0.4 and 0.6 for property acquisition and structure elevation, respectively. Therefore, the recommendation for the BT2-2 problem area is no action.

Table 37. Problem Area BT2-2 Mitigation Summary

	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	1	1.5	1.5	\$29,672	No Action	0	-	-	-
Totals	1	1.5	1.5	\$29,672	No Action	0	-	-	-

BT2-3–Galway Drive (Figure E-8)

Problem area BT2-3 includes one (1) house on Galway Drive, along Briar Creek Tributary 2. This house is located outside of the community encroachment (0.1 foot) floodway. The flooding depth in the future conditions 100-yr storm is 6.4 ft. Three alternatives were evaluated for BT2-3 – no action, property acquisition, and structure elevation. The B:C ratios are 23.5 and 22.4 for property acquisition and structure elevation, respectively. The recommendation for BT2-3 is property acquisition for one house.

Table 38. Problem Area BT2-3 Mitigation Summary									
	Total # of Buildings Flooding	Average Flood Depth	Max Flood Depth	Total Flood Damage	Recommended Mitigation	Buildings Protected by Mitigation	Benefit From Mitigation	Total Mitigation Cost	Overall B:C Ratio for Mitigation
Floodway	0	-	-	-	-	-	-	-	-
Non-Floodway	1	6.4	6.4	\$2,101,481	Acquisition	1	\$2,101,481	\$89,254	23.5
Totals	1	6.4	6.4	\$2,101,481	Acquisition	1	\$2,101,481	\$89,254	23.5

4. CONCLUSIONS AND RECOMMENDATIONS

The Briar Creek Watershed encompasses a 21.6 square mile urban area in the east-central portion of Mecklenburg County, North Carolina. The Watershed contains four County-regulated streams with FCFs that were included in this study – Briar Creek, Edwards Branch, Briar Creek Tributary #1, and Briar Creek Tributary #2.

Flood Hazard Mitigation

There are 897 structures within the FCF boundaries in the Briar Creek Watershed. Comparison of flood information with building elevation certificates revealed that 367 of the 897 structures have their lowest finished floor below the predicted water surface elevation (WSE) of the FCF, and thus are considered “flooding” structures. Flood damages for these 367 buildings were estimated using the FEMA Full Riverine Benefit:Cost model (FEMA BC), and totaled to over \$399 million (2003 dollars). Figure E-1 shows an overall map of the Briar Creek Watershed and displays problem areas identified in the study.

Several alternatives were developed to mitigate flood damages for problem areas identified along the study streams. A benefit:cost (BC) economic analysis was performed to evaluate cost-effectiveness of the alternatives at each problem area. The alternatives were then compared for their economic, technical, and social feasibility, from which a recommended mitigation strategy was developed for each problem area. If no improvement alternatives were identified as being cost effective or technically feasible, no action was recommended (i.e. leave building as-is).

The alternative evaluation indicated that it is cost-effective (or otherwise pertinent) to provide flood protection for 244 of the 367 flooding buildings. The estimated benefits (i.e. damages reduced) and improvement costs are approximately \$393.9 million and \$47.1 million respectively. This indicates that roughly 66% of the buildings are receiving approximately 99% of the flood damages, and that focusing mitigation efforts on these buildings will provide the most return for mitigation dollars spent.

It should be noted that per direction of Mecklenburg County Storm Water Services (MCSWS), all structures within the community encroachment (0.1 foot) floodway were recommended for acquisition, regardless of their cost-effectiveness (i.e. B:C ratio). Public safety (the floodway is considered an especially hazardous area due to high velocities and potential debris hazards) and the fact that local floodplain regulations greatly restrict potential construction/re-construction in the floodway, were the primary considerations for the decision to recommend acquisition for all structures in the community encroachment floodway. In the Briar Creek Watershed, there were a total of 221 buildings recommended for acquisition. The analysis conducted in this study estimated that 89 (40%) of these buildings are not cost-effective for acquisition. For the 155 buildings that were identified as being cost-effective for flood mitigation (=244 – 89), the estimated benefits and costs were \$388.6 million and \$29.7 million, yielding a B:C ratio of 13.1. Figures E-2 through E-10 show the recommended mitigation improvements within the Briar Creek Watershed.

Environmental Characterization

The Briar Creek Watershed is located in an established, highly urbanized area within the City of Charlotte. Land use is predominately residential (> 85%), but also includes limited commercial, industrial, vacant, and other uses. The streams in the Watershed have been modified (e.g. straightened, widened, armored, etc.) to accommodate urbanization, and thus do not exhibit natural, healthy stream characteristics. Reference to local water/biological monitoring data indicates that overall conditions are “good to excellent” and have been improving over the last several years. However, benthic sample readings in the Watershed have consistently been classified as “poor” at several sites.

The County has completed several environmental restoration related projects (discussed in Section 1.2). In addition, the County owns and has been actively purchasing significant portions of vacant land adjacent to the study streams within the Briar Creek Watershed. This land will likely be used for proposed greenways along the Creek, which in turn will likely incorporate water quality and/or environmental restoration features.

The majority of environmental analysis included in this PER are broad in nature, however, several locations were identified for potential environmental restoration within the Watershed (Figures E-2 through E-10). In addition, it is recommended that more detailed analysis be conducted at a smaller scale level to investigate other environmental restoration opportunities.

5. REFERENCES

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APPENDIX A

BRIAR CREEK WATERFED FEMA CB IMPRT SPREADSHEET

UPDATED 10/20

Table with columns: UNCLSD ID, BATH NAME, STATE, STAB/BACK, PID, SUTOT, SUTOS, OWNER NAME, CRITICAL PCT, BLDG SUBTYPE, TYPE, BLDG TYPE, EFF YR, YEAR, BULL, INST, FLAG, HEATS AREA, BLDG VAL, ESCRP, QTY, Q650W, Q100W, Q500W, WSE10W, WSE50W, WSE100W, PSE50W, CLMNT, STRENC, MANUAL, FLOWAT, FLWAT, COMMENTS. The table contains a comprehensive list of property records with detailed attributes for each entry.

747	Bran Creek	4038.4961	09/31/21	3000 DUNLAVIN WY	CHARLOTTE, NC	HOUSE LOUISE MERRIAM	0.20	SINGLE F4 I.D STORY	677.70	1989	1007	\$59,540	Brnk	4372	6983	7918	10041	676.0	678.0	678.6	680.0	\$5,200	N	N	
748	Bran Creek	3909.2474	09/31/21	3014 DUNLAVIN WY	CHARLOTTE, NC	BRIDGES CLYDE A WIFE	0.20	SINGLE F4 I.D STORY	662.50	1989	1030	\$61,180	Brnk	4372	6983	7918	10041	676.2	677.0	677.3	679.0	\$5,200	N	N	
749	Bran Creek	3877.5021	09/31/26	2983 DUNLAVIN WY	CHARLOTTE, NC	LAUGHRIN GEORGE VERNON	0.20	SINGLE F4 I.D STORY	674.40	1981	1307	\$81,180	Brnk	4372	6983	7918	10041	676.0	677.0	677.3	679.0	\$5,200	N	N	
750	Bran Creek	4011.4526	09/31/26	3008 DUNLAVIN WY	CHARLOTTE, NC	MATTHEWS RANDY	0.20	SINGLE F4 I.D STORY	676.50	1989	1046	\$47,400	Brnk	4372	6983	7918	10041	676.8	677.0	677.4	679.0	\$5,200	N	N	
751	Bran Creek	3911.4414	09/31/26	3011 DUNLAVIN WY	CHARLOTTE, NC	CLINE EDWARD JR	0.20	SINGLE F4 I.D STORY	653.00	1989	1188	\$63,000	Brnk	4372	6983	7918	10041	674.8	674.8	675.0	676.0	\$5,200	N	N	
752	Bran Creek	4000.4774	09/31/26	3000 DUNLAVIN WY	CHARLOTTE, NC	CONNELL GERALD G	0.20	SINGLE F4 I.D STORY	676.10	1989	1144	\$53,040	Brnk	4372	6983	7918	10041	676.8	677.0	677.3	679.0	\$5,200	N	N	
753	Bran Creek	3941.4024	09/31/26	2981 DUNLAVIN WY	CHARLOTTE, NC	COLE JOHN HARRY	0.20	SINGLE F4 I.D STORY	676.00	1989	1150	\$54,000	Brnk	4372	6983	7918	10041	677.0	677.0	677.3	679.0	\$5,200	N	N	
754	Bran Creek	3999.5672	09/31/26	2984 DUNLAVIN WY	CHARLOTTE, NC	HONE YUJIE JEFFREY HOWARD	0.20	SINGLE F4 I.D STORY	675.80	1986	1246	\$72,460	Brnk	4372	6983	7918	10041	675.5	675.5	675.8	677.0	\$5,200	N	N	
755	Bran Creek	3991.2904	09/31/26	2985 DUNLAVIN WY	CHARLOTTE, NC	SPORRIER PHAN W	0.20	SINGLE F4 I.D STORY	675.00	1989	1309	\$56,120	Brnk	4372	6983	7918	10041	676.8	676.7	676.2	677.2	\$5,200	N	N	
756	Bran Creek	3950.4485	09/31/26	2983 DUNLAVIN WY	CHARLOTTE, NC	DEWITT PATRICIA ANN	0.20	SINGLE F4 I.D STORY	675.00	1989	1327	\$47,300	Brnk	4372	6983	7918	10041	674.0	674.0	674.3	675.0	\$5,200	N	N	
757	Bran Creek	3904.8484	09/31/26	3000 ARLIE ST	CHARLOTTE, NC	KEELING THOMAS	0.20	SINGLE F4 I.D STORY	674.00	1989	1834	\$75,190	Brnk	4372	6983	7918	10041	673.7	676.7	676.2	677.2	\$5,200	N	N	
758	Bran Creek	3948.7074	09/31/26	2983 DUNLAVIN WY	CHARLOTTE, NC	BYRD S RAY ANBERSON W III	0.20	SINGLE F4 I.D STORY	675.00	1989	1835	\$61,480	Brnk	4372	6983	7918	10041	673.0	674.0	673.7	674.0	\$5,200	N	N	
759	Bran Creek	3930.7250	09/31/26	2971 DUNLAVIN WY	CHARLOTTE, NC	SHARMAN OLIVER W	0.20	SINGLE F4 I.D STORY	675.00	1989	1346	\$61,820	Brnk	4372	6983	7918	10041	673.8	675.0	675.2	677.2	\$5,200	N	N	
760	Bran Creek	3897.7804	09/31/26	3014 ARLIE ST	CHARLOTTE, NC	COCKMAN ROBERT J	0.20	SINGLE F4 I.D STORY	673.50	1989	1329	\$61,390	Brnk	4372	6983	7918	10041	674.7	675.0	674.2	677.2	\$5,200	N	N	
761	Bran Creek	3927.7631	09/31/26	2973 DUNLAVIN WY	CHARLOTTE, NC	JURK RANBY E	0.20	SINGLE F4 I.D STORY	671.20	1991	1510	\$72,790	Brnk	4372	6983	7918	10041	675.4	675.0	675.3	677.0	\$5,200	N	N	
762	Bran Creek	3931.6076	09/31/26	2989 DUNLAVIN WY	CHARLOTTE, NC	RICE R SCOTT JR	0.20	SINGLE F4 I.D STORY	673.80	1989	1326	\$47,610	Brnk	4372	6983	7918	10041	673.7	676.7	676.3	677.2	\$5,200	N	N	
763	Bran Creek	3890.2035	09/31/26	1917 COUNTRY CLUB DR	CHARLOTTE, NC	BASOR DAVID P	0.20	SINGLE F4 I.D STORY	676.20	1989	1903	\$46,290	Brnk	4372	6983	7918	10041	675.3	675.0	675.0	676.0	\$5,200	N	N	
764	Bran Creek	3907.2951	09/31/26	2971 DUNLAVIN WY	CHARLOTTE, NC	RENAUD MARY G	0.20	SINGLE F4 I.D STORY	674.10	1989	1466	\$59,310	Brnk	4372	6983	7918	10041	673.0	675.0	676.3	677.2	\$5,200	N	N	
765	Bran Creek	3886.0724	09/31/26	2917 COUNTRY CLUB DR	CHARLOTTE, NC	SHAW PHILIP L	0.20	SINGLE F4 I.D STORY	673.20	1986	2136	\$66,510	Brnk	4372	6983	7918	10041	674.3	675.0	675.0	676.0	\$5,200	N	N	
766	Bran Creek	3882.2147	09/31/26	2981 COUNTRY CLUB DR	CHARLOTTE, NC	HEISENWAY DONAVAN W	0.20	SINGLE F4 I.D STORY	670.30	1989	1670	\$75,100	Brnk	4372	6983	7918	10041	675.8	674.0	675.0	676.0	\$5,200	N	N	
767	Bran Creek	3881.2633	09/31/26	2911 COUNTRY CLUB DR	CHARLOTTE, NC	FALCONE ELAINE	0.20	SINGLE F4 I.D STORY	672.80	1989	1462	\$69,300	Brnk	4372	6983	7918	10041	674.4	674.0	676.0	677.2	\$5,200	N	N	
768	Bran Creek	3862.5428	09/31/26	1917 COUNTRY CLUB DR	CHARLOTTE, NC	HOLMES MICHAEL J M	0.20	SINGLE F4 I.D STORY	674.00	1989	1329	\$75,170	Brnk	4372	6983	7918	10041	675.0	675.0	675.0	676.0	\$5,200	N	N	
769	Bran Creek	3864.5428	09/31/26	1917 COUNTRY CLUB DR	CHARLOTTE, NC	TISON WILLIAM WOODBRIDGE	0.20	SINGLE F4 I.D STORY	672.80	1989	1433	\$60,290	Brnk	4372	6983	7918	10041	674.0	674.0	674.3	675.0	\$5,200	N	N	
770	Bran Creek	3868.6283	09/31/26	2980 COUNTRY CLUB DR	CHARLOTTE, NC	HERSET STEPHEN D	0.20	SINGLE F4 I.D STORY	672.20	1986	1466	\$62,660	Brnk	4372	6983	7918	10041	676.2	674.0	674.0	675.0	\$5,200	N	N	
771	Bran Creek	3853.8451	09/31/26	2907 HARRINGER CT	CHARLOTTE, NC	LESBENET DEAN A	0.20	SINGLE F4 I.D STORY	668.80	1986	1922	\$66,690	Brnk	4210	6123	7212	10103	657.3	658.0	660.0	664.0	\$5,200	N	N	
772	Bran Creek	3429.5961	09/31/26	1919 HARRINGER CT	CHARLOTTE, NC	LAUB KENNETH THAIR	0.20	SINGLE F4 I.D STORY	668.00	1989	1092	\$51,840	Brnk	4210	6123	7212	10103	657.3	658.0	660.0	664.0	\$5,200	N	N	
773	Bran Creek	3420.3071	09/31/26	1903 HARRINGER CT	CHARLOTTE, NC	BRODIE JOHN R IV	0.20	SINGLE F4 I.D STORY	666.80	1989	1194	\$53,290	Brnk	4210	6123	7212	10103	657.3	658.0	660.0	664.0	\$5,200	N	N	
774	Bran Creek	3414.6681	09/31/26	2006 HARRINGER CT	CHARLOTTE, NC	SMITH BROOKE C	0.20	SINGLE F4 I.D STORY	666.70	1986	1072	\$65,820	Brnk	4210	6123	7212	10103	657.1	658.0	660.0	664.0	\$5,200	N	N	
775	Bran Creek	3418.2041	09/31/26	2008 HARRINGER CT	CHARLOTTE, NC	MCCLELLAND COUNTY	0.20	SINGLE F4 I.D STORY	666.20	1986	1075	\$48,740	Brnk	4210	6123	7212	10103	657.1	658.0	660.0	664.0	\$5,200	N	N	
776	Bran Creek	3418.2041	09/31/26	2014 HARRINGER CT	CHARLOTTE, NC	MCCLELLAND COUNTY	0.20	SINGLE F4 I.D STORY	666.10	1997	1075	\$47,130	Brnk	4210	6123	7212	10103	657.1	658.0	660.0	664.0	\$5,200	N	N	
777	Bran Creek	3417.4071	09/31/26	2020 HARRINGER CT	CHARLOTTE, NC	COLLINS ROSAMARY CONCH	0.20	SINGLE F4 I.D STORY	668.20	1986	1092	\$45,860	1-stor	4210	6123	7212	10103	657.1	658.0	660.0	664.0	\$5,200	N	N	
778	Bran Creek	3387.8035	09/31/26	1907 HARRINGER CT	CHARLOTTE, NC	HARRIS LANE TWENTY	0.20	SINGLE F4 I.D STORY	669.10	1991	1100	\$46,030	Brnk	4210	6123	7212	10103	656.4	658.0	660.0	664.0	\$5,200	N	N	
779	Bran Creek	3354.4519	09/31/26	1915 MASONIC DR	CHARLOTTE, NC	PERRY THOMAS L & P SIBILLI	0.20	SINGLE F4 I.D STORY	667.10	1999	1150	\$53,580	Brnk	4210	6123	7212	10103	656.3	658.0	660.0	664.0	\$5,200	N	N	
780	Bran Creek	3347.5484	09/31/26	1919 MASONIC DR	CHARLOTTE, NC	PERRY ERNESTINE	0.20	SINGLE F4 I.D STORY	667.20	1999	1175	\$55,200	Brnk	4210	6123	7212	10103	656.2	658.0	660.0	664.0	\$5,200	N	N	
781	Bran Creek	3346.1626	09/31/26	1909 MASONIC DR	CHARLOTTE, NC	MCCLELLAND COUNTY	0.20	SINGLE F4 I.D STORY	667.00	1989	1170	\$47,130	Brnk	4210	6123	7212	10103	657.1	658.0	660.0	664.0	\$5,200	N	N	
782	Bran Creek	3346.6682	09/31/26	1901 MASONIC DR	CHARLOTTE, NC	FRIESEL CAPITAL CORP	0.20	SINGLE F4 I.D STORY	666.80	1989	1150	\$41,190	Brnk	4210	6123	7212	10103	656.2	658.0	660.0	664.0	\$5,200	N	N	
783	Bran Creek	3342.7426	09/31/26	1902 MASONIC DR	CHARLOTTE, NC	MCCLELLAND COUNTY	0.20	SINGLE F4 I.D STORY	667.00	1989	1134	\$47,130	Brnk	4210	6123	7212	10103	656.4	658.0	660.0	664.0	\$5,200	N	N	
784	Bran Creek	3324.2524	09/31/26	1919 MASONIC DR	CHARLOTTE, NC	LOWDER ERIC V	0.20	SINGLE F4 I.D STORY	667.70	1996	912	\$39,830	Brnk	4210	6123	7212	10103	656.0	658.0	660.0	664.0	\$5,200	N	N	
785	Bran Creek	3326.1794	09/31/26	1922 MASONIC DR	CHARLOTTE, NC	MCCLELLAND COUNTY	0.20	SINGLE F4 I.D STORY	668.20	1986	1154	\$44,910	1-stor	4210	6123	7212	10103	656.1	658.0	660.0	664.0	\$5,200	N	N	
786	Bran Creek	3316.6741	09/31/26	1913 MASONIC DR	CHARLOTTE, NC	WEBB GEORGE HOWARD A	0.20	SINGLE F4 I.D STORY	667.00	1986	1122	\$49,410	Brnk	4210	6123	7212	10103	656.0	658.0	660.0	664.0	\$5,200	N	N	
787	Bran Creek	3310.1178	09/31/26	1927 MASONIC DR	CHARLOTTE, NC	MCDONALD MARTHA W	0.20	SINGLE F4 I.D STORY	667.80	1986	1074	\$42,740	Brnk	4210	6123	7212	10103	655.8	658.0	660.0	664.0	\$5,200	N	N	
788	Bran Creek	3299.0520	09/31/26	1917 MASONIC DR	CHARLOTTE, NC	HARRIS TIMOTHY	0.20	SINGLE F4 I.D STORY	667.00	1986	1018	\$47,030	Brnk	4210	6123	7212	10103	655.8	658.0	660.0	664.0	\$5,200	N	N	
789	Bran Creek	3331.1071	09/31/26	1847 ARNOLD DR	CHARLOTTE, NC	GIST DAVID A	0.20	SINGLE F4 I.D STORY	668.20	1948	748	\$34,310	White	4210	6123	7212	10103	656.1	658.0	660.0	664.0	\$5,200	N	N	
790	Bran Creek	2972.7228	09/31/26	1919 MASONIC DR	CHARLOTTE, NC	HIGHCHURCH GARTH W	0.20	SINGLE F4 I.D STORY	667.80	1986	1056	\$41,780	Brnk	4210	6123	7212	10103	655.8	657.0	659.0	664.0	\$5,200	N	N	
791	Bran Creek	3316.6741	09/31/26	1913 MASONIC DR	CHARLOTTE, NC	KULIS LEONARD ALFRED A V	0.20	SINGLE F4 I.D STORY	667.00	1986	1176	\$46,190	Brnk	4210	6123	7212	10103	655.8	657.0	659.0	664.0	\$5,200	N	N	
792	Bran Creek	3308.7978	09/31/26	1909 MASONIC DR	CHARLOTTE, NC	FLURBER PHILIP J A W F	0.20	SINGLE F4 I.D STORY	667.20	1985	1176	\$46,190	Brnk	4210	6123	7212	10103	655.8	657.0	659.0	664.0	\$5,200	N	N	
793	Bran Creek	3310.1178	09/31/26	1917 MASONIC DR	CHARLOTTE, NC	LEIBERMAN MARFIELD S	0.20	SINGLE F4 I.D STORY	667.00	1986	1100	\$47,030	Brnk	4210	6123	7212	10103	655.8	657.0	659.0	664.0	\$5,200	N	N	
794	Bran Creek	3281.0719	09/31/26	1901 MASONIC DR	CHARLOTTE, NC	TAYLOR EARL G	0.20	SINGLE F4 I.D STORY	666.80	1986	1144	\$39,950	Brnk	4210	6123	7212	10103	655.7	657.0	659.0	664.0	\$5,200	N	N	
795	Bran Creek	3276.2604	09/31/26	1919 MASONIC DR	CHARLOTTE, NC	WILCOX RENEE	0.20	SINGLE F4 I.D STORY	666.80	1986	1122	\$46,520	White	4210	6123	7212	10103	655.7	657.0	659.0	664.0	\$5,200	N	N	
796	Bran Creek	3264.8484	09/31/26	1909 MASONIC DR	CHARLOTTE, NC	LONG E ERNEST JR	0.20	SINGLE F4 I.D STORY	666.80	1986	117														

APPENDIX B

REPETITIVE LOSS STRUCTURES - BRIAR CREEK WATERSHED

(As of 7/31/2003)

3020 AIRLIE ST	616 MELANIE CT
524 BRAMLET RD	623-631 MELANIE CT BLDG 8
548 BRAMLET RD BLDG 1	624-632 MELANIE CT
610-640 BRAMLET RD 605 609	639 MELANIE CT BLDG 9
638 CAVALIER CT	640 MELANIE CT BLDG 12
2717 CHILTON PL	647-655 MELANIE CT BLDG 10
3001-3005 CHANTILLY LN	648-656 MELANIE CT
3009-3015 CHANTILLY LN	717 MANNING DR
3801 COUNTRY CLUB DR	1608 MYERS PARK DR
3404 COMMONWEALTH AVE	1419 MYERS PARK DR
5129 DOLPHIN LANE	1425 MYERS PARK DR
5130 DOLPHIN LN	1437 MYERS PARK DR
5331 DOLPHIN LN	1516 MYERS PARK DR
2909 DUNLAVIN WAY	1523 MYERS PARK DR
2941 DUNLAVIN WAY	1536 MYERS PARK DR
3001 DUNLAVIN WAY	1605 MYERS PARK DR
1645 EASTWAY DR	1638 MYERS PARK DR
1207 GREEN OAKS LN	1643 MYERS PARK DR
1213 GREEN OAKS LN	1644 MYERS PARK DR
1217 GREEN OAKS LN	1645 MYERS PARK DR
1219 GREEN OAKS LN	1622 MYERS PARK RD
2910 HANSON DR	1230 MORNINGSIDE DR
2916 HANSON DR	110 PLACID PL
2920 HANSON DR	122 PLACID PL
2924 HANSON DR	128 PLACID PL
2928 HANSON DR	134 PLACID PL
3000 HANSON DR	138 PLACID PL
3008 HANSON DR	1727 PROVIDENCE RD
3012 HANSON DR	2231 PURSER DR
3016 HANSON DR	4512 PERTH CT
3026 HANSON DR	4520 PERTH CT
637 HUNGERFORD PL	4528 PERTH CT
3008 HARBINGER CT	4532 PERTH CT
5129 KILDARE DR	4536 PERTH CT
3000-3004 KAREN CT BLDG 29	4539 PERTH CT
3001-3003 KAREN CT BLDG 30	4601 PERTH CT
3005-3007 KAREN CT BLDG 31	4619 PERTH CT
3006-3010 KAREN CT BLDG 28	5515 RUTH DR
3009-3011 KAREN CT BLDG 32	1609 SCOTLAND AVE
3014-3030 KAREN COURT BLDG 27	1645 SCOTLAND AVE
3015-3017 KAREN CT BLDG 33	2321 SHARON RD
3019-3021 KAREN CT BLDG 34	2323 SHARON RD
3023-3025 KAREN CT BLDG 35	2328 SHARON RD
3027-3029 KAREN CT BLDG 36	1114 TARRINGTON AVE
3031-3033 KAREN CT BLDG 37	2907 VIOLET DR
3035-3037 KAREN CT BLDG 38	2919 VIOLET DR
LAUNDRY RM BLDG CHANTILLYLANE	2718 CHILTON PL
601 MUSEUM DR	2726 CHILTON PL
618 MUSEUM DR	2959 DUNLAVIN WAY
1649 MASONIC DR	3032 HANSON DR
2009 MILTON RD	3216 HARROW PL
615 MELANIE CT	5521 RUTH DR

APPENDIX C

Interest Rate 7.0%
Project Life 50

BRIAR CREEK WATERSHED INDIVIDUAL BENEFIT:COST ANALYSIS SPREADSHEET

Mecklenburg County Flood Hazard Mitigation Project
Upper Little Sugar, Briar, Irwin, and McMullen Creek Watersheds

BUILDING INFORMATION				BENEFIT		COSTS					B/C RATIOS					FLDWAY01	NOTES	RECOMMENDED ALTERNATIVE
UNBLD_ID	PID	SITE ADDRESS	FLD_GRP	FLOOD DAMAGE	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMENTS	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMENTS				
2458	17511101	711 MANNING DR	BR01	\$10,447	\$226,274	\$96,014	na	na	na	0.0	0.1	na	na	na	na	N		No Action
2075	17505135	2415 ROSWELL AVENUE	BR02	\$683,454	\$326,985	\$67,716	\$60,000	na	na	2.1	10.1	11.4	na	na	na	N		Flood Proofing
2018	17502215	2328 SHARON RD	BR03	\$272,910	\$194,757	\$87,917	na	na	na	1.4	3.1	na	na	na	na	N	repetitive loss structure	Acquisition
2022	15310519	2319 SHARON RD	BR03	\$133,495	\$178,346	\$64,701	na	na	na	0.7	2.1	na	na	na	na	N		Elevation
2025	17502213	2711 CHILTON PL	BR03	\$56,114	\$231,140	\$85,184	na	na	na	0.2	0.7	na	na	na	na	N		No Action
2026	15310520	2323 SHARON RD	BR03	\$158,170	\$156,713	\$76,351	na	na	na	1.0	2.1	na	na	na	na	Y	repetitive loss structure	Acquisition
2032	15310521	2327 SHARON RD	BR03	\$305,797	\$158,994	\$74,261	na	na	na	1.9	4.1	na	na	na	na	Y		Acquisition
2035	17502214	2717 CHILTON PL	BR03	\$962,602	\$187,512	\$69,391	na	na	na	5.1	13.9	na	na	na	na	N	repetitive loss structure	Acquisition
1860	15309216	2921 HANSON DR	BR04	\$6,321	\$126,364	\$38,973	na	\$883,214	na	0.1	0.2	na	na	0.0	na	N		No Action
1861	15309215	2917 HANSON DR	BR04	\$11,054	\$136,784	\$44,551	na	na	na	0.1	0.2	na	na	na	na	N		No Action
1864	15309214	2911 HANSON DR	BR04	\$126,553	\$174,085	\$68,195	na	na	na	0.7	1.9	na	na	na	na	N		Elevation
1875	15310538	2932 HANSON DR	BR04	\$191,361	\$126,658	\$39,110	na	na	na	1.5	4.9	na	na	na	na	N		Acquisition
1876	15310537	3000 HANSON DR	BR04	\$101,532	\$130,843	\$20,019	na	na	na	0.8	5.1	na	na	na	na	N	repetitive loss structure	Elevation
1877	15310539	2928 HANSON DR	BR04	\$141,209	\$130,721	\$42,055	na	na	na	1.1	3.4	na	na	na	na	N	repetitive loss structure	Acquisition
1878	15310536	3004 HANSON DR	BR04	\$174,469	\$133,016	\$41,016	na	na	na	1.3	4.3	na	na	na	na	N		Acquisition
1879	15310540	2924 HANSON DR	BR04	\$408,392	\$153,708	\$65,644	na	na	na	2.7	6.2	na	na	na	na	N	repetitive loss structure	Acquisition
1882	15310541	2920 HANSON DR	BR04	\$53,906	\$163,408	\$28,418	na	na	na	0.3	1.9	na	na	na	na	N	repetitive loss structure	Elevation
1883	15310535	3008 HANSON DR	BR04	\$186,351	\$139,016	\$50,960	na	na	na	1.3	3.7	na	na	na	na	N	repetitive loss structure	Acquisition
1886	15310542	2916 HANSON DR	BR04	\$165,443	\$132,376	\$41,873	na	na	na	1.2	4.0	na	na	na	na	N	repetitive loss structure	Acquisition
1888	15310543	2910 HANSON DR	BR04	\$127,270	\$141,558	\$43,294	na	na	na	0.9	2.9	na	na	na	na	N	repetitive loss structure	Elevation
1892	15310534	3012 HANSON DR	BR04	\$293,349	\$130,194	\$44,999	na	na	na	2.3	6.5	na	na	na	na	N	repetitive loss structure	Acquisition
1897	15310533	3016 HANSON DR	BR04	\$210,475	\$133,206	\$41,873	na	na	na	1.6	5.0	na	na	na	na	N	repetitive loss structure	Acquisition
1902	15310532	3020 HANSON DR	BR04	\$376,457	\$132,896	\$41,873	na	na	na	2.8	9.0	na	na	na	na	N	repetitive loss structure	Acquisition
1905	15309318	3027 HAMPTON AV	BR04	\$17,596	\$342,524	\$121,455	na	na	na	0.1	0.1	na	na	na	na	N		No Action
1907	15310531	3026 HANSON DR	BR04	\$400,580	\$138,114	\$26,154	na	na	na	2.9	15.3	na	na	na	na	N	repetitive loss structure	Acquisition
1909	15309230	3034 HAMPTON AV	BR04	\$129,741	\$366,942	\$110,515	na	na	na	0.4	1.2	na	na	na	na	N		Elevation
1911	15309339	3115 HANSON DR	BR04	\$11,482	\$74,688	\$16,888	na	na	na	0.2	0.7	na	na	na	na	N		No Action
1913	15309319	3033 HAMPTON AV	BR04	\$261,800	\$339,713	\$100,165	na	na	na	0.8	2.6	na	na	na	na	N		Elevation
1724	15513408	843 MUSEUM DR	BR05	\$24,869	\$430,471	\$90,183	na	na	na	0.1	0.3	na	na	na	na	N		No Action
1740	15513402	1633 TWIFORD PL	BR05	\$239,733	\$853,336	\$219,276	na	na	na	0.3	1.1	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1741	15513111	1620 TWIFORD PL	BR05	\$18,810	\$483,995	\$113,121	na	na	na	0.0	0.2	na	na	na	na	N		No Action
1744	15513112	1626 TWIFORD PL	BR05	\$64,808	\$541,825	\$149,375	na	na	na	0.1	0.4	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1749	15513113	1636 TWIFORD PL	BR05	\$83,315	\$955,083	\$151,502	na	na	na	0.1	0.5	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1754	15513113	1636 TWIFORD PL	BR05	\$21,515	\$223,717	\$35,487	na	na	na	0.1	0.6	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1769	15512320	1609 SCOTLAND AV	BR05	\$93,790	\$399,721	\$62,251	na	na	na	0.2	1.5	na	na	na	na	N	repetitive loss structure	Elevation
1800	15512226	1620 SCOTLAND AV	BR05	\$727,506	\$756,770	\$194,400	na	na	na	1.0	3.7	na	na	na	na	N		Acquisition
1807	15512225	1626 SCOTLAND AV	BR05	\$53,837	\$290,639	\$28,550	na	na	na	0.2	1.9	na	na	na	na	N		Elevation
1818	15512224	1632 SCOTLAND AV	BR05	\$36,958	\$296,714	\$54,047	na	na	na	0.1	0.7	na	na	na	na	N		No Action
1835	15512315	1637 SCOTLAND AV	BR05	\$43,528	\$774,480	\$157,567	na	na	na	0.1	0.3	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1850	15512313	1649 SCOTLAND AV	BR05	\$24,703	\$257,018	\$40,995	na	na	na	0.1	0.6	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1859	15512311	1659 SCOTLAND AV	BR05	\$1,585,720	\$857,559	\$85,635	na	na	na	1.8	18.5	na	na	na	na	N		Acquisition
1862	15512309	1663 SCOTLAND AV	BR05	\$24,165	\$261,508	\$47,270	na	na	na	0.1	0.5	na	na	na	na	N		No Action
1868	15512308	1667 SCOTLAND AV	BR05	\$32,708	\$404,041	\$58,447	na	na	na	0.1	0.6	na	na	na	na	N		No Action
1898	15512303	1701 PROVIDENCE RD	BR05	\$25,876	\$265,690	\$111,655	na	na	na	0.1	0.2	na	na	na	na	N		No Action
1916	15512301	1727 PROVIDENCE RD	BR05	\$183,384	\$898,006	\$583,621	na	na	na	0.2	0.3	na	na	na	na	N	repetitive loss structure	No Action
1759	18101219	831 MEADOWBROOK RD	BR06	\$9,260	\$146,122	\$23,128	na	na	na	0.1	0.4	na	na	na	na	N		No Action
1765	18101220	825 MEADOWBROOK RD	BR06	\$7,452	\$145,928	\$22,653	na	na	na	0.1	0.3	na	na	na	na	N		No Action
1768	18101201	801 MEADOWBROOK RD	BR06	\$32,570	\$165,159	\$46,120	na	na	na	0.2	0.7	na	na	na	na	N		No Action
1779	18101107	100 PLACID PL	BR06	\$180,955	\$149,456	\$45,144	na	na	na	1.2	4.0	na	na	na	na	Y		Acquisition
1782	18101202	815 MEADOWBROOK RD	BR06	\$10,420	\$183,794	\$78,365	na	na	na	0.1	0.1	na	na	na	na	N		No Action
1793	18101108	110 PLACID PL	BR06	\$157,577	\$154,441	\$23,000	na	na	na	1.0	6.9	na	na	na	na	Y	repetitive loss structure	Acquisition
1798	18101105	116 PLACID PL	BR06	\$131,590	\$156,278	\$80,482	na	na	na	0.8	1.6	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1801	18101104	122 PLACID PL	BR06	\$427,326	\$178,850	\$31,539	na	na	na	2.4	13.5	na	na	na	na	Y	repetitive loss structure	Acquisition
1812	18101103	128 PLACID PL	BR06	\$135,496	\$164,470	\$30,986	na	na	na	0.8	4.4	na	na	na	na	Y	not cost-effective, but in floodway; repetitive loss structure	Acquisition
1816	18101102	134 PLACID PL	BR06	\$255,424	\$161,431	\$48,597	na	na	na	1.6	5.3	na	na	na	na	Y	repetitive loss structure	Acquisition
1823	18102102	113 PLACID PL	BR06	\$14,091	\$155,842	\$46,852	na	na	na	0.1	0.3	na	na	na	na	N		No Action
1827	18101101	138 PLACID PL	BR06	\$263,732	\$160,402	\$25,342	na	na	na	1.6	10.4	na	na	na	na	Y	repetitive loss structure	Acquisition
1833	18102103	117 PLACID PL	BR06	\$15,926	\$174,246	\$67,698	na	na	na	0.1	0.2	na	na	na	na	N		No Action
1673	15515115	601 MUSEUM DR	BR07	\$90,340	\$802,475	\$146,238	na	na	na	0.1	0.6	na	na	na	na	Y	not cost-effective, but in floodway; repetitive loss structure; further investigate water quality enhancements	Acquisition
1510	15701606	407 FANNIE CR	BR08	\$3,878	\$46,724	\$26,772	na	na	na	0.1	0.1	na	na	na	na	N		No Action
1514	15701607	401 FANNIE CR	BR08	\$3,285	\$46,644	\$26,772	na	na	na	0.1	0.1	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1537	15701609	353 FANNIE CR	BR08	\$4,775	\$46,644	\$26,772	na	na	na	0.1	0.2	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1555	15701610	349 FANNIE CR	BR08	\$3,519	\$48,024	\$26,772	na	na	na	0.1	0.1	na	na	na	na	Y	not cost-effective, but in floodway	Acquisition

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BUILDING INFORMATION				BENEFIT		COSTS					B/C RATIOS						
UNBLD_ID	PID	SITE ADDRESS	FLD_GRP	FLOOD DAMAGE	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	FLDWAY01	NOTES	RECOMMENDED ALTERNATIVE
1220	12710110	2637 SHENANDOAH AV	BR09	\$11,110	\$104,140	\$34,163	na	na	\$15,300	0.1	0.3	na	na	0.7	N		No Action
1227	12710222	2626 SHENANDOAH AV	BR09	\$16,754	\$122,884	\$52,995	na	na	\$15,300	0.1	0.3	na	na	1.1	N		No Action
1233	12710226	2644 SHENANDOAH AV	BR09	\$86,931	\$82,566	\$211,798	na	na	na	1.1	0.4	na	na	na	N		Acquisition
1234	12710225	2640 SHENANDOAH AV	BR09	\$10,723	\$86,712	\$32,178	na	na	\$15,300	0.1	0.3	na	na	0.7	N		No Action
1245	12710204	2100 INDEPENDENCE BL	BR09	\$150,097	\$401,201	\$1,104,684	na	na	na	0.4	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1260	12710206	2647 CHESTERFIELD AV	BR09	\$15,581	\$127,354	\$40,019	na	na	\$15,300	0.1	0.4	na	na	1.0	N		No Action
1264	12710205	2645 CHESTERFIELD AV	BR09	\$32,390	\$125,222	\$59,029	na	na	\$15,300	0.3	0.5	na	na	2.1	N		No Action
1266	12710204	2120 INDEPENDENCE BL	BR09	\$43,928	\$63,902	\$179,098	na	na	na	0.7	0.2	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1275	12710319	2632 CHESTERFIELD AV	BR09	\$11,938	\$91,384	\$34,093	na	na	\$15,300	0.1	0.4	na	na	0.8	N		No Action
1278	12710318	2636 CHESTERFIELD AV	BR09	\$21,488	\$88,235	\$29,987	na	na	\$15,300	0.2	0.7	na	na	1.4	N		No Action
1281	12710317	2640 CHESTERFIELD AV	BR09	\$55,617	\$84,762	\$36,035	na	na	na	0.7	1.5	na	na	na	N		Elevation
1287	12710316	2644 CHESTERFIELD AV	BR09	\$185,565	\$81,850	\$20,133	na	na	na	2.3	9.2	na	na	na	Y		Acquisition
1290	15901619	224 E INDEPENDENCE BL	BR09	\$159,523	\$1,347,543	\$1,307,264	\$60,000	na	\$15,300	0.1	0.1	2.7	na	10.4	Y	not cost-effective, but in floodway	Acquisition
1297	12710311	2639 BAY ST	BR09	\$13,207	\$87,530	\$44,756	na	na	\$15,300	0.2	0.3	na	na	0.9	N		No Action
1299	12710313	2643 BAY ST	BR09	\$13,069	\$87,740	\$33,117	na	na	\$15,300	0.1	0.4	na	na	0.9	N		No Action
1306	15901618	2726 CHESTERFIELD AV	BR09	\$899,533	\$664,140	\$235,026	na	na	na	1.6	3.8	na	na	na	N		Acquisition
1344	12710570	2640 LABURNUM AV	BR09	\$10,571	\$84,306	\$13,768	na	na	\$15,300	0.1	0.8	na	na	0.7	N		No Action
1348	12710571	2644 LABURNUM AV	BR09	\$10,696	\$85,919	\$14,463	na	na	\$15,300	0.1	0.7	na	na	0.7	N		No Action
1353	12710572	2648 LABURNUM AV	BR09	\$30,858	\$106,132	\$51,335	na	na	\$15,300	0.3	0.6	na	na	2.0	N		No Action
1354	12710C97	ADDRESS VARIES	BR09	\$12,458,292	\$919,258	\$1,418,527	na	na	na	13.6	8.8	na	na	na	N	repetitive loss structure	Acquisition
1356	12710573	2652 LABURNUM AV	BR09	\$91,609	\$102,146	\$19,361	na	na	na	0.9	4.7	na	na	na	N	high flood depth	Elevation
1364	12710C97	ADDRESS VARIES	BR09	\$39,214,089	\$919,258	\$1,465,129	na	na	na	42.7	26.8	na	na	na	N	repetitive loss structure	Acquisition
1365	12710514	221 WYANOKE AV	BR09	\$7,963	\$96,500	\$37,997	na	na	na	0.1	0.2	na	na	na	N		No Action
1384	12710544	442 LORNA ST	BR09	\$7,687	\$93,980	\$82,967	na	na	na	0.1	0.1	na	na	na	N		No Action
1388	12710C98	ADDRESS VARIES	BR09	\$46,832,639	\$1,103,109	\$1,758,155	na	na	na	42.5	26.6	na	na	na	N	repetitive loss structure	Acquisition
1394	12710545	446 LORNA ST	BR09	\$15,167	\$87,770	\$36,348	na	na	na	0.2	0.4	na	na	na	N		No Action
1397	15902109	0 E INDEPENDENCE BL	BR09	\$1,117,088	\$4,632,076	\$4,179,649	na	na	na	0.2	0.3	na	na	na	N	main buildings not in floodway, merchandise mart	No Action
1399	12710546	450 LORNA ST	BR09	\$7,894	\$70,010	\$13,226	na	na	na	0.1	0.6	na	na	na	N		No Action
1406	12710C99	ADDRESS VARIES	BR09	\$72,447,031	\$1,470,812	\$2,344,206	na	na	na	49.3	30.9	na	na	na	N	repetitive loss structure	Acquisition
1415	15901C99	ADDRESS VARIES	BR09	\$29,334,218	\$531,948	\$926,595	na	na	na	55.1	31.7	na	na	na	N	repetitive loss structure	Acquisition
1417	15901C98	ADDRESS VARIES	BR09	\$25,076,549	\$446,827	\$878,211	na	na	na	56.1	28.6	na	na	na	N	repetitive loss structure	Acquisition
1422	15901C98	ADDRESS VARIES	BR09	\$14,858,863	\$446,827	\$864,244	na	na	na	33.3	17.2	na	na	na	N	repetitive loss structure	Acquisition
1427	15901C99	ADDRESS VARIES	BR09	\$13,462,311	\$531,948	\$911,859	na	na	na	25.3	14.8	na	na	na	N	repetitive loss structure	Acquisition
1432	15901C97	MELANIE CT	BR09	\$16,882,094	\$472,256	\$933,596	na	na	na	35.7	18.1	na	na	na	N	repetitive loss structure	Acquisition
1433	15901C98	ADDRESS VARIES	BR09	\$9,413,931	\$446,827	\$850,277	na	na	na	21.1	11.1	na	na	na	N	repetitive loss structure	Acquisition
1436	15901C97	524 BRAMLET RD	BR09	\$89,939	\$44,130	\$73,452	na	na	na	2.0	1.2	na	na	na	Y	repetitive loss structure	Acquisition
1440	15901C97	MELANIE CT	BR09	\$10,996,200	\$472,256	\$933,596	na	na	na	23.3	11.8	na	na	na	N	repetitive loss structure	Acquisition
1441	15901C97	MELANIE CT	BR09	\$5,881,271	\$472,256	\$918,508	na	na	na	12.5	6.4	na	na	na	N	repetitive loss structure	Acquisition
1442	15901C98	ADDRESS VARIES	BR09	\$2,390,027	\$223,414	\$418,155	na	na	na	10.7	5.7	na	na	na	N		Acquisition
1443	15901C99	ADDRESS VARIES	BR09	\$1,349,589	\$177,316	\$289,217	na	na	na	7.6	4.7	na	na	na	N		Acquisition
1446	15901C97	BRAMLET RD	BR09	\$3,789,478	\$483,265	\$932,350	na	na	na	7.8	4.1	na	na	na	N	repetitive loss structure	Acquisition
1447	15901C98	ADDRESS VARIES	BR09	\$832,364	\$446,827	\$794,410	na	na	na	1.9	1.0	na	na	na	N		Acquisition
1452	15901C97	VIOLET DR	BR09	\$4,721,774	\$483,265	\$932,350	na	na	na	9.8	5.1	na	na	na	N	repetitive loss structure	Acquisition
1453	15901C97	VIOLET DR	BR09	\$847,338	\$483,265	\$870,067	na	na	na	1.8	1.0	na	na	na	N		Acquisition
1462	15901514	616 COLONNADE DR	BR09	\$164,381	\$1,037,998	\$580,302	\$60,000	na	na	0.2	0.3	2.7	na	na	N		Flood Proofing
1468	15901C96	2908 & 2910 VIOLET DR	BR09	\$597,559	\$177,316	\$279,392	na	na	na	3.4	2.1	na	na	na	N		Acquisition
1469	15901C96	2916 & 2918 VIOLET DR	BR09	\$599,905	\$177,316	\$279,392	na	na	na	3.4	2.1	na	na	na	N		Acquisition
1471	15901C96	3008 & 3010 VIOLET DR	BR09	\$542,024	\$177,316	\$279,392	na	na	na	3.1	1.9	na	na	na	N		Acquisition
1473	15901C96	3000 & 3002 VIOLET DR	BR09	\$519,281	\$177,316	\$279,392	na	na	na	2.9	1.9	na	na	na	N		Acquisition
1474	15901C96	2908 VIOLET DRIVE	BR09	\$122,564	\$177,296	\$250,039	na	na	na	0.7	0.5	na	na	na	N	not cost-effective, but all other bids on parcel recommended for acquisition	Acquisition
1120	12904108	1248 MORNINGSIDE DR	BR10	\$12,145	\$72,062	\$36,045	na	na	na	0.2	0.3	na	na	na	N		No Action
1127	12904107	1244 MORNINGSIDE DR	BR10	\$89,056	\$59,282	\$27,582	na	na	na	1.5	3.2	na	na	na	N		Acquisition
1133	12903601	2632 McCLINTOCK RD	BR10	\$433,702	\$334,646	\$839,243	na	na	na	1.3	0.5	na	na	na	N		Acquisition
1142	12904105	1230 MORNINGSIDE DR	BR10	\$85,247	\$123,528	\$41,777	na	na	na	0.7	2.0	na	na	na	Y	not cost-effective, but in floodway; repetitive loss structure	Acquisition
1155	12904103	1216 MORNINGSIDE DR	BR10	\$35,413	\$56,328	\$52,151	na	na	na	0.6	0.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1165	12904101	COMMONWEALTH AVE	BR10	\$333,454	\$471,154	\$193,340	na	na	na	0.7	1.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1169	12904101	709 COMMONWEALTH A	BR10	\$388,850	\$471,197	\$493,070	na	na	na	0.8	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1172	12903416	612 COMMONWEALTH A	BR10	\$78,319	\$58,016	\$59,505	na	na	na	1.3	1.3	na	na	na	N		Acquisition
1174	12903412	628 COMMONWEALTH A	BR10	\$11,234	\$65,361	\$30,572	na	na	na	0.2	0.4	na	na	na	N		No Action
1176	12903411	632 COMMONWEALTH A	BR10	\$14,891	\$63,030	\$42,113	na	na	na	0.2	0.4	na	na	na	N		No Action
1177	12903410	636 COMMONWEALTH A	BR10	\$29,685	\$77,384	\$98,096	na	na	na	0.4	0.3	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1178	12905202	1215 GREEN OAKS LN	BR10	\$759,303	\$310,686	\$580,420	na	na	na	2.4	1.3	na	na	na	N	repetitive loss structure	Acquisition
1179	12905202	1219 GREEN OAKS LN	BR10	\$493,860	\$52,201	\$108,970	\$60,000	na	na	9.5	4.5	8.2	na	na	N	repetitive loss structure	Acquisition
1181	12907508	1126 MORNINGSIDE DR	BR10	\$121,612	\$359,698	\$189,132	\$60,000	na	na	0.3	0.6	2.0	na	na	Y	not cost-effective, but in floodway	Acquisition
1182	12903408	1109 MORNINGSIDE DR	BR10	\$11,965	\$104,586	\$87,091	\$60,000	na	na	0.1	0.1	0.2	na	na	N		No Action
1183	12905202	1213 GREEN OAKS LANE	BR10	\$621,310	\$310,640	\$614,349	na	na	na	2.0	1.0	na	na	na	N	repetitive loss structure	Acquisition
1185	12905202	1217 GREEN OAKS LN	BR10	\$171,874	\$310,686	\$625,752	na	na	na	0.6	0.3	na	na	na	N		No Action
1189	12907507	10A MORNINGSIDE DRI	BR10	\$36,586	\$245,151	\$330,259	\$60,000	na	na	0.1	0.1	0.6	na	na	Y	not cost-effective, but in floodway	Acquisition
1190	12905202	1207 GREEN OAKS LN	BR10	\$662,891	\$310,686	\$625,752	na	na	na	2.1	1.1	na	na	na	N	repetitive loss structure	Acquisition
1191	12905202	1211 GREEN OAKS LANE	BR10	\$165,098	\$310,640	\$580,420	na	na	na	0.5	0.3	na	na	na	N		No Action
1196	12908113	1301 BRIAR CREEK RD	BR10	\$33,674	\$138,249	\$93,902	na	na	na	0.2	0.4	na	na	na	N		No Action

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BUILDING INFORMATION				BENEFIT		COSTS					B/C RATIOS					FLDWAY01	NOTES	RECOMMENDED ALTERNATIVE
UNBLD_ID	PID	SITE ADDRESS	FLD_GRP	FLOOD DAMAGE	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS				
1199	12908101	224 GREEN OAKS LANE	BR10	\$99,283	\$265,327	\$561,831	na	na	na	0.4	0.3	na	na	na	N		No Action	
1201	12905202	1201 GREEN OAKS LN	BR10	\$172,868	\$310,686	\$560,420	na	na	na	0.6	0.2	na	na	na	N		No Action	
1213	12907507	116 MORNINGSTAR DR	BR10	\$151,422	\$322,437	\$466,700	na	na	na	0.5	0.3	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
1222	12907504	COMMONWEALTH AVE	BR10	\$22,468	\$64,493	\$117,486	\$60,000	na	na	0.3	0.2	0.4	na	na	N		No Action	
1223	12907401	800 COMMONWEALTH AVE	BR10	\$24,855	\$101,981	\$138,563	\$101,981	na	na	0.2	0.2	na	na	na	N		No Action	
1237	12907430	816 COMMONWEALTH AVE	BR10	\$42,810	\$100,702	\$81,122	na	na	na	0.4	0.5	na	na	na	N		No Action	
1021	12904138	2826 CENTRAL AV	BR11	\$18,327	\$141,854	\$63,555	na	na	na	0.1	0.3	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
1025	12905209	2906 CENTRAL AV	BR11	\$75,987	\$187,978	\$108,069	na	na	na	0.4	0.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
1026	12904133	1501 ST GEORGE ST	BR11	\$35,716	\$136,330	\$145,800	\$60,000	na	na	0.3	0.2	0.6	na	na	N		No Action	
1030	12904137	1544 ST GEORGE ST	BR11	\$97,157	\$122,427	\$101,816	\$60,000	na	na	0.8	1.0	1.6	na	na	Y	not cost-effective, but in floodway	Acquisition	
1044	12905207	2920 CENTRAL AV	BR11	\$90,975	\$619,884	\$589,490	na	na	na	0.2	0.2	na	na	na	N		No Action	
1053	12904141	1505 ST GEORGE ST	BR11	\$18,783	\$62,558	\$37,714	na	na	na	0.3	0.5	na	na	na	N		No Action	
1068	12905210	1711/1713 EASTCREST DR	BR11	\$225,035	\$1,172,505	\$2,252,221	na	na	na	0.2	0.1	na	na	na	N		No Action	
1070	12905210	1707 EASTCREST DRIVE	BR11	\$96,246	\$412,788	\$792,909	na	na	na	0.2	0.1	na	na	na	N		No Action	
1083	12905205	1601 EASTCREST DR	BR11	\$64,477	\$238,440	\$141,565	na	na	na	0.3	0.5	na	na	na	N		No Action	
1090	12905205	1601 EASTCREST DRIVE	BR11	\$57,190	\$356,787	\$202,895	na	na	na	0.2	0.3	na	na	na	N		No Action	
1094	12905205	1601 EASTCREST DR	BR11	\$68,314	\$262,469	\$155,831	na	na	na	0.3	0.4	na	na	na	N		No Action	
1095	12905205	1601 EASTCREST DR	BR11	\$68,314	\$262,469	\$155,831	na	na	na	0.3	0.4	na	na	na	N		No Action	
1102	12905205	1601 EASTCREST DR	BR11	\$58,018	\$238,440	\$141,565	na	na	na	0.2	0.4	na	na	na	N		No Action	
1105	12905205	1601 EASTCREST DRIVE	BR11	\$5,493	\$30,056	\$47,489	na	na	na	0.2	0.1	na	na	na	N		No Action	
1110	12905203	2704 OAK VALLEY LN	BR11	\$28,802	\$181,548	\$60,770	na	na	na	0.2	0.5	na	na	na	N		No Action	
1125	12905203	2720 OAK VALLEY LN	BR11	\$22,606	\$181,548	\$60,770	na	na	na	0.1	0.4	na	na	na	N		No Action	
925	09509335	1821 MASONIC DR	BR12	\$13,787	\$71,054	\$20,092	na	na	na	0.2	0.7	na	na	na	N		No Action	
927	09509334	1815 MASONIC DR	BR12	\$35,233	\$69,030	\$41,800	na	na	na	0.5	0.8	na	na	na	N		No Action	
933	09509333	1809 MASONIC DR	BR12	\$30,513	\$70,725	\$42,709	na	na	na	0.4	0.7	na	na	na	N		No Action	
937	09510213	1808 MASONIC DR	BR12	\$92,493	\$103,880	\$31,852	na	na	na	0.9	2.9	na	na	na	Y	acquired by County	No Action	
940	09509332	1801 MASONIC DR	BR12	\$35,316	\$56,600	\$41,800	na	na	na	0.6	0.8	na	na	na	N		No Action	
941	09510214	1738 MASONIC DR	BR12	\$19,514	\$90,710	\$26,960	na	na	na	0.2	0.7	na	na	na	Y	acquired by County	No Action	
942	09509331	1739 MASONIC DR	BR12	\$19,569	\$54,566	\$32,471	na	na	na	0.4	0.6	na	na	na	N		No Action	
943	09510215	1732 MASONIC DR	BR12	\$18,424	\$70,432	\$20,426	na	na	na	0.3	0.9	na	na	na	Y	acquired by County	No Action	
947	09509330	1733 MASONIC DR	BR12	\$18,603	\$55,397	\$20,043	na	na	na	0.3	0.9	na	na	na	N		No Action	
952	09509329	1727 MASONIC DR	BR12	\$20,411	\$57,782	\$36,102	na	na	na	0.4	0.6	na	na	na	N		No Action	
956	09509328	1721 MASONIC DR	BR12	\$21,019	\$62,462	\$40,731	na	na	na	0.3	0.5	na	na	na	N		No Action	
957	09510253	1847 ARNOLD DR	BR12	\$10,102	\$51,584	\$12,853	na	na	na	0.2	0.8	na	na	na	N		No Action	
959	09509327	1715 MASONIC DR	BR12	\$17,982	\$56,630	\$33,824	na	na	na	0.3	0.5	na	na	na	N		No Action	
961	09510251	1839 ARNOLD DR	BR12	\$9,357	\$49,525	\$20,263	na	na	na	0.2	0.5	na	na	na	N		No Action	
963	09509326	1709 MASONIC DR	BR12	\$24,800	\$63,628	\$41,870	na	na	na	0.4	0.6	na	na	na	N		No Action	
967	09510250	1835 ARNOLD DR	BR12	\$13,152	\$65,919	\$20,424	na	na	na	0.2	0.6	na	na	na	N		No Action	
971	09509325	1701 MASONIC DR	BR12	\$27,988	\$55,382	\$41,582	na	na	na	0.5	0.7	na	na	na	N		No Action	
974	09509324	1649 MASONIC DR	BR12	\$37,000	\$61,336	\$46,235	na	na	na	0.6	0.8	na	na	na	N	repetitive loss structure	No Action	
979	09509323	1643 MASONIC DR	BR12	\$37,014	\$60,408	\$46,744	na	na	na	0.6	0.8	na	na	na	N		No Action	
984	09509322	1637 MASONIC DR	BR12	\$54,416	\$58,598	\$39,540	na	na	na	0.9	1.4	na	na	na	N		Elevation	
991	09509321	1631 MASONIC DR	BR12	\$68,700	\$61,686	\$42,174	na	na	na	1.1	1.6	na	na	na	N		Acquisition	
1009	09509320	2821 CENTRAL AV	BR12	\$273,448	\$247,616	\$437,368	na	na	na	1.1	0.6	na	na	na	Y		Acquisition	
1010	09510230	1617 ARNOLD DR	BR12	\$9,177	\$48,174	\$13,022	na	na	na	0.2	0.7	na	na	na	N		No Action	
1011	09510227	2903 CENTRAL AV	BR12	\$108,460	\$166,101	\$139,841	na	na	na	0.7	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
1013	09510227	2903 CENTRAL AV	BR12	\$54,044	\$304,771	\$248,851	na	na	na	0.2	0.2	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
1014	09510229	1615 ARNOLD DR	BR12	\$28,292	\$62,660	\$16,231	na	na	na	0.5	1.7	na	na	na	N		Elevation	
1017	09510228	2919 CENTRAL AV	BR12	\$36,393	\$136,060	\$71,549	na	na	na	0.3	0.5	na	na	na	N		No Action	
1023	09512318	3001 CENTRAL AV	BR12	\$10,323	\$108,678	\$96,478	na	na	na	0.1	0.1	na	na	na	N		No Action	
913	09510101	3007 HARBINGER CT	BR13	\$20,646	\$101,856	\$60,029	na	na	na	0.2	0.3	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
915	09510103	3019 HARBINGER CT	BR13	\$30,196	\$75,116	\$38,880	na	na	na	0.4	0.8	na	na	na	N		No Action	
917	09510104	3023 HARBINGER CT	BR13	\$12,365	\$76,812	\$41,623	na	na	na	0.2	0.3	na	na	na	N		No Action	
918	09510266	3000 HARBINGER CT	BR13	\$100,607	\$84,636	\$47,181	na	na	na	1.2	2.1	na	na	na	Y		Acquisition	
920	09510265	3008 HARBINGER CT	BR13	\$144,839	\$66,965	\$39,874	na	na	na	2.2	3.6	na	na	na	Y	acquired by County; repetitive loss structure	No Action	
921	09510264	3014 HARBINGER CT	BR13	\$161,786	\$65,355	\$39,874	na	na	na	2.5	4.1	na	na	na	Y	acquired by County	No Action	
922	09510263	3020 HARBINGER CT	BR13	\$23,530	\$63,836	\$35,319	na	na	na	0.4	0.7	na	na	na	N		No Action	
655	09313421	3038 EASTWAY DR	BR14	\$2,336,356	\$290,494	\$224,073	na	na	na	8.0	10.4	na	na	na	N		Acquisition	
676	09313420	1722 EASTWAY DR	BR14	\$25,435	\$68,581	\$35,853	na	na	na	0.4	0.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
691	09312602	3225 HARROW PL	BR14	\$13,359	\$71,771	\$38,939	na	na	na	0.2	0.3	na	na	na	N		No Action	
703	09312601	3217 HARROW PL	BR14	\$79,382	\$92,560	\$56,703	na	na	na	0.9	1.4	na	na	na	N		Elevation	
706	09313415	3135 DUNLAVIN WY	BR14	\$53,188	\$94,440	\$60,777	na	na	na	0.6	0.9	na	na	na	N		No Action	
710	09312618	3210 BRIXTON CT	BR14	\$38,642	\$74,790	\$41,301	na	na	na	0.5	0.9	na	na	na	N		No Action	
711	09313406	3029 DUNLAVIN WY	BR14	\$56,569	\$81,675	\$40,165	na	na	na	0.7	1.4	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
713	09313405	3025 DUNLAVIN WY	BR14	\$36,655	\$95,414	\$48,706	na	na	na	0.4	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
714	09313407	3035 DUNLAVIN WY	BR14	\$57,977	\$80,441	\$39,874	na	na	na	0.7	1.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
719	09313404	3021 DUNLAVIN WY	BR14	\$38,228	\$73,172	\$37,527	na	na	na	0.5	1.0	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
721	09313408	3041 DUNLAVIN WY	BR14	\$80,086	\$83,936	\$46,235	na	na	na	1.0	1.7	na	na	na	Y		Acquisition	
725	09313409	3047 DUNLAVIN WY	BR14	\$32,087	\$60,311	\$39,058	na	na	na	0.5	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
727	09313403	3015 DUNLAVIN WY	BR14	\$31,659	\$84,525	\$42,191	na	na	na	0.4	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
728	09312619	3204 BRIXTON CT	BR14	\$87,386	\$													

BUILDING INFORMATION				BENEFIT		COSTS					B/C RATIOS					FLDWAY01	NOTES	RECOMMENDED ALTERNATIVE
UNBLD_ID	PID	SITE ADDRESS	FLD_GRP	FLOOD DAMAGE	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS				
732	09313402	3009 DUNLAVIN WY	BR14	\$45,046	\$84,159	\$46,392	na	na	na	0.5	1.0	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
735	09313410	3101 DUNLAVIN WY	BR14	\$28,388	\$76,305	\$38,274	na	na	na	0.4	0.7	na	na	na	N		No Action	
738	09313412	3117 DUNLAVIN WY	BR14	\$25,366	\$77,960	\$41,657	na	na	na	0.3	0.6	na	na	na	N		No Action	
739	09313411	3109 DUNLAVIN WY	BR14	\$50,152	\$83,078	\$42,226	na	na	na	0.6	1.2	na	na	na	N		Elevation	
741	09313401	3001 DUNLAVIN WY	BR14	\$133,577	\$80,184	\$40,356	na	na	na	1.7	3.3	na	na	na	Y	repetitive loss structure	Acquisition	
742	09312620	3200 BRIXTON CT	BR14	\$83,163	\$83,980	\$44,708	na	na	na	1.0	1.9	na	na	na	N		Acquisition	
744	09312534	2965 DUNLAVIN WY	BR14	\$137,676	\$81,709	\$44,993	na	na	na	1.7	3.1	na	na	na	Y		Acquisition	
747	09313121	3020 DUNLAVIN WY	BR14	\$13,690	\$83,161	\$42,076	na	na	na	0.2	0.3	na	na	na	N		No Action	
755	09313122	3014 DUNLAVIN WY	BR14	\$20,246	\$86,276	\$45,388	na	na	na	0.2	0.4	na	na	na	N		No Action	
757	09312532	2953 DUNLAVIN WY	BR14	\$128,623	\$85,170	\$48,343	na	na	na	1.5	2.7	na	na	na	Y		Acquisition	
760	09313123	3008 DUNLAVIN WY	BR14	\$29,658	\$70,548	\$33,325	na	na	na	0.4	0.9	na	na	na	N		No Action	
763	09312531	2947 DUNLAVIN WY	BR14	\$57,453	\$61,718	\$44,563	na	na	na	0.9	1.3	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
765	09313124	3000 DUNLAVIN WY	BR14	\$39,208	\$76,472	\$40,731	na	na	na	0.5	1.0	na	na	na	N		Elevation	
771	09312530	2941 DUNLAVIN WY	BR14	\$46,812	\$99,678	\$52,195	na	na	na	0.5	0.9	na	na	na	Y	not cost-effective, but in floodway; repetitive loss structure	Acquisition	
777	09313125	2964 DUNLAVIN WY	BR14	\$52,222	\$96,198	\$44,363	na	na	na	0.5	1.2	na	na	na	N		Elevation	
778	09312529	2935 DUNLAVIN WY	BR14	\$18,548	\$81,300	\$36,952	na	na	na	0.2	0.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
781	09312528	2929 DUNLAVIN WY	BR14	\$5,976	\$95,938	\$46,922	na	na	na	0.1	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
787	09312515	3020 AIRLIE ST	BR14	\$52,953	\$100,092	\$58,177	na	na	na	0.5	0.9	na	na	na	N		No Action	
789	09312527	2923 DUNLAVIN WY	BR14	\$23,033	\$85,570	\$46,364	na	na	na	0.3	0.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
791	09312526	2917 DUNLAVIN WY	BR14	\$579,604	\$85,958	\$66,417	na	na	na	6.7	8.7	na	na	na	Y		Acquisition	
796	09312516	3014 AIRLIE ST	BR14	\$65,747	\$85,260	\$46,889	na	na	na	0.8	1.4	na	na	na	N		Elevation	
799	09312525	2913 DUNLAVIN WY	BR14	\$819,585	\$98,818	\$75,933	na	na	na	8.3	10.8	na	na	na	Y		Acquisition	
804	09312524	2909 DUNLAVIN WY	BR14	\$82,818	\$100,494	\$48,270	na	na	na	0.8	1.7	na	na	na	Y	not cost-effective, but in floodway; repetitive loss structure	Acquisition	
808	09312518	8709 COUNTRY CLUB DR	BR14	\$12,255	\$109,090	\$55,776	na	na	na	0.1	0.2	na	na	na	N		No Action	
814	09312523	2901 DUNLAVIN WY	BR14	\$105,175	\$69,958	\$53,286	na	na	na	1.5	2.0	na	na	na	Y		Acquisition	
815	09312519	8717 COUNTRY CLUB DR	BR14	\$36,337	\$131,900	\$75,837	na	na	na	0.3	0.5	na	na	na	N		No Action	
823	09312520	8801 COUNTRY CLUB DR	BR14	\$834,421	\$113,681	\$77,620	na	na	na	7.3	10.8	na	na	na	Y	repetitive loss structure	Acquisition	
830	09312521	8811 COUNTRY CLUB DR	BR14	\$59,343	\$93,686	\$69,965	na	na	na	0.6	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
834	09312522	8817 COUNTRY CLUB DR	BR14	\$43,238	\$99,694	\$47,282	na	na	na	0.4	0.9	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
835	09515111	8726 COUNTRY CLUB DR	BR14	\$9,978	\$99,589	\$49,954	na	na	na	0.1	0.2	na	na	na	N		No Action	
840	09515110	8690 COUNTRY CLUB DR	BR14	\$14,781	\$102,018	\$69,066	na	na	na	0.1	0.2	na	na	na	N		No Action	
606	10101119	3218 SHAMROCK DR	BR15	\$165,913	\$680,405	\$601,479	\$60,000	na	na	0.2	0.3	2.8	na	na	N		Flood Proofing	
635	10101117	1645 EASTWAY DR	BR15	\$244,287	\$72,370	\$76,816	na	na	na	3.4	3.4	na	na	na	N		repetitive loss structure	
564	0996345	3267 SHAMROCK DR	BR16	\$1,593,338	\$297,454	\$470,520	na	na	na	5.4	3.4	na	na	na	N		further investigate water qual	
566	0996345	3265 SHAMROCK DRIVE	BR16	\$1,700,459	\$297,454	\$477,935	na	na	na	5.7	3.6	na	na	na	N		further investigate water qual	
568	0996345	3263 SHAMROCK DR	BR16	\$2,653,249	\$297,454	\$477,935	na	na	na	8.9	3.6	na	na	na	Y		further investigate water qual	
571	0996345	3261 SHAMROCK DR	BR16	\$2,051,343	\$337,298	\$541,941	na	na	na	6.1	3.8	na	na	na	Y		further investigate water qual	
577	0996345	3253 SHAMROCK DR	BR16	\$4,382,827	\$184,518	\$296,411	na	na	na	23.8	14.8	na	na	na	Y		further investigate water qual	
578	0996345	3259 SHAMROCK DR	BR16	\$1,914,578	\$246,023	\$395,215	na	na	na	7.8	4.8	na	na	na	N		further investigate water qual	
579	0996345	3255 SHAMROCK DR	BR16	\$1,172,884	\$184,518	\$296,411	na	na	na	6.4	4.0	na	na	na	Y		further investigate water qual	
583	0996345	3249 SHAMROCK DR	BR16	\$1,221,027	\$152,782	\$246,410	na	na	na	8.1	5.0	na	na	na	Y		further investigate water qual	
584	0996345	3257 SHAMROCK DR	BR16	\$1,389,821	\$246,023	\$395,215	na	na	na	5.6	3.5	na	na	na	N		further investigate water qual	
586	0996345	3249 SHAMROCK DRIVE	BR16	\$852,732	\$155,836	\$250,339	na	na	na	5.5	3.4	na	na	na	Y		further investigate water qual	
587	0996345	3246 SHAMROCK DR	BR16	\$979,232	\$124,287	\$244,234	na	na	na	4.6	2.8	na	na	na	N		further investigate water qual	
588	0996345	3247 SHAMROCK DR	BR16	\$2,028,972	\$184,518	\$296,411	na	na	na	11.0	6.8	na	na	na	Y		further investigate water qual	
590	0996345	3243 SHAMROCK DR	BR16	\$996,331	\$246,023	\$395,215	na	na	na	4.0	2.5	na	na	na	N		further investigate water qual	
591	0996345	3239 SHAMROCK DR	BR16	\$1,731,400	\$246,023	\$401,265	na	na	na	7.0	4.3	na	na	na	Y		further investigate water qual	
592	0996345	3237 SHAMROCK DR	BR16	\$2,085,086	\$184,518	\$300,949	na	na	na	11.3	6.9	na	na	na	Y		further investigate water qual	
593	0996345	3231 SHAMROCK DR	BR16	\$2,474,419	\$449,207	\$732,660	na	na	na	5.5	3.4	na	na	na	N		further investigate water qual	
596	0996345	3233 SHAMROCK DR	BR16	\$3,746,185	\$368,854	\$601,602	na	na	na	10.2	6.2	na	na	na	N		further investigate water qual	
597	0996345	3225 SHAMROCK DR	BR16	\$1,087,057	\$246,023	\$395,215	na	na	na	4.4	2.8	na	na	na	Y		further investigate water qual	
600	0996345	3229 SHAMROCK DR	BR16	\$991,142	\$246,023	\$395,215	na	na	na	4.0	2.5	na	na	na	Y		further investigate water qual	
609	0996345	3221 SHAMROCK DR	BR16	\$395,930	\$184,518	\$296,411	na	na	na	2.1	1.3	na	na	na	N		further investigate water qual	
613	0996345	3227 SHAMROCK DR	BR16	\$330,417	\$246,023	\$389,165	na	na	na	1.3	0.8	na	na	na	N		further investigate water qual	
617	0996345	3219 SHAMROCK DR	BR16	\$528,969	\$184,518	\$296,411	na	na	na	2.9	1.8	na	na	na	Y		further investigate water qual	
623	0996345	3217 SHAMROCK DRIVE	BR16	\$1,657,470	\$57,029	\$37,572	na	na	na	29.1	44.1	na	na	na	N		further investigate water qual	
570	0996345	3235 SHAMROCK DR	BR17	\$744,136	\$184,427	\$291,730	na	na	na	4.0	2.6	na	na	na	Y		further investigate water qual	
575	0996345	3233 SHAMROCK DR	BR17	\$655,085	\$377,324	\$587,581	na	na	na	1.5	1.0	na	na	na	Y		further investigate water qual	
582	0996345	3241 SHAMROCK DR	BR17	\$3,296,184	\$246,023	\$389,165	na	na	na	13.4	8.5	na	na	na	Y		further investigate water qual	
526	0996109	2225 PURSER DR	BR18	\$218,383	\$39,772	\$13,169	na	na	na	5.5	16.6	na	na	na	Y		Acquisition	
527	0996110	2231 PURSER DR	BR18	\$268,279	\$38,842	\$14,276	na	na	na	6.9	19.8	na	na	na	Y		Acquisition	
529	0996111	2237 PURSER DR	BR18	\$180,376	\$39,902	\$13,722	na	na	na	4.5	17.1	na	na	na	Y		repetitive loss structure	
536	0996204	2224 PURSER DR	BR18	\$98,027	\$40,604	\$13,594	na	na	na	2.4	7.2	na	na	na	Y		Acquisition	
539	0996203	2230 PURSER DR	BR18	\$219,625	\$40,554	\$14,165	na	na	na	5.4	15.5	na	na	na	Y		Acquisition	
542	0996202	2236 PURSER DR	BR18	\$278,816	\$42,834	\$14,736	na	na	na	6.5	18.9	na	na	na	Y		Acquisition	
549	0996212	2223 JENNIE LINN DR	BR18	\$14,601	\$45,918	\$15,871	na	na	na	0.3	0.9	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
551	0996213	2229 JENNIE LINN DR	BR18	\$72,771	\$39,394	\$13,594	na	na	na	1.8	5.4	na	na	na	Y		Acquisition	
552	0996214	2235 JENNIE LINN DR	BR18	\$1,395,200	\$40,604	\$14,736	na	na	na	34.4	94.7	na	na	na	Y		Acquisition	
553	0996302	2218 JENNIE LINN DR	BR18	\$9,495	\$55,524	\$23,874	na	na	na	0.2	0.4	na	na	na	N		No Action	
555	0996301	2224 JENNIE LINN DR	BR18	\$481,812	\$44,284	\$13,594	na											

BUILDING INFORMATION				BENEFIT		COSTS					B/C RATIOS					FLDWAY01	NOTES	RECOMMENDED ALTERNATIVE
UNBLD_ID	PID	SITE ADDRESS	FLD_GRP	FLOOD DAMAGE	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS				
532	09906503	2409 DORA DR	BR19	\$6,224	\$72,850	\$33,117	na	na	na	0.1	0.2	na	na	na	N		No Action	
547	09906343	2338 PURSER DR	BR19	\$4,968	\$77,825	\$32,943	na	na	na	0.1	0.2	na	na	na	N		No Action	
411	09908116	442 SHANNONHOUSE D	BR20	\$86,607	\$85,573	\$81,080	na	na	na	1.0	1.1	na	na	na	Y	further investigate water quality enhancements	Acquisition	
417	09908114	5219 DOLPHIN LN	BR20	\$20,743	\$80,332	\$48,246	na	na	na	0.3	0.4	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
418	09908113	5213 DOLPHIN LN	BR20	\$25,987	\$78,946	\$48,525	na	na	na	0.3	0.5	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
421	09908112	5207 DOLPHIN LN	BR20	\$38,407	\$79,844	\$44,434	na	na	na	0.5	0.9	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
423	09908111	5201 DOLPHIN LN	BR20	\$77,546	\$122,908	\$93,852	na	na	na	0.6	0.8	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
426	09908110	5135 DOLPHIN LN	BR20	\$27,864	\$79,194	\$47,340	na	na	na	0.4	0.6	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
427	09908109	5129 DOLPHIN LN	BR20	\$387,401	\$85,922	\$88,030	na	na	na	4.5	4.4	na	na	na	Y	further investigate water quality enhancements; repetitive loss structure	Acquisition	
428	09908108	5125 DOLPHIN LN	BR20	\$35,509	\$80,330	\$46,285	na	na	na	0.4	0.8	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
430	09908107	5121 DOLPHIN LN	BR20	\$32,197	\$77,935	\$43,259	na	na	na	0.4	0.7	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
432	09908215	5212 DOLPHIN LN	BR20	\$7,632	\$81,247	\$45,283	na	\$1,890,261	na	0.1	0.2	na	0.0	na	N		No Action	
433	09908216	5206 DOLPHIN LN	BR20	\$45,625	\$76,841	\$43,686	na	na	na	0.6	1.0	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
434	09908217	5200 DOLPHIN LN	BR20	\$82,418	\$82,763	\$46,321	na	na	na	1.0	1.8	na	na	na	Y		Acquisition	
435	09908106	5117 DOLPHIN LN	BR20	\$28,816	\$83,640	\$48,804	na	na	na	0.3	0.6	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
436	09908218	5130 DOLPHIN LN	BR20	\$117,610	\$80,190	\$46,997	na	na	na	1.5	2.5	na	na	na	Y	repetitive loss structure	Acquisition	
437	09908219	5124 DOLPHIN LN	BR20	\$139,677	\$78,975	\$49,252	na	na	na	1.8	2.8	na	na	na	Y		Acquisition	
438	09908220	5112 DOLPHIN LN	BR20	\$26,856	\$78,714	\$43,157	na	na	na	0.3	0.6	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
439	09908105	5111 DOLPHIN LN	BR20	\$59,771	\$82,545	\$52,872	na	na	na	0.7	1.1	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
443	09908104	5101 DOLPHIN LN	BR20	\$35,979	\$94,228	\$75,338	na	na	na	0.4	0.5	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
444	09908201	5100 KILDARE DR	BR20	\$28,650	\$83,184	\$43,854	na	na	na	0.3	0.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
446	09908102	5123 KILDARE DR	BR20	\$48,758	\$79,506	\$49,561	na	na	na	0.6	1.0	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements	Acquisition	
447	09908203	5215 KILDARE DR	BR20	\$49,862	\$80,928	\$62,021	na	na	na	0.6	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
448	09908202	5209 KILDARE DR	BR20	\$41,499	\$81,978	\$51,839	na	na	na	0.5	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
449	09908204	5221 KILDARE DR	BR20	\$6,224	\$80,052	\$48,246	na	na	na	0.1	0.1	na	na	na	N		No Action	
450	09908103	5129 KILDARE DR	BR20	\$60,723	\$75,068	\$46,143	na	na	na	0.8	1.3	na	na	na	Y	not cost-effective, but in floodway; further investigate water quality enhancements; repetitive loss structure	Acquisition	
453	09908329	5122 KILDARE DR	BR20	\$349,959	\$67,592	\$78,654	na	na	na	5.2	4.4	na	na	na	Y		Acquisition	
456	09908326	5140 KILDARE DR	BR20	\$11,082	\$79,114	\$43,505	na	na	na	0.1	0.3	na	na	na	N		No Action	
457	09908327	5134 KILDARE DR	BR20	\$24,662	\$80,656	\$46,782	na	na	na	0.3	0.5	na	na	na	N		No Action	
459	09908328	5128 KILDARE DR	BR20	\$36,917	\$75,944	\$42,298	na	na	na	0.5	0.9	na	na	na	N		No Action	
383	09911627	5516 RUTH DR	BR21	\$485,427	\$87,282	\$90,161	na	na	na	5.6	5.4	na	na	na	N		Acquisition	
387	09911606	5424 KINSALE LN	BR21	\$19,652	\$68,661	\$36,847	na	na	na	0.3	0.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
389	09911607	5418 KINSALE LN	BR21	\$5,852	\$71,530	\$38,346	na	na	na	0.1	0.2	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
391	09911608	5412 KINSALE LN	BR21	\$487,870	\$78,945	\$65,802	na	na	na	6.2	7.4	na	na	na	Y		Acquisition	
395	09911623	5421 DOLPHIN LN	BR21	\$13,801	\$83,752	\$25,841	na	na	na	0.2	0.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
396	09911622	5415 DOLPHIN LN	BR21	\$7,494	\$80,510	\$53,684	na	na	na	0.1	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
397	09911621	5409 DOLPHIN LN	BR21	\$10,295	\$97,896	\$62,469	na	na	na	0.1	0.2	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
399	09911620	5401 DOLPHIN LN	BR21	\$5,341	\$68,526	\$38,067	na	na	na	0.1	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
400	09911619	5337 DOLPHIN LN	BR21	\$12,766	\$80,018	\$20,279	na	na	na	0.2	0.6	na	na	na	Y	not cost-effective, but in floodway	Acquisition	
405	09911618	5331 DOLPHIN LN	BR21	\$197,847	\$95,071	\$63,268	na	na	na	2.1	3.1	na	na	na	Y	repetitive loss structure	Acquisition	

BUILDING INFORMATION				BENEFIT		COSTS					B/C RATIOS						
UNBLD_ID	PID	SITE ADDRESS	FLD_GRP	FLOOD DAMAGE	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	ACQUISITION	ELEVATION	FLOOD PROOFING	LEVEE/FLOOD WALL	DRAINAGE IMPRVMTS	FLDWAY01	NOTES	RECOMMENDED ALTERNATIVE
406	09911617	5325 DOLPHIN LN	BR21	\$52,457	\$77,622	\$46,503	na	na	na	0.7	1.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition
408	09911618	5319 DOLPHIN LN	BR21	\$72,275	\$67,628	\$37,858	na	na	na	1.1	1.9	na	na	na	Y		Acquisition
409	09911615	5313 DOLPHIN LN	BR21	\$59,964	\$66,713	\$36,289	na	na	na	0.9	1.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition
347	09910283	5701 ILFORD ST	BR22	\$7,508	\$99,758	\$94,978	na	\$36,063	na	0.1	0.1	na	0.2	na	N		No Action
352	09910282	5617 ILFORD ST	BR22	\$137,276	\$88,808	\$94,978	na	\$36,063	na	1.5	1.4	na	3.8	na	N		Acquisition
361	09910273	5527 CUTSHAW CT	BR22	\$15,664	\$102,066	\$35,133	na	\$36,063	na	0.2	0.4	na	0.4	na	Y	not cost-effective, but in floodway	Acquisition
227	09709205	6138 COVECREEK DR	BR23	\$7,314	\$74,548	\$40,298	na	\$52,161	na	0.1	0.2	na	0.1	na	N		No Action
242	09709207	6126 COVECREEK DR	BR23	\$38,739	\$78,638	\$71,593	na	na	na	0.5	0.5	na	na	na	N		No Action
474	09908431	714 SHANNONHOUSE D	BT2-1	\$155,645	\$90,209	\$88,598	na	na	na	1.7	1.8	na	na	na	Y		Acquisition
478	09908430	720 SHANNONHOUSE D	BT2-1	\$163,028	\$102,028	\$39,028	na	na	na	1.6	4.2	na	na	na	Y		Acquisition
481	09908429	726 SHANNONHOUSE D	BT2-1	\$250,539	\$79,076	\$50,596	na	na	na	3.2	5.0	na	na	na	Y		Acquisition
482	09908428	732 SHANNONHOUSE D	BT2-1	\$282,184	\$79,651	\$50,415	na	na	na	3.5	5.6	na	na	na	Y		Acquisition
485	09908427	738 SHANNONHOUSE D	BT2-1	\$185,082	\$89,190	\$90,882	na	na	na	2.1	2.0	na	na	na	Y		Acquisition
486	09908426	744 SHANNONHOUSE D	BT2-1	\$750,181	\$93,935	\$67,993	na	na	na	8.0	11.1	na	na	na	N		Acquisition
488	09908422	812 SHANNONHOUSE D	BT2-1	\$684,338	\$99,350	\$96,221	na	na	na	6.9	7.1	na	na	na	N		Acquisition
489	09908424	800 SHANNONHOUSE D	BT2-1	\$204,858	\$82,869	\$48,088	na	na	na	2.5	4.3	na	na	na	N		Acquisition
490	09908423	801 SHANNONHOUSE D	BT2-1	\$234,585	\$92,286	\$61,864	na	na	na	2.5	3.8	na	na	na	N		Acquisition
491	09908425	750 SHANNONHOUSE D	BT2-1	\$192,796	\$91,440	\$70,152	na	na	na	2.1	2.7	na	na	na	N		Acquisition
503	09908409	3431 DONOVAN PL	BT2-2	\$29,672	\$83,759	\$47,104	na	na	na	0.4	0.6	na	na	na	N		No Action
499	09915218	5400 GALWAY DR	BT2-3	\$2,101,481	\$89,254	\$99,938	na	na	na	23.5	22.4	na	na	na	N		Acquisition
1362	12910154	802 COMMONWEALTH A	EDB1	\$50,166	\$140,744	\$253,109	na	na	na	0.4	0.2	na	na	na	N		No Action
1371	12910153	846 COMMONWEALTH A	EDB1	\$43,873	\$89,273	\$56,425	na	na	na	0.5	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1383	12910152	848 COMMONWEALTH A	EDB1	\$56,197	\$94,550	\$139,968	na	na	na	0.6	0.4	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1389	12910151	856 COMMONWEALTH A	EDB1	\$66,382	\$30,480	\$41,449	na	na	na	2.2	1.6	na	na	na	Y		Acquisition
1391	12910150	400 COMMONWEALTH A	EDB1	\$91,982	\$86,456	\$108,383	na	na	na	1.1	0.8	na	na	na	Y		Acquisition
1396	12910149	404 COMMONWEALTH A	EDB1	\$111,013	\$63,408	\$112,498	na	na	na	1.8	1.0	na	na	na	Y	repetitive loss structure	Acquisition
1405	12910147	408 COMMONWEALTH A	EDB1	\$50,566	\$60,150	\$45,198	na	na	na	0.8	1.1	na	na	na	N		Elevation
1626	16101202	600E INDEPENDENCE B	EDB2	\$126,028	\$1,175,516	\$869,161	na	na	na	0.1	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1630	16101201	528E INDEPENDENCE B	EDB2	\$224,511	\$463,690	\$298,038	na	na	na	0.5	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1607	13109211	701E INDEPENDENCE B	EDB3	\$36,351	\$761,810	\$283,143	na	na	na	0.0	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1612	13109104	7 EAST INDEPENDENCE	EDB3	\$2,650	\$81,104	\$84,802	na	na	na	0.0	0.0	na	na	na	N		No Action
1613	13109212	745E INDEPENDENCE B	EDB3	\$45,749	\$368,723	\$116,338	na	na	na	0.1	0.4	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1617	13109215	751E INDEPENDENCE B	EDB3	\$8,474	\$625,083	\$210,638	na	na	na	0.0	0.0	na	na	na	N		No Action
1565	13109201	8774 DRESDEN DR EAST	EDB4	\$48,137	\$95,975	\$61,877	na	na	na	0.5	0.8	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1567	13109202	8766 DRESDEN DR EAST	EDB4	\$59,674	\$95,965	\$63,197	na	na	na	0.6	0.9	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1575	13109203	8760 DRESDEN DR EAST	EDB4	\$11,606	\$95,965	\$61,877	na	na	na	0.1	0.2	na	na	na	N		No Action
1596	13109219	8748 DRESDEN DR EAST	EDB4	\$41,858	\$75,770	\$45,318	na	na	na	0.6	0.9	na	na	na	N		No Action
1602	13109214	2014 WOODLAND DR	EDB4	\$536,394	\$146,605	\$171,744	na	na	na	3.7	3.1	na	na	na	N		Acquisition
1542	13110234	3838 SHEFFIELD DR	EDB5	\$51,877	\$105,624	\$58,675	na	na	na	0.5	0.9	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1548	13110204	2001 WOODLAND DR	EDB5	\$19,832	\$77,941	\$41,379	na	na	na	0.3	0.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1559	13110233	3914 SHEFFIELD DR	EDB5	\$17,996	\$95,810	\$47,061	na	na	na	0.2	0.4	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1572	13110206	3815 WINFIELD DR	EDB5	\$31,631	\$88,707	\$47,375	na	na	na	0.4	0.7	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1579	13110205	3803 WINFIELD DR	EDB5	\$58,225	\$99,972	\$67,078	na	na	na	0.6	0.9	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1587	13110208	3827 WINFIELD DR	EDB5	\$4,844	\$88,649	\$50,303	na	na	na	0.1	0.1	na	na	na	Y	not cost-effective, but in floodway	Acquisition
1509	13111355	1124 TARRINGTON AV	EDB6	\$16,023	\$99,573	\$58,948	na	na	na	0.2	0.3	na	na	na	N		No Action
1511	13111356	1114 TARRINGTON AV	EDB6	\$7,632	\$97,022	\$51,384	na	na	na	0.1	0.1	na	na	na	N		repetitive loss structure
1515	13111301	4001 SHEFFIELD DR	EDB6	\$25,380	\$89,389	\$48,909	na	na	na	0.3	0.5	na	na	na	Y	not cost-effective, but in floodway	Acquisition

COUNT 367 DAMAGE \$399,024,676

APPENDIX D

BUILDING DEPTH-DAMAGE FUNCTION (DDF)													
Mecklenburg County Flood Hazard Mitigation Project													
Lower Little Sugar, Briar, Irwin, and McMullen Creek Watersheds													
Building Type	Curve Type	Flood Depth (feet)											
		-2	-1	0	1	2	3	4	5	6	7	8	>8
1 Story, w/o Basement	Local	0	0	9	22	35	40	45	50	55	55	55	55
2 Story, w/o Basement	Default	0	0	5	9	13	18	20	22	24	26	29	33
Split Level, w/o Basement	Default	0	0	3	9	13	25	27	28	33	34	41	43
1 or 2 Story, with Basement	Default	4	8	11	15	20	23	28	33	38	44	49	51
Split Level, with Basement	Default	3	5	6	16	19	22	27	32	35	36	44	48
Mobile Home	Default	0	0	8	44	63	73	78	80	81	82	82	82

NOTES: Local curve developed by Watershed Concepts (1998)
 Default curves from FEMA Full Riverine Benefit:Cost Model (V5.2.3)

CONTENTS DEPTH-DAMAGE FUNCTION (DDF)													
Mecklenburg County Flood Hazard Mitigation Project													
Lower Little Sugar, Briar, Irwin, and McMullen Creek Watersheds													
Building Type	Curve Type	Flood Depth (feet)											
		-2	-1	0	1	2	3	4	5	6	7	8	>8
1 Story, w/o Basement	Local	0	0	8	18	30	50	55	60	65	70	75	75
2 Story, w/o Basement	Default	0	0	7.5	13.5	19.5	27	30	33	36	39	43.5	49.5
Split Level, w/o Basement	Default	0	0	4.5	13.5	19.5	37.5	40.5	42	49.5	51	61.5	64.5
1 or 2 Story, with Basement	Default	6	12	16.5	22.5	30	34.5	42	49.5	57	66	73.5	76.5
Split Level, with Basement	Default	4.5	7.5	9	24	28.5	33	40.5	48	52.5	54	66	72
Mobile Home	Default	0	0	12	66	90	90	90	90	90	90	90	90

NOTES: Local curve developed by Watershed Concepts (1998)
 Default curves from FEMA Full Riverine Benefit:Cost Model (V5.2.3)