LOCAL FLOOD ANALYSIS

WEST BRANCH DELAWARE RIVER
VILLAGE AND TOWN OF WALTON
DELAWARE COUNTY, NEW YORK

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ABBREVIATIONS/ACRONYMS

BFE	Base Flood Elevation
CFS	Cubic Feet per Second
CWC	Catskill Watershed Corporation
CY	Cubic Yards
DCSWCD	Delaware County Soil and Water Conservation District
DFIRM	Digital Flood Insurance Rate Map
FEMA	Federal Emergency Management Agency
FHMIP	Flood Hazard Mitigation Implementation Program
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FTP	File Transfer Protocol
GIS	Geographic Information System
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HMP	Hazard Mitigation Plan
LFA	Local Flood Analysis
LiDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
MMI	Milone & MacBroom, Inc.
NFIP	National Flood Insurance Program
NRCS	Natural Resource Conservation Service
NYCDEP	New York City Department of Environmental Protection
PMR	Physical Map Revision
SFHA	Special Flood Hazard Area
SMP	Stream Management Plan
STA	River Station
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

EXECUTIVE SUMMARY

The subject Local Flood Analysis (LFA) was undertaken in partnership with the Walton Flood Commission to evaluate potential flood mitigation options along the West Branch Delaware River within the Village of Walton. Flooding has long been a problem in the community, evidenced most recently by the extensive devastation during floods in 1996, 2006, and 2010. The Walton Flood Commission guided this LFA through a number of commission meetings and two public meetings from March 2014 through February 2015.

The study area along the West Branch Delaware was selected to coincide with the majority of the developed area in the Village of Walton. The West Branch Delaware discharges into the Cannonsville Reservoir, a drinking water supply source to the New York City water system. The study area extends 1.5 stream miles along the West Branch Delaware through the Village of Walton from the wastewater treatment plant to a point slightly upstream of the commercial properties on the east end of Delaware Street.

Sources of information that informed this LFA included the FEMA Flood Insurance Study (FIS), the Stream Corridor Management Plan for the West Branch Delaware River, the Delaware County Hazard Mitigation Plan including annex reports for the Village and Town of Walton, the Village of Walton Flood and Hydraulic Study completed in 2010, water quality reports, and accounts of flood events that have impacted Walton.

Three general types of flood mitigation options were considered in Walton – hydraulic, hydrologic, and property-specific. Hydraulic options change the water surface elevation of a flood whereas hydrologic options change the timing or volume of water flowing downstream. The primary objective identified by the Walton Flood Commission was to develop a set of flood mitigation alternatives that would prevent floodwaters from entering Delaware Street near Breakey Motors and keep it off the street, providing flood risk reduction to the majority of the businesses located in the downtown area. Secondary objectives were to:

- Reduce flooding at key sites such as the fairgrounds and Kraft;
- Reduce flooding at residences along streets running north from Delaware Street;
- Create pathways for floodwaters to return to the river channel after flooding Delaware Street;
- Shift the floodway boundary further to the south (riverward) in the downtown area if possible; and
- Reduce flood insurance premiums.

Hydraulic analysis of the West Branch Delaware River was conducted using the HEC-RAS program. The HEC-RAS software (*River Analysis System*) was written by the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) and is considered to be the

industry standard for riverine flood analysis. The model is used to compute water surface profiles for one-dimensional, steady-state, or time-varied flow.

The model utilized for this analysis originated with the FEMA Flood Insurance Study (FIS) effective in 2012. Sediment removal, bridge modification/replacement, and floodplain enhancement/creation were evaluated. Sediment removal was found to have little benefit and was not considered further as the LFA progressed. Specifically, removal of the gravel bar beneath the Bridge Street bridge was modeled and found to not provide any reduction in flood water surface[1].

The following flood mitigation alternatives, advanced through an iterative evaluation process supervised by the Walton Flood Commission over the course of several months, were found to provide the greatest flood damage reductions benefits:

Short-Term

- ❑ Lower the floodplain south of Water Street on publicly owned lands
- ❑ Relocate Breakey Motors and restore the site to more natural floodplain conditions

Long-Term

- ❑ Extend lowered floodplain south of Water Street through Dollar General to Bridge Street
- ❑ Replace bridge with a 380' span and two piers
- ❑ Additional floodplain work on the left bank related to bridge

These short and long term alternatives were grouped into two scenarios[2]: option "A" representing the above listed alternatives and option "C" representing the above alternatives combined with floodplain creation at the fairgrounds site. The four combinations are known as ST-A, LT-A, ST-C, and LT-C.

Tables ES-1, ES-2, and ES-3 provide the change in the water surface elevations at 15 cross sections extending from the wastewater treatment plant to upstream of High Street. A negative figure indicates that the flood water surface elevation was decreased by modeling the alternative. A positive figure indicates that the elevation increased slightly. Elevations for the 10, 50, and 500-year floods are provided in the report. For ease of communication, only the 100-year elevations are presented in the executive summary.

[1] Refer to Section 4.6.4 of this report for more information about modeling sediment removal.
[2] The "B" options were not advanced for consideration; these are described in Section 4.7 of this report.

TABLE ES-1
Change in Water Surface Elevations at Fairgrounds (100-Year*) [feet]

Alternative Description	WWTP	Fair Parking	Fair Parking	Fair "H" Buildings	Fair Buildings
Short-Term A	0	0	0	0	0
Short-Term C	-0.1	-0.2	-0.2	-0.5	-0.9
Long-Term A	0	0	0	0	0
Long-Term C	-0.1	-0.2	-0.2	-0.5	-0.9

*The 100-year flood is the flood that has 1% chance of occurring in any year (the 1% annual chance flood). This is also the FEMA "base flood" used to delineate the Special Flood Hazard Area (SFHA). Refer to Section 1.4 of this report ("Nomenclature").

TABLE ES-2
Change in Water Surface Elevations in Village Downstream of Bridge (100-Year) [feet]

Alternative Description	Kraft	End of Water St	DPW	Dollar General	Downstream side of bridge
Short-Term A	0	-0.1	-0.1	-0.7	-0.4
Short-Term C	-2.1	-1.4	-1.3	-1.8	-0.9
Long-Term A	0	-0.1	-0.1	-0.3	-0.7
Long-Term C	-2.1	-1.5	-1.3	-1.4	-1.6

TABLE ES-3
Change in Water Surface Elevations in Village Upstream of Bridge (100-Year) [feet]

Alternative Description	Upstream side of bridge	Old Ford	Breakey Motors	High/ Griswold Streets	Upstream of High St
Short-Term A	-0.4	-0.4	+0.6	-1.4	-1.2
Short-Term C	-0.9	-0.9	+0.3	-1.6	-1.3
Long-Term A	-0.9	-1.1	-0.2	-1.8	-1.5
Long-Term C	-1.6	-1.8	-0.7	-2.0	-1.6

Modeling demonstrated the following:

- The breakdown of alternatives into short-term and long-term implementation shows the incremental benefits of constructing projects over time.
- The short term "A" results show a reduction of flood depths in the Village of 0.7 feet near Dollar General and 1.4 feet upstream where water first enters Delaware Street for the 100-year flood.

- Reduction of flooding at the Kraft factory occurs when downstream alternatives are implemented, such as the "C" alternatives that include floodplain enhancement at the Fairgrounds.
- Adding the fairgrounds alternative reduces backwater effects from the downstream area and allows water to more easily exit the Village. 100-year water surface reductions in the Village are on the order of 1.5 to 2.0 feet.
- Two of the alternatives cause very slight local water surface *increases* in locations where the water surface elevation was dipping under existing hydraulic conditions.

The combinations of alternatives presented reduce flooding, but do still predict water reaching Delaware Street for storms as low at the 10-year recurrance interval. It has been determined that there may not be any sustainable actions to the river or floodplains that can accomplish the goal of preventing all floodwater on Delaware Street for the 10, 25, 50, 100-year storms. Actions such as levees or flood walls could potentially keep floodwaters from reaching Delaware Street but are not desired actions because they would cut off the river from the community, displace numerous commercial buildings, and are not funded by local, state, and federal agencies. They can also be overtopped in large floods, and present significant maintenance costs for communities. Therefore, levees and flood walls were not modeled.

Hydrologic alternatives were not a significant consideration for the Walton LFA, as there is no feasible method of retaining or detaining significant volumes of water upstream of Walton to reduce flooding in Walton. However, a specific hydrologic flood problem is of great interest to the Walton Flood Commission. Concentrated flows down the side streets (Liberty Street, Townsend Street, Gardiner Place, and North Street) toward Delaware Street are a considerable problem during certain flood events, and especially when the tributaries are in flood stage and overflowing. Conveyance of the water from roadways to the West Branch Delaware River could be facilitated by removing some of the buildings in the path of this water, such as the 181 Delaware Street building. If this building were removed, it may be possible to create a conveyance channel in its footprint. Another option could be to utilize side yards such as a strip of the McDonald's property to return floodwaters to the river.

A number of residential properties may be removed from the FEMA Special Flood Hazard Area SFHA if the Short-Term and Long-Term C mitigation projects are constructed. These properties are located north of Delaware Street along Liberty, Townsend, North, and Griswold Streets and Gardiner Place. Commercial properties will not be removed from the SFHA as a result of the A and C mitigation projects with the exception of West Branch Collision which may shift out of the SFHA; and with the exception of businesses that would be relocated for the A and C alternatives such as Breakey Motors and Dollar General.

The majority of the properties in the Walton study that are currently in the SFHA associated with the West Branch Delaware River *will remain* in the SFHA, and therefore will be subject to

continued flood risk and flood insurance coverage requirements. However, the reduction of flood water surface elevations may lead to reduced time and costs for clean-up and recovery after floods; and may reduce flood insurance premiums for some properties if flood maps are modified.

Property owners may wish to conduct site-specific mitigation actions to reduce flood risks. The basic choice is to determine whether a building should be removed and the parcel converted to open space; or mitigated through elevation, floodproofing, and/or elevating utilities.

Breakey Motors, the two highway garage buildings south of Water Street, and the Delaware Reporter buildings are structures that are assumed to be demolished as part of the A and C options. Dollar General is the additional structure that would be demolished for the long-term variations of A and C. The buildings at the fairground closest to the river are assumed to be moved as part of the C options. In these cases, the businesses would be relocated in the village and the highway garages would either be relocated or the functions moved to existing facilities.

Aside from the A and C options, there may be other anchor businesses or critical facilities in Walton that can be relocated from the zone of flood risk. The school bus maintenance facility is a good example. The facility will remain at risk for flooding, and the Village and Walton Central School District may determine that relocation is prudent. Anchor businesses like CVS and the Big M supermarket are other examples of buildings that will remain at risk for flooding, and the property owners may one day determine that relocation is prudent. If property owners are interested, the Walton Flood Commission should help facilitate relocations that are not part of the A and C projects. It will be important to track and record flood damage over time for the anchor businesses and critical facilities.

A Benefit-Cost Analysis (BCA) was used to validate the cost-effectiveness of proposed hazard mitigation projects. A BCA is a method by which the future benefits of a project are estimated and compared to its cost. The end result is a benefit-cost ratio (BCR), which is derived from a project's total net benefits divided by its total project cost. The BCR is a numerical expression of the cost effectiveness of a project. A project is considered by FEMA to be cost effective when the BCR is 1.0 or greater, indicating the long-term benefits of the project are sufficient to justify the up-front and long-term costs. A BCA was conducted for the proposed A and C alternatives.

Total benefits for Short Term A, Long Term A, Short Term C, and Long Term C were then summed. Table ES-4 presents these figures.

TABLE ES-4
Summary of Benefits

Type of Benefits	Short Term A	Short Term C	Long Term A	Long Term C
Acquisition Benefits[1]	$797,114	$797,114	$823,512	$823,512
Residential Benefits[2]	$609,162	$1,025,095	$756,530	$1,188,339
Non-Residential Benefits[2]	$2,419,939	$493,282,052	$3,712,116	$494,796,101
Total Benefits	**$3,826,215**	**$495,104,261**	**$5,292,158**	**$496,807,952**

1. Computed by comparing the current condition (flood damage could occur) to a future condition where damage cannot occur because the building has been removed.
2. Computed by comparing the current condition (flood damage could occur) to a future condition where damage is lower because a mitigation project has been completed.

Costs and benefits are compared in Table ES-5 below. For LT-A, two costs are provided. The first include a full replacement of the bridge with a longer, higher bridge that reduces effects on floodwater conveyance. The second cost includes only the incremental cost for the longer, higher bridge relative to an in-kind replacement. The second cost was an important consideration because mitigation programs should consider the incremental cost rather than the full cost when future infrastructure replacements are inevitable. However, in this particular case, using the incremental cost did not lead to a BCR greater than one for LT-A.

TABLE ES-5
Comparison of Costs and Benefits

Alternative		Cost Estimates	Total Benefits	BCR > 1?
ST-A	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site	$3.0M	$3.8M	Yes
ST-C	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site ❑ Create/lower the fairgrounds floodplain	$8.1M	$495.1M	Yes

Alternative		Cost Estimates	Total Benefits	BCR > 1?
LT-A	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site ❑ Extend the lowered floodplain through Dollar General ❑ Replace bridge with a 380' span and two piers ❑ Additional floodplain work related to bridge and connecting through to Water Street area	$9.8M[1] $6.3M[2]	$5.3M	No
LT-C	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site ❑ Extend the lowered floodplain through Dollar General ❑ Replace bridge with a 380' span and two piers ❑ Additional floodplain work related to bridge and connecting through to Water Street area ❑ Create/lower the fairgrounds floodplain	$14.9M	$496.8M	Yes

1. Includes the full cost of bridge replacement to include a longer/higher bridge
2. Includes the incremental cost for a longer/higher bridge compared to a bridge replacement in kind

The BCA does not include consideration of water quality benefits that would be provided by flood mitigation projects. Water quality benefits should be used to increase benefits when the BCR is poorly represented by the flood reduction benefits generated by the BCA program or when stratification or prioritization of mitigation projects is difficult due to a calculation of similar BCRs.

Although reduced flood damage in Walton would undoubtedly lead to improved water quality during floods, inclusion of water quality benefits was not considered necessary for this LFA because the BCRs are well represented by flood reduction benefits and because the BCRs are sufficiently different than one another. If the Walton Flood Commission determines that option LT-A should be pursued immediately, prior to the eventual replacement of the bridge due to its age and/or condition, then water quality benefits may be useful for improving the BCR for LT-A.

The following flood mitigation recommendations are offered:

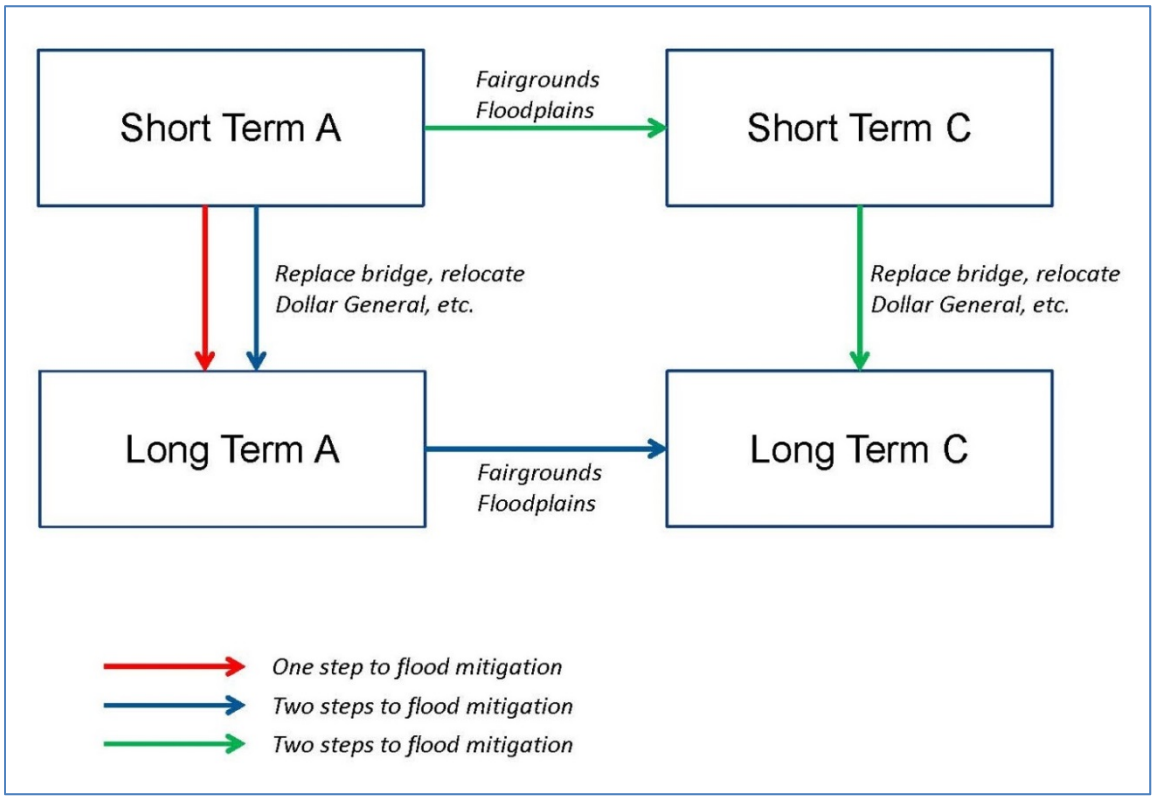
1. Proceed with implementation of the A and C mitigation projects as funding allows.
2. Pursue floodproofing of commercial buildings along Delaware Street. Floodproofing should include sealing of lower portions of buildings including doors and other openings, and elevation of building utilities. Ensure that floodproofing is viable under a set of potential future conditions (for example, designed according to the higher of future flood elevation based on A or C).
3. Pursue elevation of homes on a case-by-case basis as property owners approach the Walton Flood Commission and/or the Village about mitigation. Ensure that elevations are conducted in accordance with the effective BFE at the time of the work.
4. If property owners are interested, pursue relocations that are not part of the A and C projects. These may include critical facilities such as the school bus maintenance facility and key businesses such as the CVS.
5. Seek funding for a flood mitigation feasibility study and master plan for the county fairgrounds property (this will help facilitate recommendation #1).

The following procedural recommendations are offered:

- ❑ Continue to gather and file revenue information as provided by businesses. This may help improve future BCA determinations.
- ❑ During and after future floods, record and compile municipal, county, and state costs related to clean-up and recovery in Walton. This may help improve future BCA determinations.
- ❑ During and after future floods, record high water marks throughout the village. Track and record flood damage over time for anchor businesses and critical facilities.
- ❑ Identify opportunities to include water quality benefits in future BCA determinations. This may be particularly helpful when costs exceed standard flood mitigation benefits by narrow margins.
- ❑ Continue to evaluate the cost effectiveness and viability of constructing a flood wall for Kraft as described in the Third Brook Watershed Management Plan.

Figure ES-1 presents a general overview of three potential pathways that can be taken in Walton for flood mitigation through the A and C projects described in this LFA.

Figure ES-1
Implementation Framework



The figure depicts the two desired outcomes of flood mitigation projects: either Long-Term A or Long-Term C. In both cases, mitigation will begin with Short-Term A, as it involves village and county-owned land as well as a business owner that is reportedly willing to relocate. The long-term options rely on bridge replacement, which will occur sometime in the future although the date is not known. In general, there are three potential pathways to the long-term outcomes:

- ST-A then LT-A: Fairgrounds floodplain enhancement does not occur in this outcome, and total flood mitigation benefits of $5.3 million are possible.
- ST-A then LT-A then LT-C: the bridge is replaced and Dollar General is relocated in favor of floodplain work *prior to* the fairgrounds work, but total flood mitigation benefits of $496.8 million are possible. If Kraft chooses to pursue flood mitigation on its own terms, total flood mitigation benefits of $12.5 million are possible.
- ST-A then ST-C then LT-C: the bridge is replaced and Dollar General is relocated in favor of floodplain work *subsequent to* the fairgrounds work, but total flood mitigation benefits of $496.8 million are possible. If Kraft chooses to pursue flood mitigation on its own terms, total flood mitigation benefits of $12.5 million are possible.

Several funding sources may be available to the Walton Flood Commission, the Village and Town of Walton, and Delaware County and its departments for the implementation of recommendations. These are listed below. Descriptions are provided in Section 6.4.

Table ES-6
Potential Funding Sources for Components of Mitigation Projects A and C

Alternative		Federal	State	Other
ST-A	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
ST-C	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
	Create/lower the fairgrounds floodplain	ACOE	NYSDOS	DCSWCD SMP, CWC
LT-A	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Dollar General	FEMA	None	NYCDEP Buyout, CWC
	Extend the lowered floodplain through Dollar General	ACOE	NYSDOS	DCSWCD SMP, CWC
	Replace bridge with a 380’ span and two piers	None	NYSDOT	DCSWCD SMP, CWC
	Additional floodplain work related to bridge and connecting through to Water Street area	ACOE	NYSDOS	DCSWCD SMP, CWC
LT-C	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC

Alternative		Federal	State	Other
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Dollar General	FEMA	None	NYCDEP Buyout, CWC
	Extend the lowered floodplain through Dollar General	ACOE	NYSDOS	DCSWCD SMP, CWC
	Replace bridge with a 380' span and two piers	None	NYSDOT	DCSWCD SMP, CWC
	Additional floodplain work related to bridge and connecting through to Water Street area	ACOE	NYSDOS	DCSWCD SMP, CWC
	Create/lower the fairgrounds floodplain	ACOE	NYSDOS	DCSWCD SMP, CWC

Table ES-7
Potential Funding Sources for Other Mitigation Projects

Option	Federal	State	Other
Floodproofing of individual non-residential buildings	FEMA	NYSDOS	None
Elevation of individual non-residential buildings in floodway	None	None	None
Elevation of individual residential buildings in floodway	None	None	None
Elevation of individual non-residential buildings outside of floodway	FEMA	NYSDOS	None
Elevation of individual residential buildings outside of floodway	FEMA	None	None
Relocation of anchor businesses and critical facilities such as CVS, Big M, and the school bus maintenance facility	FEMA	NYSDOS	NYCDEP Buyout, CWC*

*CWC funding may be available only if off-site flood levels are reduced as a result of the action

As this LFA plan is implemented, the Walton Flood Commission will need to work closely with potential funders to ensure that the best combinations of funds are secured for mitigation options A and C, and for the property-specific mitigation such as floodproofing, elevations and relocations.

1.0 INTRODUCTION

1.1 Project Background

The Walton Flood Commission, utilizing funding provided by NYCDEP through the Delaware County Soil and Water Conservation District (DCSWCD), has retained Milone & MacBroom, Inc. (MMI) to complete a Local Flood Analysis (LFA) in the Village of Walton, New York, along the West Branch Delaware River. The LFA builds upon Federal Emergency Management Agency (FEMA) modeling to evaluate flood risks along the West Branch Delaware River and assess potential mitigation measures aimed at reducing flood inundation and the associated damages and water quality impairment that may occur due to floods.

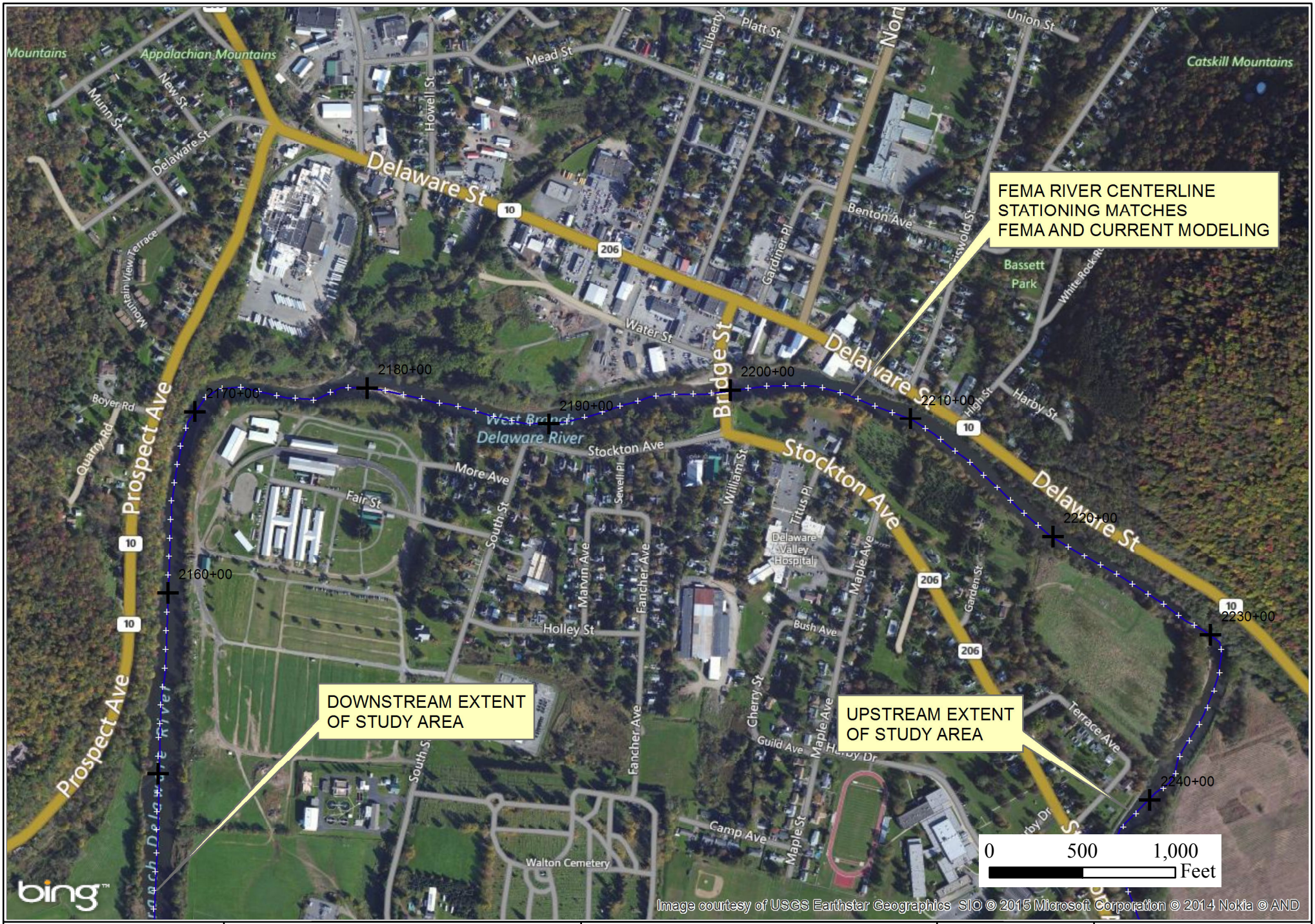
The LFA is a new program within in the New York City water supply watersheds, initiated following Tropical Storm Irene to help communities identify long term, cost effective projects to mitigate flood hazards. The DCSWCD is implementing the LFA program in the watershed communities associated with the West Branch and East Branch Delaware River watersheds.

1.2 Study Area

The study area along the West Branch Delaware was selected to coincide with the majority of the developed area in the Village of Walton. The West Branch Delaware discharges into the Cannonsville Reservoir, a drinking water supply source to the New York City public water system. The graphic to the right depicts the West Branch and the East Branch relative to Delaware County and adjacent counties.



Figure 1-1 is a location plan of the study area. The study area extends 1.5 stream miles along the West Branch Delaware through the Village of Walton. The upstream study area boundary is located near the first major bend in the river within the village. The downstream study area boundary is located at the wastewater treatment plant.



SOURCE(S): BING MMI HECRAS	N MXD: Y:\5197-02\Maps\Report Figures\1-1-StudyArea.mxd	**Figure 1-1: STUDY AREA** **LOCAL FLOOD ANALYSIS** **WEST BRANCH DELAWARE RIVER** **LOCATION: WALTON, DELAWARE COUNTY, NY**	**Map By:** JCL **MMI#:** 5197-02 **Original:** 1/30/2015 **Revision:** **Scale:** 1 in = 667 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com

Walton is key commercial hub within Delaware County and in the Delaware River drinking water supply watersheds. According to the Town of Walton Comprehensive Plan (2006), "The Town of Walton is a picturesque rural town where scenic views abound. Commercial life and employment are located primarily in the Village of Walton, with hills, forests and farmlands covering most of the rest of the Town." The Comprehensive Plan continues with a brief historical profile of the town and village; this profile is reprinted in the text box below.

Historical profile from Walton Comp Plan

"Early settlers depended on lumbering, logs being transported via the Delaware River downstream to Trenton and Philadelphia. Saw mills and grist mills were also active in the early years, followed by carding and fulling mills as sheep-raising emerged as the major agricultural activity in the 1830s.

With the arrival of the railroad in 1872, dairy production emerged to replace sheep as the primary agricultural activity, leading to the establishment of dairy processing as a major local industry. The Breakstone Company began dairy processing in Walton in 1912 and grew as a producer of condensed milk during World War I. It continues to prosper today even since being purchased by Kraft Foods, which continue to produce under the Breakstone name.

Manufacturing of wood products began to replace shipping of raw timber with the establishment of furniture factories in the 1830s and 1840s. S. J. Bailey & Son moved to Walton in 1939. By 1975, Bailey employed 175 persons in Walton and was the second largest manufacturer of unfinished furniture in the US. In 1999, however, Bailey left Walton. Quarrying of bluestone emerged early as an important component of the local economy and has continued to be active until the present day."

The Comprehensive Plan describes a general decrease in population of the town and village combined from 1990 through 2000. From 2000 to 2010, the population of the village increased from 3,070 to 3,088 while the population of the town (inclusive of the village) decreased slightly from 5,607 to 5,576. As of the 2010 census, 55% of the population in the town resides in the village. Therefore, the town's rural population *outside* the village decreased from 2,537 to 2,488 from 2000 to 2010. Interestingly, this reflects a slight increase in density in the village, potentially coinciding with the area of focus for this LFA.

The Comprehensive Plan speaks of a significant part-time population of second homeowners in the town and village. The part-time residents of Delaware County and Walton are important components of the demographic and economy. As of the 2010 census, 2,958 housing units were located in the town, and 1,514 were located in the village, with 1,444 in the town outside the village. This translates to 51% of the housing units in Walton located in the village. This percentage is slightly lower than the percent of population located in the village, which makes sense because the number of persons per housing unit is likely higher in the village.

1.3 Community Involvement

The Walton Flood Commission guided the LFA process and advised MMI regarding which mitigation alternatives to evaluate. Table 1-1 lists the members of the Walton Flood Commission. The commission is appointed by the Town and Village Boards, and is comprised of people with technical and non-technical backgrounds and is meant to represent various interests and stakeholders at the village, town, and county levels; as well as NYCDEP. The Walton Flood Commission is the primary pathway for community involvement in the planning process.

TABLE 1-1
Walton Flood Commission

Committee Member	Affiliation
Bruce Dolph	Walton Town Supervisor
Edward Snow	Walton Village Mayor
Walter Geidel	Town of Walton Highway Department
Roger Hoyt	Village of Walton Highway Department
Len Govern	Town Board, Town of Walton
Carl Fancher	Walton Fire Department
Art Sochia, Sr.	Walton Fire Department
Stephen Dutcher	Village and Town of Walton Code Enforcement Officer
Al Reynolds	Village of Walton Trustee
Roger Clough	Walton Central School District
Robert Cairns	Delaware Reporter
Ed Rossley	Delaware County Fair Board
Niles Wilson	Delaware County Fair Board
Gale Sheridan	Walton Planning Board
Graydon Dutcher	Delaware County Soil and Water Conservation District
Rick Weidenbach	Delaware County Soil and Water Conservation District
Jessica Rall	Delaware County Soil and Water Conservation District
Bill Willis	Delaware County Economic Development Department
Steve Hood	Delaware County Department of Emergency Services
Dean Frazier	Delaware County Watershed Affairs Commissioner
Kevin Charles	Delaware County Department of Public Works
Molly Oliver	Delaware County Planning Department
Kristin Schneider	Delaware County Planning Department
Nate Hendrix	Catskill Watershed Corporation
Phil Eskeli	NYCDEP

Table 1-2 lists Walton Flood Commission meeting dates that occurred when this particular LFA was on the agenda for discussion.

TABLE 1-2
Walton Flood Commission Meeting Dates

Date	Purpose
March 20, 2014	Kick off project and review very preliminary model results
May 1, 2014	Review model results and prepare for public meeting
July 17, 2014	Discuss model results and identify alternatives to advance to benefit cost analysis (BCA)
August 21, 2014	Discuss BCA
November 16, 2014	Review BCA and building-specific mitigation options
January 8, 2015	Review BCA and draft report

In addition to the Walton Flood Commission meetings, other correspondence was occasionally necessary to address certain aspects of the LFA. In particular, a technical team meeting was held on June 17, 2014 in lieu of a full Walton Flood Commission meeting. This meeting provided a chance for DCSWCD personnel to discuss various technical aspects of the modeling and help advance appropriate alternatives for further evaluation.

The LFA process included two public meetings. These were held near the beginning and end of the LFA project as noted below.

TABLE 1-3
Public Meeting Dates

Date	Purpose
May 1, 2014	Present LFA background, purpose, types of flood mitigation, and model concepts
February 4, 2015	Present the LFA report

Appendix A contains copies of the power point presentations used at meetings listed in Table 1-2 and Table 1-3, along with meeting notes.

1.4 Nomenclature

In this report and associated mapping, stream stationing is occasionally used as an address to identify specific points along the West Branch Delaware River. Stationing is typically measured in feet from downstream to upstream. To simplify the nomenclature, the FEMA cross section stationing was used for the Walton. All references to right bank and left bank in this report refer to "river right" and "river left," meaning the orientation assumes that the reader is standing in the river looking downstream. The datum used throughout this report is NAVD88.

In order to provide a common standard, FEMA's National Flood Insurance Program (NFIP) has adopted a baseline probability called the base flood. The base flood has a one percent (one in 100) chance of occurring in any given year, and the base flood elevation (BFE) is the elevation of this level. For the purpose of this report, the one percent annual chance flood is referred to as the ***100-year flood event***. Other reoccurrence probabilities used in this report include the ***2-year flood event*** (50 percent annual chance flood), the ***10-year flood event*** (10 percent annual chance flood), the ***25-year flood event*** (4 percent annual chance flood), the ***50-year flood event*** (2 percent annual chance flood), and the ***500-year flood event*** (0.2 percent annual chance flood). The Special Flood Hazard Area (SFHA) is the area inundated by flooding during the 100-year flood event.

2.0 WATERSHED FACTS AND CHARACTERISTICS

2.1 Initial Data Collection

Initial data collected for this study and analysis included publicly available data as well as input from DCSWCD representatives. Chapter 7.0 includes a full listing of resource material gathered. A brief summary of key documents follows.

Flood Insurance Study (FIS)

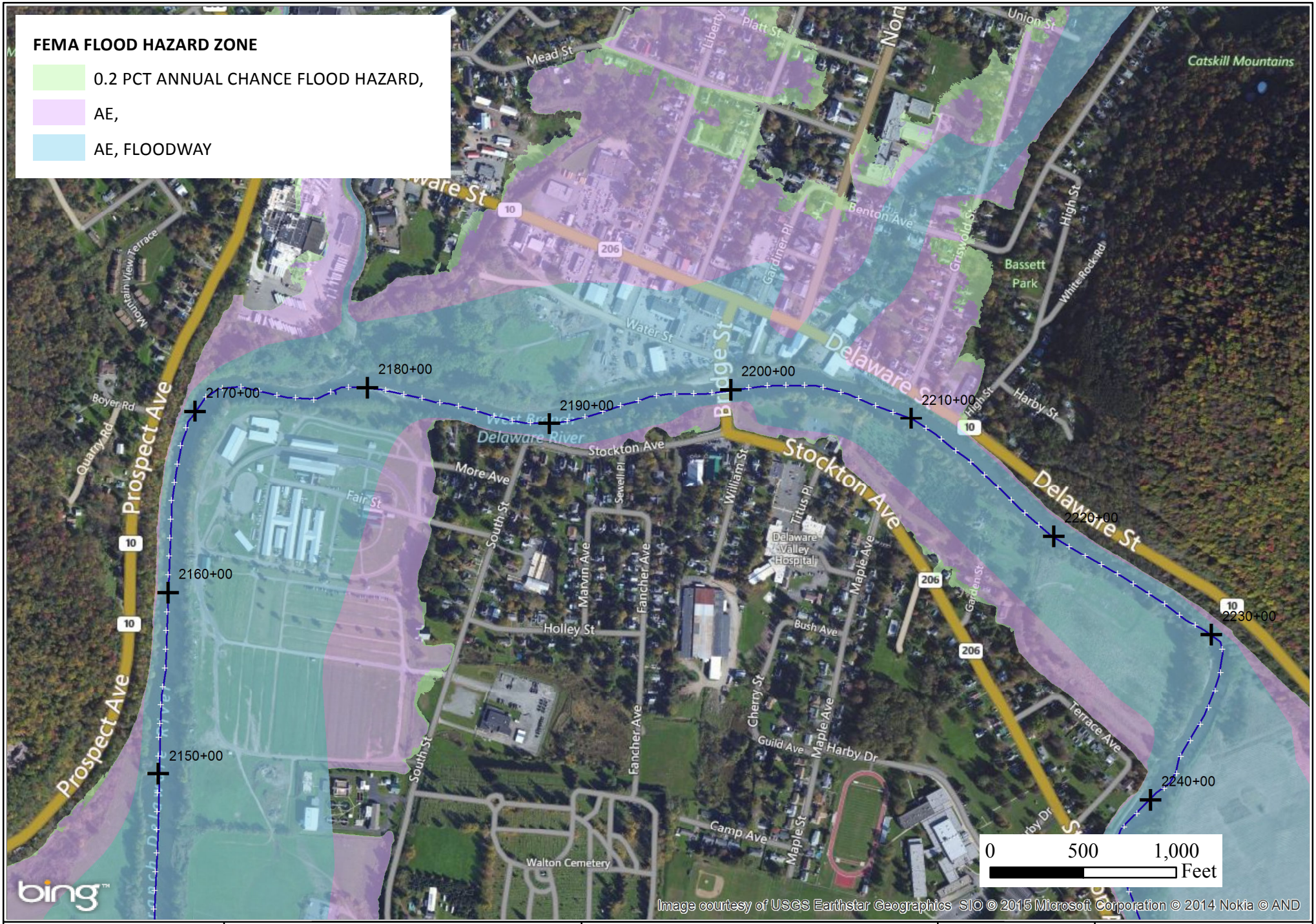
The current Flood Insurance Study (FIS) for Delaware County became effective on June 19, 2012. The FIS covers all jurisdictions in the county, inclusive of the village and town of Walton. The previous FIS covering Walton resulted in FIRM panels that were effective on April 2, 1991 (village) and September 2, 1988 (town). A copy of the FIRM is presented on the next page as Figure 2-1.

Stream Management Plan

Central to maintaining NYCDEP's FAD is a series of partnership programs between New York City and the upstate communities along with the set of rules and regulations administered by the NYCDEP. As required in the FAD, Stream Corridor Management Plans are developed and implemented under the Stream Management Program (SMP). The West Branch Delaware River Stream Corridor Management Plan (SCMP) was developed by DCSWCD and the DCPD under contract with NYCDEP. One component of the SMP is the preservation of water quality through effective management of the streams and associated floodplains that feed water supply reservoirs.

According to the Executive Summary of the SCMP, the plan "provides a foundation for local residents, municipalities, interested organizations and cooperating agencies to enhance stewardship of the West Branch Delaware River and its tributaries…. this Stream Corridor Management Plan is representative of how both upstate and downstate stakeholders can work in partnership to protect and enhance a mutually beneficial resource."

The SCMP states that "West Branch Delaware River has a tendency to become shallower and wider than is desirable due to increased sediment supply from excessive bank and bed erosion in the main river and its tributaries. While erosion and deposition are natural processes, many management activities can significantly increase erosion rates that in turn contribute to increases in sediment supply."



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Figure 2-1: FEMA FLOOD HAZARD ZONE MAPPING

LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By:	JCL
MMI#:	5197-02
Original:	1/30/2015
Revision:	
Scale:	1 in = 667 ft

MILONE & MACBROOM
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The erosion and deposition problems articulated in the SCMP are not new phenomena. Interest in developing a coordinated management strategy for the West Branch of the Delaware River emerged after the January 19, 1996 flood event described in Chapter 3.0. After this flood, the dramatic stream and infrastructure damages that resulted, and subsequent emergency repair work, it was apparent that stream-related activities in certain areas were well intentioned but had set the stage for excess damages during a flood. As a result, the condition of the West Branch significantly changed in many areas of the watershed. Small instability and erosion problems worsened, small eroding banks became larger failures, and some stream courses were significantly altered.

It is important to note that the current version of the SCMP was published in May 2006, only a month before the devastating flood of June 2006. Recommendations of the SCMP include the following (with **bold text** added for emphasis relative to this LFA):

- ❑ Integration of the Stream Corridor Management Program and Watershed Agricultural Program
- ❑ Provide Technical Support to the USDA Conservation Reserve Enhancement Program (CREP)
- ❑ Enhance the Implementation of CREP on New York City Watershed Cropland and Explore Long-Term CREP Contracts
- ❑ Implement a Variable Width Riparian Buffer Pilot Program
- ❑ Participation with the Catskill Watershed Corporation
- ❑ Stream Corridor Management Plans for Non-Agricultural Riparian Landowner Stewardship
- ❑ Stream Gravel Deposition Issues
- ❑ Streamline Stream Work Permitting
- ❑ Assist Municipalities with Culvert Sizing and Design
- ❑ Participation with the DCAP
- ❑ **Expand Public Education and Outreach Efforts**
- ❑ Geomorphic Assessments at Bridges and Culverts
- ❑ **Flood Hazard Mitigation and Flood Recovery**
- ❑ Continuation of Geomorphic Research/Assessments
- ❑ Seek Funds Necessary for Construction of Walton Stream bank Stabilization Projects
- ❑ Prioritization of Identified Stream Intervention Projects
- ❑ Develop a Process for Updating the West Branch Delaware River Stream Corridor Management Plan

The SCMP provides a framework for general stream management decision making in the watershed. The plan provides documentation of current stream conditions along the West Branch and a broad assessment of the condition of existing infrastructure.

Multi-Jurisdiction Hazard Mitigation Plan

The Delaware County Hazard Mitigation Plan Update was developed in 2012 by Tetra Tech and became effective March 2013. The plan includes annex reports for the Town and Village of Walton. The following discussions are taken from the hazard mitigation plan annexes.

Town of Walton – It is estimated that in the town of Walton, 76 residents live within the 1% annual chance (100-year) and 0.2% chance (500-year) floodplains. Of the town's total land area, 3.2 square miles are located within the 1% annual chance flood boundary, and 3.3 square miles are located within the 0.2% annual chance flood boundary.

The computer model HAZUS-MH 2.0 estimates that for a 1% annual chance flood event 120 people may be displaced, and 15 people may seek short-term sheltering, representing 4.7% and 0.6% of the town's population, respectively. For the 0.2% annual chance event, it is estimated that 120 people may be displaced, and 17 people may seek short-term sheltering, representing 4.7% and 0.7% of the town's population, respectively.

The town of Walton has a total of 256 properties located within the 1% annual chance flood boundary and 258 properties located within the 0.2% annual chance flood boundary. There is $20,666,816 of total assessed property (structure and land) exposed to the 1% annual chance flood in the town of Walton. For the 0.2% annual chance event, it is estimated that $20,728,732 of total assessed property is exposed in the town of Walton.

The program calculates the estimated potential damage to the general building stock inventory associated with the 1% annual chance and 0.2% annual chance flood events. HAZUS-MH 2.0 estimates approximately $5,321,000 and approximately $5,381,000 of potential general building stock loss as a result of the 1% and 0.2% annual chance mean return period (MRP) events, respectively.

The plan notes that the town has zoning, subdivision, and flood damage prevention ordinances as well as a comprehensive plan and a highway management plan. Two feet of freeboard is required for new construction in flood zones per the New York State Building Code. **Recommendations of the annex that are consistent with the focus of this LFA include:**

- "Retrofit structures located in hazard-prone areas to protect structures from future damage."
- "Acquire and demolish or relocate structures located in hazard-prone areas to protect structures from future damage."

Village of Walton – It is estimated that in the village of Walton, 770 residents live within the 1% annual chance floodplain, and 864 residents live within the 0.2% chance floodplain. Of the village's total land area, 0.5 square miles are located within the 1% annual chance flood boundary, and 0.5 square miles are located within the 0.2% annual chance flood boundary. **These areas are largely coincident with the LFA study.**

HAZUS-MH 2.0 estimates that for a 1% annual chance event 801 people may be displaced and 663 people may seek short-term sheltering, representing 26.1% and 21.6% of the village's population, respectively. For the 0.2% annual chance event, it is estimated that 808 people may be displaced, and 697 people may seek short-term sheltering, representing 26.3% and 22.7% of the village's population, respectively.

The village of Walton has a total of 276 properties located within the 1% annual chance flood boundary and 311 properties located within the 0.2% annual chance flood boundary. There is $14,196,798 of total assessed property (structure and land) exposed to the 1% annual chance flood in the village of Walton. For the 0.2% annual chance event, it is estimated that there is $15,171,940 of total assessed property exposed in the village.

With the exception of losses along the tributaries, the 1% annual chance flood losses estimated by HAZUS for the Village represent the potential flood losses in the LFA study area.

HAZUS-MH 2.0 calculates the estimated potential damage to the general building stock inventory associated with the 1% annual chance and 0.2% annual chance flood events. HAZUS-MH 2.0 estimates approximately $33,001,000 and approximately $33,406,000 of potential general building stock loss as a result of the 1% and 0.2% annual chance MRP events, respectively.

The plan notes that the village has zoning, subdivision, and flood damage prevention ordinances as well as a comprehensive plan. Two feet of freeboard is required for new construction in flood zones per the New York State Building Code. **Recommendations of the village's annex are similar to those listed in the town's annex.**

Water Quality Reports

In order to fulfill requirements of the Federal Clean Water Act, the NYSDEC must provide periodic assessments of the quality of the water resources in the state and their ability to support specific uses. These assessments reflect monitoring and water quality information drawn from a number of programs and sources both within and outside the Department. This information has been compiled by the NYSDEC Division of Water and

merged into an inventory database of all water bodies in New York State. The database is used to record current water quality information, characterize known and/or suspected water quality problems and issues, and track progress toward their resolution.

This inventory of water quality information is the division's Waterbody Inventory/Priority Waterbodies List (WI/PWL). The Delaware River Basin WI/PWL was last published in December 2002. **The West Branch Delaware, Upper, Main Stem (1404-0021, from Cannonsville Reservoir near Beerston to Hawleys) is listed as having "Minor Impacts."** Known sources of pollution are agriculture and municipal wastewater, and suspected sources are septic systems, streambank erosion, and urban runoff. The discussion in the text box to the right is provided in the WI/PWL report.

Recreational uses (swimming, fishing) and aesthetics in this reach of the Upper West Branch are stressed by excessive nutrient loads from agricultural activities and other nonpoint sources in the watershed. Urban runoff from more developed areas and inadequate on-site septic systems are suspected of being contributing sources as well. Aquatic life support in the reach is threatened by the nutrient loadings.

A combined biological (macroinvertebrate and periphyton) survey of the Upper West Branch at multiple sites between Stamford and Beerston was conducted in 2000; overall, water quality in the West Branch Delaware River is considered slightly impacted. Both biological approaches identified nonpoint nutrient enrichment as the likely cause of the impact, although the river is still supportive of a healthy, productive invertebrate fauna. Water quality in the reach may be vulnerable to additional sources of enrichment; seemingly minor nonpoint source inputs could result in substantial changes in the stream community.

NYC DEP routinely monitors 18 sites along the West Branch Delaware above the Cannonsville Reservoir. Analysis of water quality data collected during 2000 identified 9 of these sites as exceeding guidance values for total phosphorus.

NYC DEP biological monitoring on the West Branch revealed generally non-impacted conditions and healthy aquatic communities; two of the eight sites were occasionally found to be slightly impacted.

NYSDEC has been working on an update to the WI/PWL, but a formal draft has not been published as of the date of this plan.

The New York State Section 303(d) List of Impaired Waters (2012, revised 2013) identifies those waters that do not support appropriate uses and that may require development of a Total Maximum Daily Load (TMDL). **The portion of the river downstream of Walton is not listed in this document.**

The NYSDEC Water Quality Standards and Classifications program is responsible for setting New York State ambient water quality standards and guidance values for surface water and groundwaters. The program is also responsible for the classification of surface waters for their best usage. The water quality standards program is a state program with EPA oversight. New York's longstanding water quality standards program predates the federal Clean Water Act and protects both surface waters and groundwaters. All waters in New York State are assigned a

letter classification that denotes their best uses. Letter classes such as A, B, C, and D are assigned to fresh surface waters. This section of the West Branch is Class B.

Village of Walton Flood and Hydraulic Study

From 2008 through 2010, Woidt Engineering and FIScH Engineering conducted a flood and hydraulic study for the Village of Walton using a grant from the Catskill Watershed Corporation. The study included the development of a hydraulic model in parallel with the FEMA FIS effort that was underway at the same time and later became effective in May 2012. The study included Third Brook, West Brook, East Brook, and the West Branch Delaware River.

The flood study noted that flood mitigation options were limited in Walton. Attenuation of peak flows would be challenging due to high costs and limited space in the valley. Miles of levees and floodwalls would likewise be expensive and would exacerbate sediment and debris transport. Recommendations of the flood study included the adoption of more restrictive floodplain regulations, development of flood evacuation routes, reclamation of floodplains along the West Branch Delaware River, floodproofing of residential and commercial structures, implementation of an early warning system, stream maintenance through debris removal, debris management, stormwater management, bridge capacity improvements, and slope stabilization where applicable.

Flood Damage Prevention Codes

Town of Walton – The Town of Walton has adopted a local law for flood damage prevention. Revisions were adopted in 2012 to be consistent with the guidance provided by the state in 2007 for counties where new FEMA studies were being conducted. The town adopted the recommended revisions. These are identical to the revisions adopted in the village, as described below.

Village of Walton – The Village of Walton has adopted a local law for flood damage prevention. Chapter 25 of the municipal code is the Flood Damage Prevention code. Revisions were adopted in 2012 to be consistent with the guidance provided by the state in 2007 for counties where new FEMA studies were being conducted.

The stated purposes of this local law are to:

- Regulate uses that are dangerous to health, safety, and property due to water or erosion hazards, or that result in damaging increases in erosion or in flood heights or velocities;
- Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

- Control the alteration of natural floodplains, stream channels, and natural protective barriers that are involved in the accommodation of flood waters;
- Control filling, grading, dredging and other development that may increase erosion or flood damages;
- Regulate the construction of flood barriers that will unnaturally divert flood waters or that may increase flood hazards to other lands, and;
- Qualify and maintain for participation in the National Flood Insurance Program.

The stated objectives of the local law are:

- To protect human life and health;
- To minimize expenditure of public money for costly flood control projects;
- To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- To minimize prolonged business interruptions;
- To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone, sewer lines, streets and bridges located in areas of special flood hazard;
- To help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;
- To provide that developers are notified that property is in an area of special flood hazard; and,
- To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

The Code Enforcement Officer or the Building Inspector is empowered as the Local Administrator for administering and implementing the Flood Damage Prevention local law. The primary responsibility of the Local Administrator is the granting or denying of floodplain development permits. The Local Administrator must conduct a thorough permit application review prior to approval and must make periodic inspections during the construction phase of a project after permit approval. Finally, upon completion of a project, the Local Administrator must issue a Certificate of Compliance stating that the project conforms to all requirements of the local law.

The local law identifies a series of Construction Standards for development in the floodplain, broken down into General Standards, Standards for All Structures, Residential Structures, Non-Residential Structures, and Manufactured Homes and Recreational Vehicles.

The General Standards section is broken down into standards for subdivision proposals and encroachments. All new subdivision proposals and other development proposed in a

SFHA must be consistent with the need to minimize flood damage, minimize flood damage to utilities, and provide adequate drainage. When encroaching on zones A1-A30 and AE along streams without a regulatory floodway, development must not increase the base flood elevation by more than one foot. Along streams with a regulatory floodway, development must not create any increase in the base flood elevation.

Standards for All Structures include provisions for anchoring, construction materials and methods, and utilities. New structures must be anchored so as to prevent flotation, collapse, or lateral movement during the base flood. Construction materials must be resistant to flood damage, and construction methods must minimize flood damage. Enclosed areas below the lowest floor in zones A1-A30, AE and AH, and, in some cases, Zone A must be designed to allow for the entry and exit of floodwaters. Utility equipment such as electrical, HVAC and plumbing connections must be located at a minimum of two feet above the base flood elevation. Water supply and sanitary sewage systems must be designed to minimize or eliminate the infiltration of floodwaters.

The elevation of residential and nonresidential structures is required in areas of special flood hazard. **In zones A1-A30, AE and AH, and, in some cases, Zone A, new residential construction and substantial improvements must have their lowest floor elevated at or above two feet above the base flood elevation.** In cases where base flood elevation data is not known for Zone A, new residential construction and substantial improvements must have their lowest floor elevated at or above three feet above the highest adjacent grade.

For nonresidential structures in zones A1-A30, AE and AH, and, in some cases, Zone A, developers have the option of either elevating the structure or improvements by a minimum of two feet above the base flood elevation or floodproofing the structure so that it is watertight below two feet above the base flood elevation. In cases where base flood elevation data is not known for Zone A, new construction and substantial improvements must have their lowest floor elevated at or above three feet above the highest adjacent grade.

Recreational vehicles are only allowed in zones A1-A30, AE, and AH if they are on site fewer than 180 consecutive days and are licensed and ready for highway use, or meet the construction standards for manufactured homes. Manufactured homes in the A1-A30, AE, and AH zones must be placed on a permanent foundation with the lowest floor elevated at or above two feet above the base flood elevation. In Zone A, such structures must be placed on reinforced piers or similar elements that are at least three feet above the base flood elevation.

2.2 Watershed and Stream Characteristics

The West Branch of the Delaware River has a contributing watershed area of 332 square miles at Walton, dominated by steep rural mountains and narrow, flat-floored, valleys. The general flow path is from northeast to southwest toward Cannonsville Reservoir. It is a single stem, slightly sinuous gravel and/or cobble-bed river with riffle-pool morphology and a low gradient (DCSWCD, 2006).

A dam is located 23 miles downstream of Walton and impounds the 12-mile long Cannonsville Reservoir. It has a watershed area of 455 square miles that contributes runoff to the impoundment. In comparison, the watershed area at the Walton USGS 01423000 gauge is 332 square miles, equal to 73% of the reservoir's watershed. The backwater influence of the dam's impoundment is quite distant from the LFA project area and does not affect hydrology or hydraulics in Walton.

The total length of the West Branch Delaware River from its headwaters to the main stem of the Delaware River is about 90 miles. The length above the reservoir is approximately 51 miles. The river has an average slope of 0.58 %, while the average valley slope is 0.66%. Figure 2-2 presents a profile of the West Branch Delaware River showing its elevation versus linear distance from its outlet.

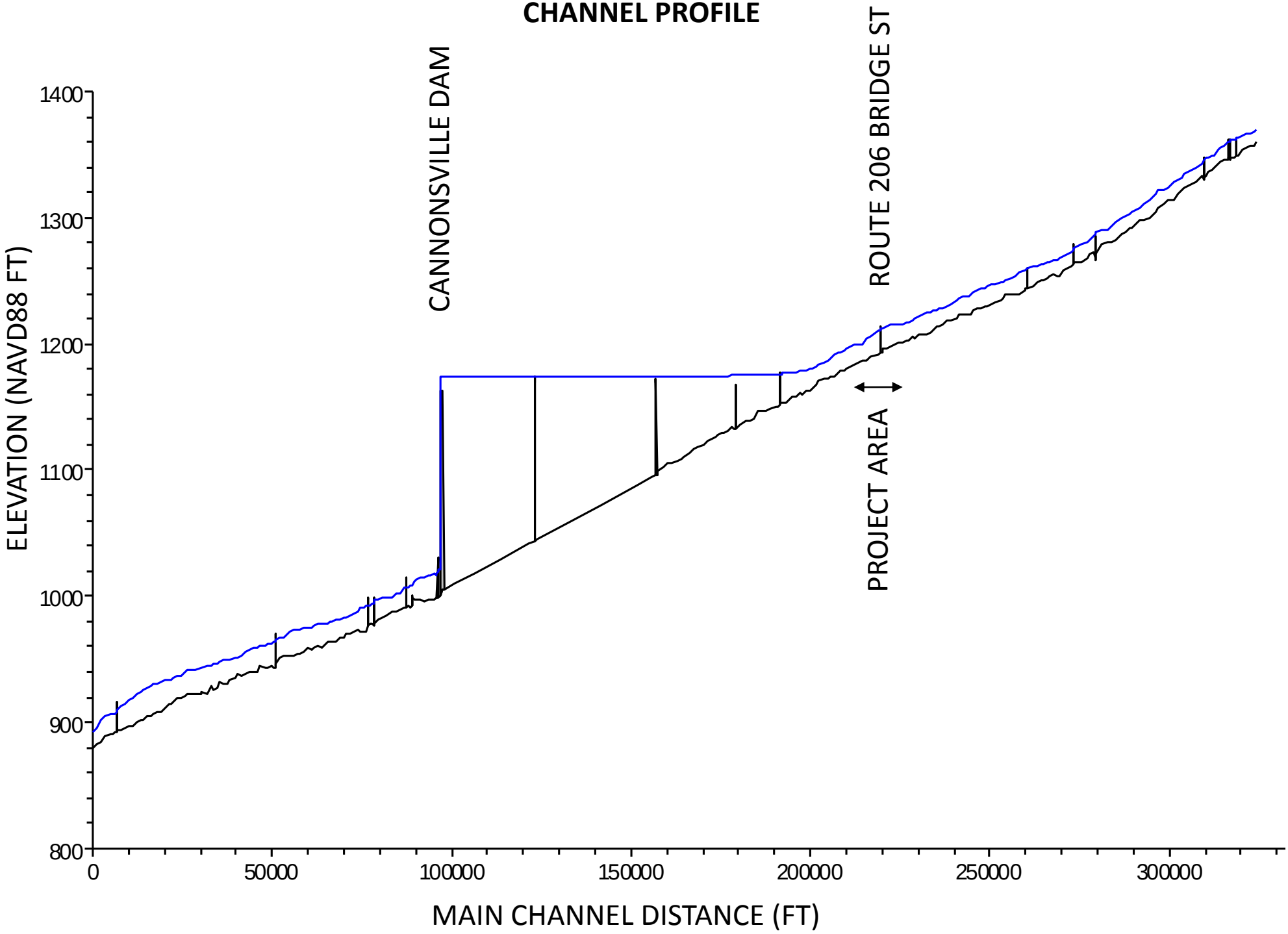
The West Branch watershed is underlain by sandstone, siltstone, and shale formed by deposition during the Devonian period about 370 million years ago. The mountains of the Catskill region are an erosional feature. As mountain-building forces raised the Appalachian mountain chain to the south, uplift of the Catskill region allowed sustained erosion that created the stream valleys of today. Multiple periods of glaciation have more recently shaped the topography of New York, and glacial rivers deposited much of the sediment in the valleys. The Village of Walton is believed to be developed on an alluvial fan that formed during the melting of glacial ice and associated deposition of sediments.

In Walton, the West Branch Delaware River forms a distinct horseshoe shape or upside-down "U." The developed part of the village is located in the middle of this horseshoe, straddling the river, but with the densest development on the right bank (north side).

2.3 Field Assessment

MMI staff conducted visual inspections of the West Branch Delaware channel and floodplain in the Village of Walton. In general, the inspections were focused on (1) the river channel and its banks (bank and channel conditions, sediment bars, vegetation along the stream corridor) and (2) development in the floodplains.

FIGURE 2-2:
CHANNEL PROFILE



Approximately 185 structures located in the SFHA were observed on foot. Channel reaches along the West Branch Delaware were photo-documented. Visual inspections were conducted throughout spring and summer 2014, often coinciding with Walton Flood Commission meetings dates. The iterative nature of the inspections was necessary to help refine and reality-check the modeling of alternatives and the BCA.

When observing the stream channel and adjacent floodplains, the following were noted:

- ❑ Does the stream profile match the profile in the FIS and model?
- ❑ Do stream cross sections match the cross sections in the model?
- ❑ Do the manning n values in the model represent current riverbank and floodplain conditions?
- ❑ Do hydraulic variances in the model make sense relative to the field conditions, such as channel restrictions and bridges?

When observing structures, the following were noted:

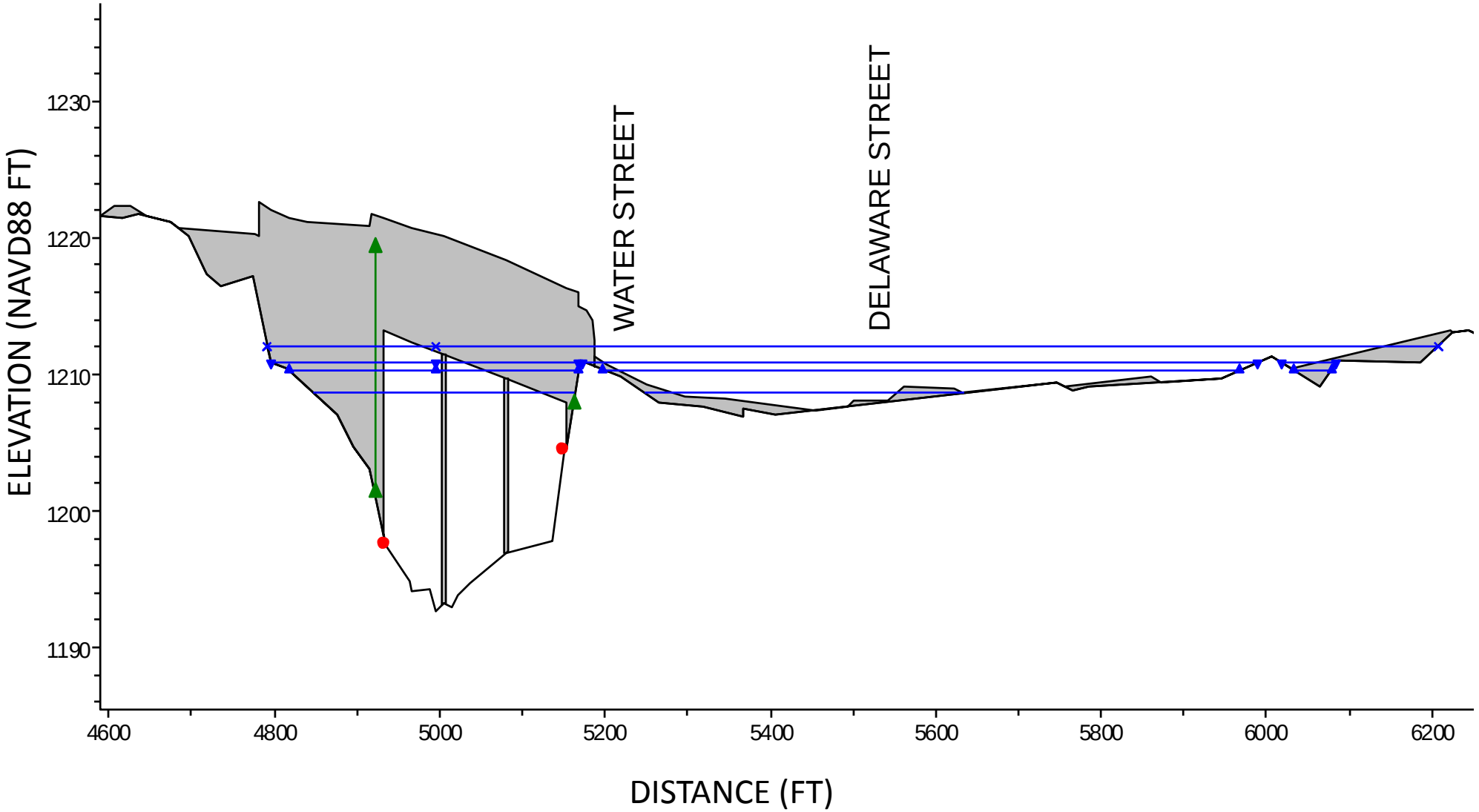
- ❑ Do the property and building(s) match the parcel data provided by the Delaware County Planning Department?
- ❑ Is the property in the SFHA or 500-year flood zone? Is the structure in the SFHA or 500-year flood zone?
- ❑ What is the current land use and building use?
- ❑ Does the building have a basement?
- ❑ Is the building vacant or occupied?
- ❑ What is the elevation of the first floor in relation to adjacent grade?
- ❑ For single-family homes, how many feet (vertical) above the adjacent grade is the first floor?
- ❑ Are any unique features present in the building or property that would increase or decrease vulnerability to flooding? For example, the rear of Brandow's Feed and Seed is lower than the front of the building.
- ❑ Is there any direct evidence of past flooding such as mud in a window sill?

Information gathered from field inspections was invaluable for aiding the modeling of alternatives and the BCA.

2.4 Infrastructure

The West Branch Delaware is crossed by only one bridge (Route 206 or "Bridge Street") in the study area. The bridge slopes gently to the north (toward the right bank) as it approaches the downtown area. Figure 2-3 shows the FEMA cross section at the bridge.

FIGURE 2-3:
BRIDGE CROSS SECTION



The bridge generally conveys the 10-year flood and the water surface comes into contact with the low cord only at the north end of the bridge, although some spillage of floodwaters into the floodplain (onto Delaware Street) already occurs upstream of the bridge. The 50 and 100-year water surfaces come into contact with more of the low cord and are therefore more obstructed, and the 500-year water surface elevation is higher than most of the low cord. For all of these floods above the 10-year flood, progressively more water has already left the channel upstream of the bridge and is bypassing the bridge.

2.5 Hydrology

Surface water hydrologic studies are conducted to understand historic and potential future river flow rates using data measured at stream gauging stations and those developed from predictive models. They inform communities of how much water flows in the river at a specific time and place.

Hydrologic data on peak flood flow rates for the West Branch of the Delaware River is available from FEMA, *StreamStats* regional data, and USGS gauging stations. *StreamStats* is a USGS website that uses Geographic Information System (GIS) data and regional regression equations to predict peak flood flow rates (Lumia, et al, 2006 & Mulvihill et al, 2009).

Three tributaries join into the West Branch of the Delaware River within the Walton project area. From upstream to downstream the tributaries are East Brook, West Brook, and Third Brook. Each of these tributaries is channelized through the Village of Walton.

The FEMA FIS of Delaware County was published in 2008 and included data for the West Branch Delaware River. The FIS describes the calculation methods as a flood frequency gauge analysis performed using PEAKFQ software, specifically using the Bulletin 17B methods. This gauge analysis was updated as part of the 2012 detailed FIS update. USGS stream gauges at Hale Eddy, NY (01426500), Stilesville, NY (01425000), Walton, NY (01423000), and Delhi, NY (1422000) were included in the analysis. Flow change locations not at a USGS gauge location were determined by scaling the gauge analysis results by drainage area. The current study used the FEMA published flows for the 10-year, 50-year, 100-year, and 500-year flow profiles (Table 2-1).

TABLE 2-1
FEMA Published Discharge Data

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharge (cfs)			
		10-yr	50-yr	100-yr	500-yr
At USGS Gage 01422000	141.93	6,399	8,828	9,883	12,372
Approximately 1.76 miles downstream of Sherwood Road	197.06	9,986	13,892	15,559	19,483
Approximately 1.35 miles upstream of Andes Delancey Road in Town of Hamden	220.66	11,661	16,347	18,332	23,076
At USGS Gage 01422700 (Near Hawleys Downsville Road in Town of Hamden)	255.75	13,622	19,103	21,478	27,005
Approximately 0.57 mile upstream of East Brook	273.54	14,281	20,050	22,559	28,400
At USGS Gage 01423000	331.23	17,793	25,031	28,137	35,526
Approximately 1.19 miles upstream of U.S. Route 268	364.92	18,309	25,593	28,724	36,100
At USGS Gage 01425000	455.27	15,300	26,600	32,110	46,520
At USGS Gage 01426500 (Hale Eddy - Broom County Line)	593.29	16,840	29,940	37,180	58,900
Approximately 1.25 miles downstream of Winterdale Road	664.38	17,726	31,516	39,137	62,000

The 2-year and 25-year flow profiles were estimated for use in the hydraulic model. These flows were not included in the FEMA model. A Bulletin 17B gauge analysis was completed on the four gauges used in the FEMA analysis gauge using data current to March 2014. For the Hale Eddy gauge the years before 1963 were removed from the analysis because of the influence of the reservoir, as was done for the FEMA study. The 2-year and 25-year recurrence flows were used at the flow change locations located at the USGS gauges. For flow change locations not at a USGS gauge, the flow values from the nearest gauge were scaled by drainage area using the scaling equation provided in the FEMA FIS (FEMA, 2012).

TABLE 2-2
Additional Modeled Flows

Flooding Source and Location	RS	Drainage Area (sq. miles)	Peak Discharge (cfs)		Notes
			2-yr	25-yr	
At USGS Gage 01422000	324676	141.93	3802.3	8554	
Approximately 1.76 miles downstream of Sherwood Road	314359	197.06	5476	12320	Use US Gage
Approximately 1.35 miles upstream of Andes Delancey Road in Town of Hamden	302518	220.66	6207	13965	Use US Gage
At USGS Gage 01422700 (Near Hawleys Downsville Road in Town of Hamden)	285193	255.75	7263	16661	Use DS Gage
Approximately 0.57 mile upstream of East Brook	260091	273.54	7822	17944	Use DS Gage
At USGS Gage 01423000	222664	331.23	9659	22157	
Approximately 1.19 miles upstream of U.S. Route 268	215987	364.92	10744	24647	Use US Gage
At USGS Gage 01425000	162937	455.27	5739	19948	In impoundment of dam
At USGS Gage 01426500 (Hale Eddy - Broom County Line)	88919	593.29	9880	29876	Downstream of impoundment
Approximately 1.25 miles downstream of Winterdale Road	50836	664.38	11179	33804	Use US Gage

According to USGS, the bankfull discharge of the West Branch Delaware River is 6,640 cfs at the Walton gauge (Scientific Investigations Report 2009–5144, Bankfull Discharge and Channel Characteristics of Streams in New York State, 2010). The associated recurrence interval for this flow is 1.25 years.

3.0 DESCRIPTION OF FLOOD HAZARDS

3.1 Flood History Along the West Branch Delaware

Walton typically experiences mild summers and cold winters with precipitation occurring year-round. The long-term mean annual precipitation in the watershed is reported to be 46.7 inches per year (DCSWCD, 2006). However, precipitation is not always distributed uniformly throughout the year, and several significant and devastating floods have occurred. Beginning with the flood of 1996, these are described below.

Flood of 1996 – On January 19 and 20, 1996, the town and village of Walton suffered a devastating flood. Under nearly five feet of water, businesses along Delaware Street sustained severe damage including a fire that destroyed two buildings during the peak of the flood. Several Walton residents reportedly indicated that this flood was the highest since the flood of July 1935.



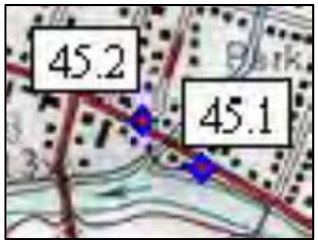
West Branch Delaware River at Delaware Street on January 19, 1996 (Photograph courtesy of the Walton Reporter, reprinted by USGS)

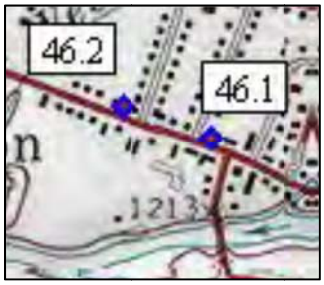
Flood of 2006 – In June 2006, Walton experienced the worst flood in its history. According to the USGS (2009), 13.36 inches of rain were recorded at Walton from June 26 through 29, 2006. The USGS determined that this four-day total precipitation had a recurrence interval *exceeding* the 100-year storm. A flood discharge of 28,600 cfs was measured on the West Branch Delaware River in Walton. A state of emergency was declared in Delaware County and many others.



Photograph courtesy of the Town of Walton web site

The town and village of Walton experienced significant damage and property loss including road and bridge failures, mass failures at hillsides, bank erosion, channel migration and instability, and gravel deposition. Two high water marks during the flood of 2006 (45.1 and 45.1, pictured to the right) were determined by USGS to have elevations of 1,213.33 and 1,212.53 (ft, NGVD 29[3]) along Delaware Street.





Slightly further west on Delaware Street, two high water marks (46.1 and 46.2, pictured to the right) were determined by USGS to have elevations of 1,211.03 and 1,211.79 (ft, NGVD).

Flood of 2010 – Heavy rain from Tropical Storm Nichole fell on Walton totaling 5.16 inches (USGS, 2010) on September 30 and October 1, 2010. The USGS (2009) computed that the 24-hour precipitation total of five inches had a recurrence interval of 25 years. Walton was placed under a state of emergency, and the West Branch Delaware River flooded areas of downtown along Delaware Street. According to USGS, flood recurrence intervals were in the 10-year to 100-year range for the region, which is generally consistent with the 25-year recurrence interval of the precipitation event. A recurrence interval of 15 years was later cited by USGS for the Walton gauge. The pictures to the right were taken in the vicinity of Delaware Street and Griswold Street.





Photographs courtesy of the Watershed Post

An important distinction between the October 1, 2010 flood and the previous devastating floods of 1996 and 2006 was that the floodwaters in 2010 spilled onto Delaware Street at Breakey Motors but did not extend all the way west along the road.

[3] To convert to NAVD 88, subtract 0.43 feet from elevations at these high water marks.

In other words, the part of Delaware Street from CVS to East Brook was not flooded. The photograph below demonstrates this pattern of flooding.



Floods of 2011 – In August and September 2011, Hurricane Irene and the remnants of Tropical Storm Lee resulted in record flooding in much of the Catskills. Walton was placed under a state of emergency once again, and the West Branch Delaware River reportedly flooded areas of downtown along Delaware Street such as Breakey Motors and McDonalds.

A summary of the peak discharges and associated stages is provided in Table 3-1. The recurrence intervals listed in the table were published by USGS at the time of each flood and do not necessarily represent a continuous updating of the hydrologic record with calculation of new recurrence intervals.

TABLE 3-1
Recent Flood Discharges >15,000 cfs at Gauge #01423000 in Walton

Date	Discharge	Stage*	RI** (years)
March 15, 1986	19,500 cfs	14.84	Not reported
January 19, 1996	25,000 cfs	16.36	70
June 28, 2006	28,600 cfs	16.85	>100
October 1, 2010	19,700 cfs	14.75	15
August 29, 2011	16,000 cfs	13.66	7
September 8, 2011	18,500 cfs	14.40	Not reported

*Flood stage = 9.5 feet
**RI as reported by USGS for the period of record available at the date of the flood

3.2 FEMA Mapping

FEMA Flood Insurance Rate Maps are available for the study area and depict the SFHA. The maps also depict the FEMA designated floodway, which is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood. Floodwaters are typically deepest and swiftest in the floodway, and anything in this area is in the greatest danger during a flood (FEMA, 2008).

FEMA mapping indicates that during a 100-year frequency event, waters from the West Branch Delaware River will inundate much of the downtown area. This was verified during some of the recent floods, and especially in 1996 and 2006.

4.0 FLOOD MITIGATION ANALYSIS AND ALTERNATIVES

The purpose of a hydraulic assessment is to evaluate historic and predicted water surface elevations, identify flood prone areas, and help develop mitigation strategies to minimize future flood damages and protect water quality. Hydraulic analysis techniques can also help predict flow velocities, sediment transport, scour, and deposition if these outcomes are desired.

Specific risk areas along the West Branch Delaware have been identified as being prone to flooding during severe rain events. Numerous alternatives were developed and assessed at each area where flooding is known to have caused extensive damage to homes and businesses. Alternatives were assessed with hydraulic modeling to determine their effectiveness. The sections below describe these alternatives and their results.

4.1 Analysis Approach

Hydraulic analysis of the West Branch Delaware through the study area was conducted using the HEC-RAS program. The HEC-RAS software (*River Analysis System*) was written by the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) and is considered to be the industry standard for riverine flood analysis. The model is used to compute water surface profiles for one-dimensional, steady-state, or time-varied flow. The system can accommodate a full network of channels, a dendritic system, or a single river reach. HEC-RAS is capable of modeling water surface profiles under subcritical, supercritical, and mixed-flow conditions.

The FEMA FIS (see Section 2.0) was based on a detailed study utilizing the HEC-RAS computer software. In order to develop hydraulic modeling to assess the alternatives, MMI obtained the effective FEMA HEC-RAS model from NYCDEP on March 10, 2014. This model was used in the FEMA Effective FIS to create the regulatory floodplain and floodway boundaries. The model does not include the tributaries that join the West Branch of the Delaware River (West Brook, East Brook, and Third Brook). It is important to note that the FEMA Effective model was developed before the flooding of 2010 and 2011, using detailed topography data collected in 2009, and therefore does not include any changes to the river and floodplain that may have occurred during recent floods.

Water surface profiles are computed by HEC-RAS from one cross section to the next by solving the one-dimensional energy equation with an iterative procedure called the standard step method. Energy losses are evaluated by friction (Manning's Equation) and the contraction/ expansion of flow through the channel. The momentum equation is used in situations where the water surface profile is rapidly varied, such as hydraulic

jumps, mixed-flow regime calculations, hydraulics of dams and bridges, and evaluating profiles at a river confluence.

4.2 Existing Conditions Analysis

A FEMA "Duplicate Effective" model was created by importing the FEMA Effective model into HEC-RAS. The model was run in HEC-RAS with no changes to the received models. The floodplain and floodway runs were completed in two different plans. Comparisons to the data listed in the Effective FIS revealed some small discrepancies between the received model and FIS Table 8.

To focus on the project area, the FEMA Duplicate Effective model was truncated. Cross sections, structures, and flow change locations downstream of 193180 (between FEMA AM and AN) and upstream of 245720 (between FEMA BD and BE) were deleted from the models. The downstream boundary condition was reset to Known Water Surface Elevation using the results of the full model at the new downstream model cross section. Additional flow profiles were added for the 2-year and 25-year recurrence intervals that were described in the Hydrology section of this report.

The Duplicate Effective model was checked for correct manning's n-values, site conditions, and expansion/contraction coefficients to ensure that the information in the model accurately reflects river and floodplain conditions. Some n-values in the overbank areas did not adequately represent site conditions. A "Corrected Effective Model" was created[4] by copying the truncated Duplicate Effective model and making necessary changes. Minor n-value changes were included in the Corrected Effective Model to more appropriately represent overbank conditions.

Gaps were identified between cross section locations in the Corrected Effective model in areas where the Walton Flood Commission desired evaluation of alternatives for flood mitigation. Additional cross sections were deemed necessary to better represent these possible future mitigation project areas. An "Existing Conditions" model was created by saving a copy of the Corrected Effective Model and adding cross sections in necessary locations.

A total of nine new cross sections were added to the model between the Waste Water Treatment Plant and just upstream of the Village and Bridge Street bridge. New cross

[4] Changes made to the FEMA model geometry were noted in the comments section in HEC-RAS. N-values for some cross sections were updated from the FEMA model in the Corrected Effective model. If a change was made, notes were added to the Cross Section Data Editor Description box where comments can be written for each cross section.

sections used overbank geometry from the 2009 1-meter resolution LiDAR data collected by NYCDEP. Elevations were sampled from the LiDAR elevation data using HEC-GeoRAS GIS extension software. No new survey was collected as part of this model update. The wet channel sections were taken from the next closest cross section that was included in the FEMA model because the LiDAR data does not penetrate the water surface and therefore underestimates the depth of the channel bottom. The wet section shape was transferred and height adjusted to match the channel slope of the FEMA model in these new cross section locations. Manning's n-values were assigned using field observations and aerial photos. For sections with a tributary in the overbank area (West Brook), an ineffective flow area was used to "fill in" the active channel to avoid overestimation of the floodplain flow.

This new Existing Conditions model was the baseline model used to evaluate flood mitigation alternatives. For purposes of water surface elevation computations, the model was run in subcritical flow regime, which tends to use slower velocities but higher water surface elevations, and also provides the worst case scenario for flood surface elevations.

4.3 Channel and Floodplain Mitigation Approaches

A number of mitigation approaches have been evaluated for the West Branch Delaware within the study area. These are introduced in a more global manner in this section and are evaluated in specific instances in the subsequent analysis.

4.3.1 Sediment Management

A common sentiment in the Catskills region is that dredging, more broadly defined as removal of sediment from river channels, will alleviate flooding and should be pursued. The need for dredging can be minimized by reducing the sediment load at its source and by improving sediment transport through reaches that are vulnerable to deposition. Natural sediment transport is often disrupted by constrictions holding back sediment or channelization causing increased sediment transport, causing abnormal deposition that can be addressed in the long term by removal of constrictions and naturalization of channel and floodplain capacity.

Dredging is often the first response to flooding. However, over-widening or over-deepening through sediment removal can initiate instability (including bed and bank erosion), foster poor sediment transport, and not necessarily provide significant flood mitigation. Sediment removal can further isolate a stream from its natural floodplain, disrupt sediment transport, expose erodible sediments, cause upstream bank/channel scour, and encourage additional downstream sediment deposition. Improperly dredged

stream channels often show signs of severe instability, which can cause larger problems after the work is complete. Such a condition is likely to exacerbate flooding on a long-term basis.

4.3.2 Levee Construction

Under certain circumstances, levees can be constructed for the purpose of protecting properties and structures from flood damage. Levees often require interior drainage pump stations, use of removable panels at road crossings, and considerable maintenance. Use of such measures requires careful consideration and risk assessment, engineering design, and ongoing monitoring and maintenance.

Risks associated with levees include the potential to increase water surface elevations in the channel by cutting off the floodplain, and the danger of a flood event that exceeds the design storm and overtops or breaches the levee. As an example, peak flood stage in the Walton exceeded the 100-year flood stage during the 2006 flood. Under this scenario, it is likely that floodwaters would have overtopped a levee designed to protect structures and properties from flooding during the 100-year flood event.

Once a levee has been overtopped, floodwaters can become trapped behind the levee, exacerbating flooding problems. This phenomenon occurs to some extent already in Walton. When floodwaters enter the business district near Breakey Motors and travel downstream along Delaware Street, the ground surface elevations along the south side of Delaware Street near McDonalds make it difficult for floodwaters to re-enter the river.

Finally, levees need to be certified by FEMA and maintained according to FEMA requirements in order for any flood mitigation benefits to be recognized on the Flood Insurance Rate Maps. A lapse in maintenance or certification can lead to sharp flood insurance increases for properties believed protected by the levee system.

4.3.3 Bridge Replacement or Modifications

In some cases, bridges cause lateral or vertical restrictions that increase flood velocities and/or water surface elevations. The replacement of a bridge with a new structure that has a longer span will often remove the lateral constrictions, while a higher structure will remove vertical restrictions and often reduce water surface elevations on the upstream side. Bridge replacement must be carefully evaluated in combination with other alternatives, because other flood mitigation projects could change the velocity or height of flows approaching and passing under bridges.

The Village of Walton has only one bridge over the West Branch Delaware River, at Bridge Street. The Bridge Street bridge was identified by the Walton Flood Commission as the single bridge that required evaluation. This bridge is believed to exacerbate flooding that occurs along the West Branch of the Delaware River.

4.3.4 Natural Channel Design and Floodplain Enhancement

Historic settlement and human desire to build near water has led to centuries of development clustered along the banks of rivers all over the nation. Dense development and placement of fill in the natural floodplain of a river can severely hinder a river's ability to convey flood flows without overtopping its banks and/or causing heavy flood damages.

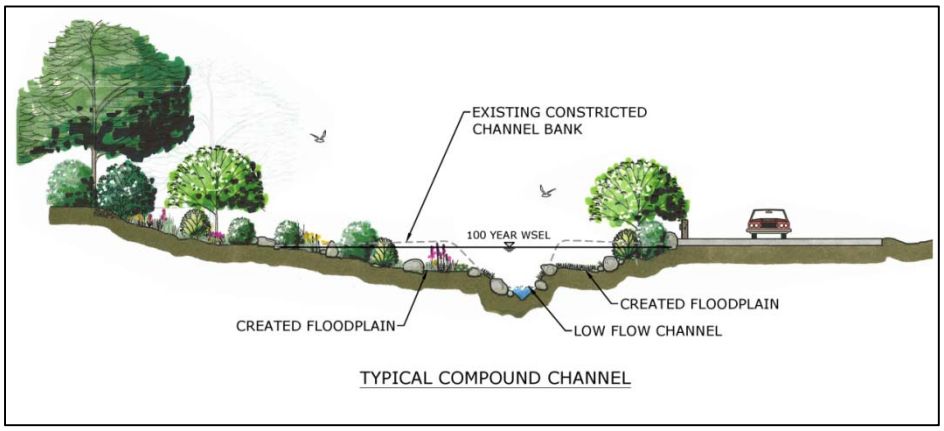
A river in flood stage must convey large amounts of water through a finite floodplain. When a channel is constricted or confined, velocities can become destructively high during a flood, with dramatic erosion and damage. When obstructions are placed in the floodplain, whether they are in the form of structures, infrastructure, or fill, they are vulnerable to flooding and damage. Reducing floodplain capacity also disrupts natural sediment deposition and may cause that sediment to accumulate elsewhere, causing a transfer of problems.

Natural channels are typically comprised of a compound channel whereby normal flow is conveyed in a low flow channel that is flanked by active floodplain, which is ideally a vegetated, undeveloped corridor at a slightly higher elevation that is able to convey high flows. Although rivers in their natural setting seem to be at their low-flow stage most often, the entire flood-prone corridor is part of the river, and the importance of the floodplain only becomes evident on rare, but extreme occasions.

The natural floodplain along the West Branch Delaware, in some locations, has been built upon and in other locations has been filled. In certain instances, an existing floodplain can be altered through reclamation, creation, or enhancement, to increase flood conveyance capacity. Floodplain *reclamation* can be accomplished by excavating previously filled areas, removing berms or obstructions from the floodplain, or removal of structures. Floodplain *creation* can be accomplished by excavating land to create new floodplain where there is none today. Finally, floodplain *enhancement* can be accomplished by excavating within the existing floodplain adjacent to the river to increase flood flow conveyance. These excavated areas are sometimes referred to as floodplain benches.

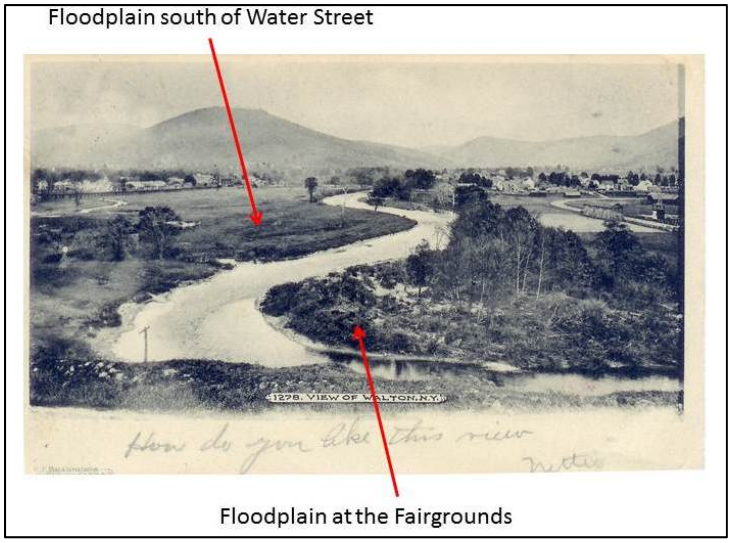
Figure 4-1 shows a typical cross section of compound channel with excavated floodplain benches on both banks. The graphic shows flood benches on both banks; however, flood benches can occur on either or both banks of a river.

FIGURE 4-1
Typical Cross Section of a Compound Channel



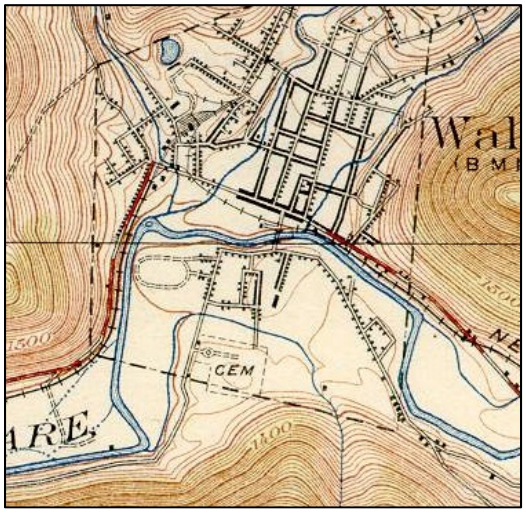
The Walton Flood Commission has provided evidence that filling of floodplains has occurred along the West Branch Delaware River. For example, in the graphic depicted below, a view to the east shows that floodplains south of present-day Water Street and at the fairgrounds property were once lower than they are now, and were undeveloped.

FIGURE 4-2
Historical View of Walton



When considering areas for floodplain reclamation, enhancement, or creation, it may make sense to target areas that were formerly providing better floodplain functions such as these depicted above.

A review of historical topographic mapping is also beneficial in providing clues about prior floodplain conditions. For example, the topographic map from 1925 (pictured to the right) depicts a railroad track between the river and Delaware Street. This track may have been built at a higher grade, cutting of some parts of the floodplain from the river while possibly providing limited flood protection to properties on the north side of the track along Delaware Street. This railroad grade is now absent.



4.4 Individual Property Flood Mitigation

A variety of measures are available to protect existing public and private properties from flood damage. While broader mitigation efforts are desirable such as those described above, they often take time and significant funding to implement. On a case-by-case basis, individual floodproofing should be explored where structures are at risk. Potential measures for property protection include the following:

Elevation of the structure. Home elevation involves the removal of the building structure from the basement and elevating it on piers to a height such that the first floor is located above the level of the 100-year flood event. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the new elevated first-floor level.

Dry floodproofing of the structure to keep floodwaters from entering. Dry floodproofing refers to the act of making areas below the flood level watertight. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents would be either permanently closed or covered with removable shields. Flood protection should extend only 2 to 3 feet above the top of the concrete foundation because building walls and floors cannot withstand the pressure of deeper water. Dry floodproofing is not appropriate for residential structures but is permissible for non-residential structures.

Wet floodproofing of the structure to allow floodwaters to pass through the lower area of the structure unimpeded. Wet floodproofing refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures. Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 100-year flood elevation. Wet floodproofing is not appropriate for residential structures unless accomplished by elevating the structure as described above, but is permissible for non-residential structures.

Construction of property improvements such as barriers, floodwalls, and earthen berms. Such structural projects can sometimes be used to prevent flooding. There may be properties within the town where implementation of such measures will serve to protect structures. For example, the Third Brook Watershed Management Plan discusses the merits of constructing a flood wall on the Kraft property to protect the building and some of the exterior assets from flooding.

Performing other home improvements to mitigate damage from flooding. The following measures can be undertaken to protect home utilities and belongings:

- ❑ Relocate valuable belongings above the 100-year flood elevation to reduce the amount of damage caused during a flood event.
- ❑ Elevate the electrical box or relocate it to a higher floor and elevate electric outlets to at least 12 inches above the high water mark.
- ❑ Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the high water mark (if the ceiling permits). A wooden platform of pressure-treated wood can serve as the base.
- ❑ Anchor a fuel tank to the wall or floor with noncorrosive metal strapping and lag bolts.
- ❑ Install a backflow valve to prevent sewer backup into the home.
- ❑ Install a floating floor drain plug at the lowest point of the lowest finished floor.

Encouraging property owners to purchase flood insurance under the National Flood Insurance Program (NFIP) and to make claims when damage occurs. While having flood insurance will not prevent flood damage, it will help a family or business put things back in order following a flood event. Property owners should be encouraged to submit claims under the NFIP whenever flooding damage occurs in order to increase the eligibility of the property for projects under the various mitigation grant programs.

4.5 Overview of Alternatives Analysis

Various alternatives have been evaluated to understand the potential for flood mitigation. These are presented in the sections that follow. **The evaluation commenced with two main alternatives identified by the Walton Flood Commission:**

1. Replacement of the Bridge Street bridge or installation of flood relief culverts in the earthen approaches to the bridge; and
2. Re-grading (lowering) the village, town, and county-owned land south of Water Street to enhance its floodplain functions.

The primary objective identified by the Walton Flood Commission was to develop a set of flood mitigation alternatives that would prevent floodwaters from entering Delaware Street near Breakey Motors and keep it off the street, providing flood risk reduction to the majority of the businesses located in the downtown area. Secondary objectives were to:

- ❑ Reduce flooding at key sites such as the fairgrounds and Kraft;
- ❑ Reduce flooding at residences along streets running north from Delaware Street;
- ❑ Create pathways for floodwaters to return to the river channel after flooding Delaware Street;
- ❑ Shift the floodway boundary further to the south (riverward) in the downtown area; and
- ❑ Reduce flood insurance premiums for all property owners in the SFHA through the Letter of Map Revision (LOMR) or Physical Map Revision (PMR) process subsequent to flood mitigation projects. These reductions could occur if a property is mapped outside the new SFHA or if it remains in the SFHA but is rated with a lower BFE.

4.6 Individual Hydraulic Alternatives

Over the course of the LFA, preliminary alternatives 1 and 2 (above) were modified and adjusted to maximize the reduction of flood water surface elevations. In addition, other alternatives were envisioned and subsequently evaluated. A total of five types of hydraulic alternatives were evaluated, each with several variations and/or subsets. These are described below.

4.6.1 Alternative # 1 – Bridge Street Bridge (STA 2183+00 to STA 2186+00)

The current bridge over the river is 220 feet long with two piers. MMI modeled the following options related to the bridge:

- Existing bridge
- No bridge (representing a longer, higher bridge that would not cause hydraulic effects)
- No bridge and remove adjacent fill
- Remove gravel bar beneath the bridge
- Relief culverts in bridge approaches
- New Bridge (modeled only in combination with other alternatives)

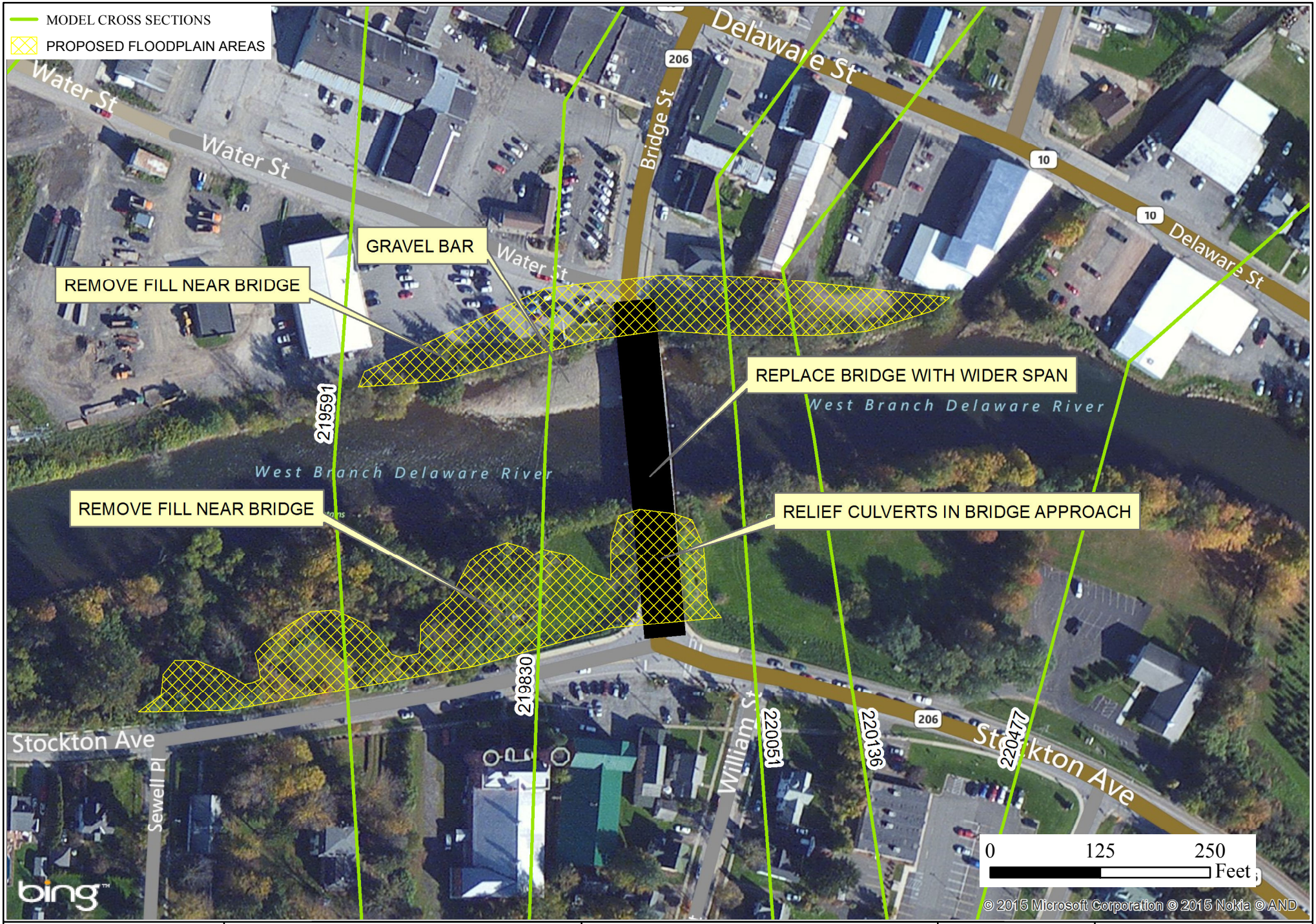
Tables 4-1 and 4-2 provide water surface elevations at cross sections upstream and downstream of the bridge. Figure 4-3 depicts the Bridge Street alternatives.

TABLE 4-1
Comparison of Water Surface Elevations Downstream of Bridge (100-Year) [feet NAVD88]

Alternative Description	218795 (end of Water St)	219011 (DPW)	219591 (Dollar General)	219830 (DS side of bridge)
Existing bridge	1209.5	1209.7	1210.1	1210.8
No bridge	1209.5	1209.7	1210.1	1210.8
No bridge and remove adjacent fill	1209.5	1209.7	1210.2	1210.9
Remove gravel bar beneath the bridge	1209.5	1209.7	1210.1	1211.0
Relief culverts in bridge	1209.5	1209.7	1210.1	1211.2

TABLE 4-2
Comparison of Water Surface Elevations Upstream of Bridge (100-Year) [feet NAVD88]

Alternative Description	220051 (US side of bridge)	220136 (Ford)	220477 (Breakey Motors)	221136 (High/ Griswold)	221807 (US of High)
Existing bridge	1211.6	1211.7	1211.2	1214.3	1214.6
No bridge	1211.2	1211.0	1210.8	1214.3	1214.6
No bridge and remove adjacent fill	1211.1	1210.9	1210.8	1214.3	1214.6
Remove gravel bar beneath the bridge	1211.6	1211.7	1211.3	1214.3	1214.6
Relief culverts in bridge	1211.8	1211.7	1211.3	1214.3	1214.6



SOURCE(S): BING MMI HECRAS	N MXD: Y:\5197-02\Maps\Report Figures\4-3-Alts-Bridge.mxd	**Figure 4-3: BRIDGE STREET BRIDGE ALTERNATIVES** **LOCAL FLOOD ANALYSIS** **WEST BRANCH DELAWARE RIVER** **LOCATION: WALTON, DELAWARE COUNTY, NY**	**Map By:** JCL **MMI#:** 5197-02 **Original:** 4/2/2015 **Revision:** **Scale:** 1 in = 141 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com

Modeling demonstrated the following:

- The existing bridge raises surface water elevations upstream of the crossing.
- The effect of removing the bridge (representing a longer, higher bridge that would not cause hydraulic effects) is to reduce flood water surface elevations upstream of the bridge by a maximum of 0.7 feet.
- Removing the bridge and adjacent fill reduces water surface elevations and velocities in the vicinity of the bridge slightly more than improvements to the bridge alone.
- Removing the gravel bar beneath the bridge provides no reduction in flooding.
- Installing the relief culverts slightly increases water surface elevations because the higher conveyance area reduces water velocity.

The old Ford building is an example of a property on Delaware Street that benefits most from bridge replacement. The water surface elevation was reduced 0.4 feet for the 10-year flood and 0.7 feet for the 100-year flood.

Given the results, a bridge replacement was advanced for consideration in combination with other alternatives. It was theorized that a bridge replacement could yield higher flood reduction results when in combination with alternatives that reduce the downstream backwater effects that can interact with the bridge opening.

4.6.2 Alternative #2 – Floodplain Enhancement South of Water Street (STA 2184+00 to STA 2190+00)

Floodplain enhancement was explored along the West Branch Delaware River on the right bank floodplain, just upstream of the confluence with the West Brook. Observances indicate that this land was filled over time to reduce the hydraulic connection to the river. This location is constricted by the naturally high land across the river. The Village of Walton owns 17 acres adjacent to the river at the confluence that has been explored for floodplain enhancement. A public water supply well is located at the west end of this property, but the well and the 200 foot buffer area would not be disturbed.

Multiple variations of this alternative were explored using incrementally larger floodplain areas. These include expanding to the publicly owned land South of Water Street (including the highway garages), the entire area South of Water Street (including Dollar General), and the entire area behind the buildings that front onto Delaware Street (including multiple commercial buildings). This alternative would not affect the function or usage of Water Street as a street for the first three alternatives, until it is expanded to the largest floodplain area that extends to the back of the buildings that front onto Delaware Street, and then Water Street would be lowered or removed. The alternative includes removing all buildings and lowering the property to match the 1.5-year modeled water surface elevation.

Figure 4-4 depicts the Water Street alternatives. Table 4-3 summarizes characteristics of the alternatives. Tables 4-4 and 4-5 provide water surface elevations at cross sections upstream and downstream of the bridge.

TABLE 4-3
Comparison of Floodplain Creation/Enhancement Options

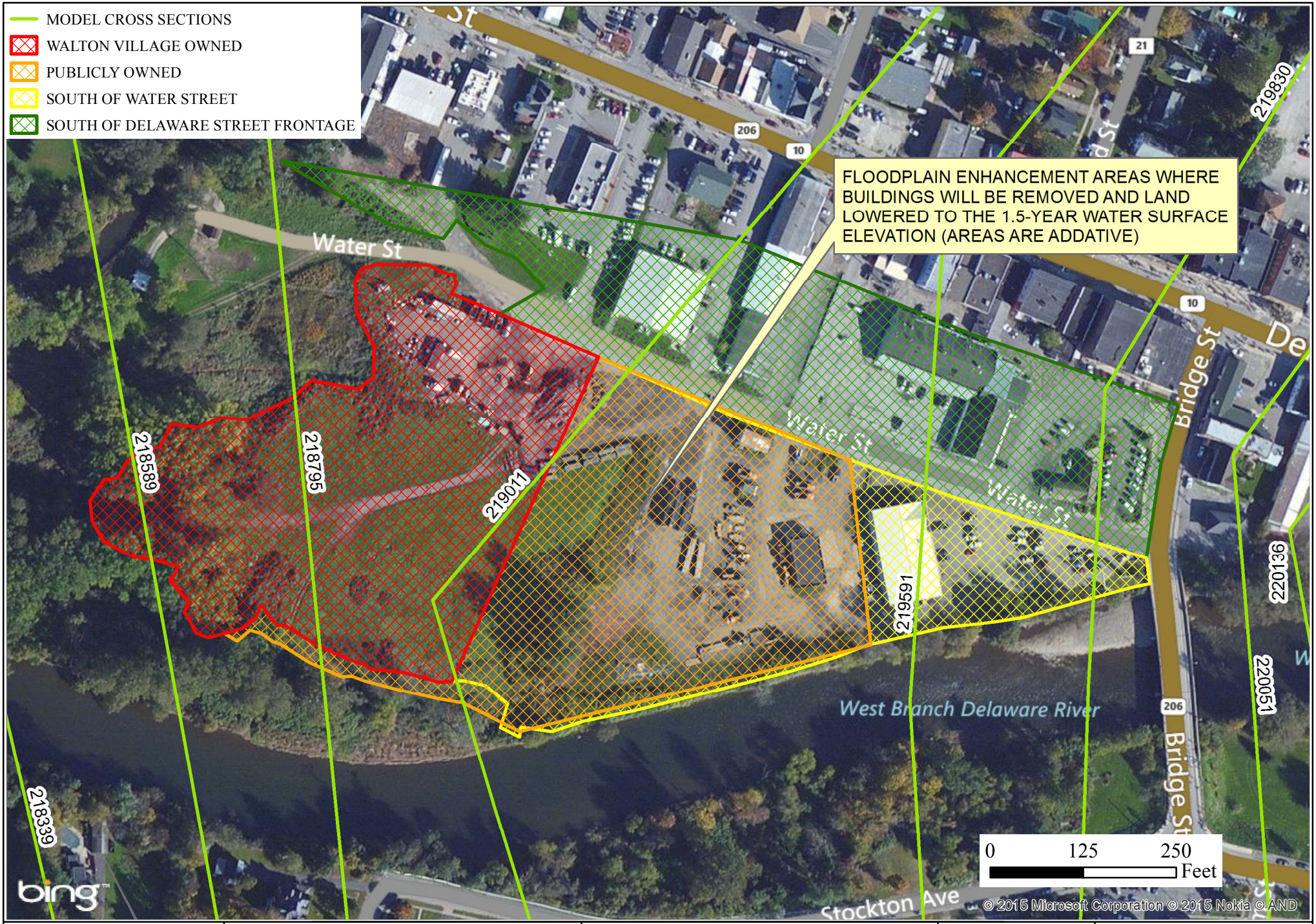
Alternative Description	Downstream Station	Upstream Station	New Floodplain Area (acres)	Length of River Bank (ft)
Walton Village Owned 17 acres	2184+00	2190+00	4.9	600
Publicly Owned Land South of Water Street	2184+00	2195+75	9.1	1175
South of Water Street	2184+00	2199+50	10.2	1550
South of Delaware Street Frontage	2184+00	2199+50	14.9	1550

TABLE 4-4
Comparison of Water Surface Elevations Adjacent to the Floodplains (100-Year) [feet NAVD88]

Alternative Description	218589 (near well)	218795 (end of Water St)	219011 (DPW)	219591 (Dollar General)	219830 (DS side of bridge)
Existing Conditions	1209.0	1209.5	1209.7	1210.1	1210.8
Walton Village Owned 17 acres	1209.1	1209.5	1209.6	1209.7	1210.6
Publicly Owned Land South of Water Street	1209.1	1209.4	1209.7	1209.4	1210.4
South of Water Street	1209.1	1209.5	1209.7	1209.7	1210.0
South of Delaware Street Frontage	1209.1	1209.5	1209.7	1209.8	1210.0

TABLE 4-5
Comparison of Water Surface Elevations Upstream of the Floodplains (100-Year)
[feet NAVD88]

Alternative Description	220051 (US side of bridge)	220136 (Ford)	220477 (Breakey Motors)	221136 (High/ Griswold)	221807 (US of High)
Existing bridge	1211.6	1211.7	1211.2	1214.3	1214.6
Walton Village Owned 17 acres	1211.3	1211.4	1210.9	1214.3	1214.6
Publicly Owned Land South of Water Street	1211.2	1211.3	1210.8	1214.3	1214.6
South of Water Street	1210.8	1210.9	1210.8	1214.3	1214.6
South of Delaware Street Frontage	1210.6	1210.7	1210.8	1214.3	1214.6



SOURCE(S):

BING
MMI HECRAS

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MXD: Y:\5197-02\Maps\Report Figures\4-4-Alts-WATER-ST-FP.mxd

Figure 4-4: WATER STREET FLOODPLAIN ALTERNATIVES

LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 4/2/2015
Revision:
Scale: 1 in = 167 ft

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Modeling demonstrated the following:

- The existing fill in the floodplain is at a higher elevation than the 100-year water surface elevation. That means that under existing conditions there are no floodplain benefits adjacent to the river for any flood with a magnitude lower than the 500-year flood.
- The existing fill in the floodplain is higher than Delaware Street and the areas beyond. This means that flood water can be trapped on Delaware Street and not have a path back to the river, therefore functioning as a levee.
- The effect of all versions of the floodplain enhancement lowers water surface elevations between Dollar General and Breakey Motors.
- Modeling confirms that as the floodplain enhancement area grows larger, the flood reduction benefits also grow larger.
- A secondary benefit to floodplain creation is to allow flood waters on Delaware Street to have a more direct path back to the river, alleviating the levee-like effect of the existing fill.

Dollar General is an example of a property that benefits most from the floodplain creation on publicly owned land. The water surface elevation was reduced 0.4 feet for the 10-year flood and 0.7 feet for the 100-year flood.

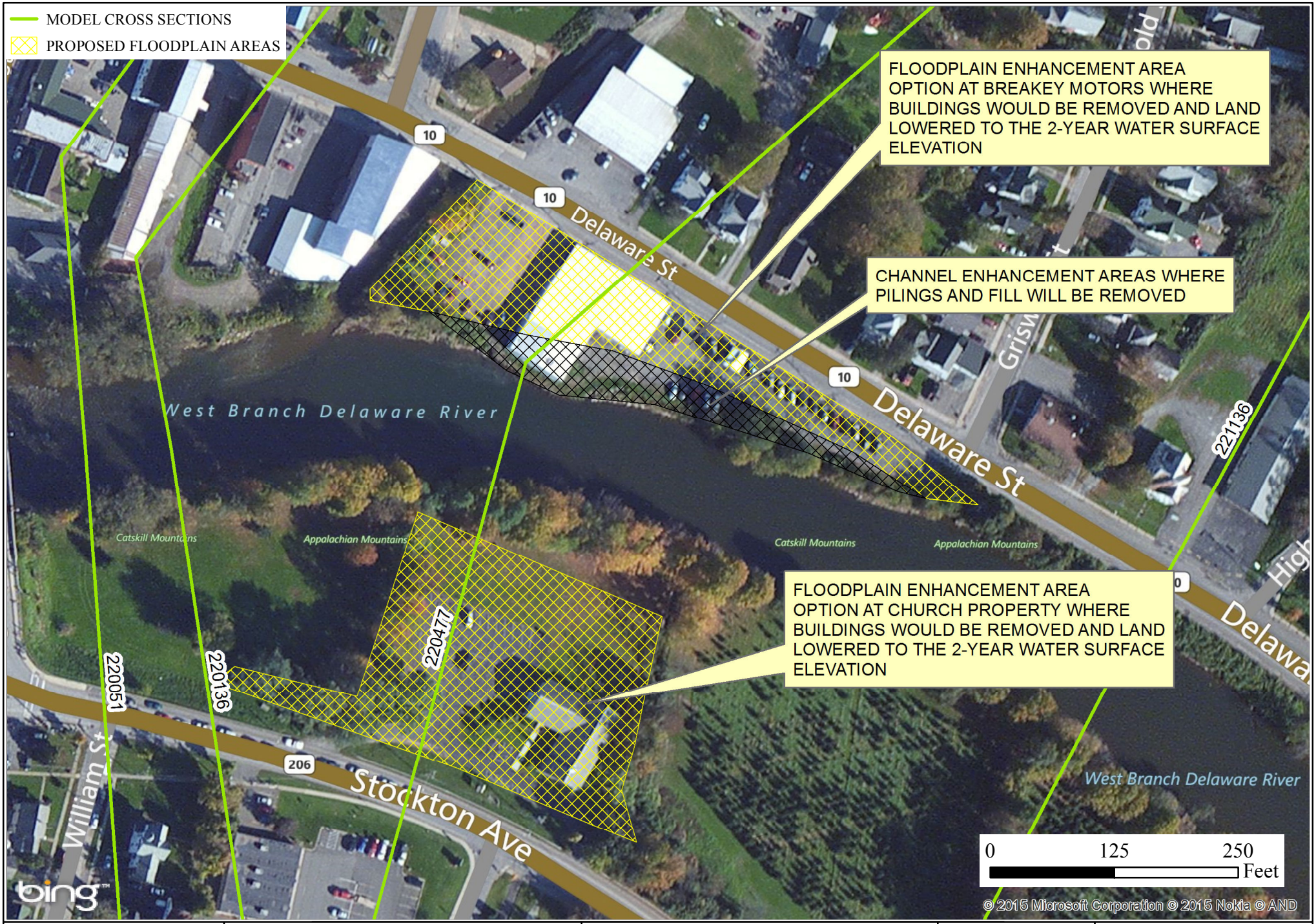
Properties at the southeast corner of Bridge Street and Delaware Street benefit the most from the floodplain creation South of Water Street. The water surface elevation was reduced 0.5 feet for the 10-year flood and 0.8 feet for the 100-year flood.

The variations of floodplain alternatives in the area near Water Street were vetted and the initial path forward was to proceed with floodplain enhancement on the publicly owned land south of Water Street in the short term and all land south of Water Street in the long term. This will provide ample time to work with private property owners that hold land south of Water Street.

4.6.3 Alternative # 3 – Channel and Floodplain Enhancement at Breakey Motors (STA 2203+50 to STA 2209+50)

Just upstream of the confluence with the East Brook, the channel of the West Branch Delaware River is constricted with a narrow available active channel width and low floodplain width. The Breakey Motors property is located on the right bank of the river and a church is located on the left bank. Observations indicate that the Breakey Motors property was filled over time both vertically and horizontally into the river channel. Alternatives that remove the floodplain constriction on both sides of the river were explored, but channel bank modification was explored only on the Breakey Motors side.

Figure 4-5 depicts the alternatives near and across from Breakey Motors. Table 4-6 provides water surface elevations at cross sections near Breakey Motors and upstream.



SOURCE(S): BING MMI HECRAS	N MXD: Y:\5197-02\Maps\Report Figures\4-5-Alts-BREAKYMOTORS-FP.mxd	**Figure 4-5: BREAKEY MOTORS ALTERNATIVES** **LOCAL FLOOD ANALYSIS** **WEST BRANCH DELAWARE RIVER** **LOCATION: WALTON, DELAWARE COUNTY, NY**	**Map By:** JCL **MMI#:** 5197-02 **Original:** 4/2/2015 **Revision:** **Scale:** 1 in = 125 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com

TABLE 4-6
Comparison of Water Surface Elevations Upstream of Bridge (100-Year) [feet NAVD88]

Alternative Description	220136 (Ford)	220477 (Breakey Motors)	221136 (High/ Griswold)	221807 (US of High)	222664 (US of Village)
Existing Conditions	1211.7	1211.2	1214.3	1214.6	1216.3
Breakey Motors Property	1211.7	1212.1	1213.0	1213.5	1215.8
Church Property	1211.7	1212.3	1212.9	1213.5	1215.7
Breakey Motors + Church Properties	1211.7	1212.5	1212.9	1213.4	1215.7

Modeling demonstrated the following:

West Branch Collision and Classics at 60 Delaware Street is an example of a property between High and Griswold Streets that benefits most from bridge replacement. The water surface elevation was reduced 1.1 feet for the 10-year flood and 1.2 feet for the 100-year flood.

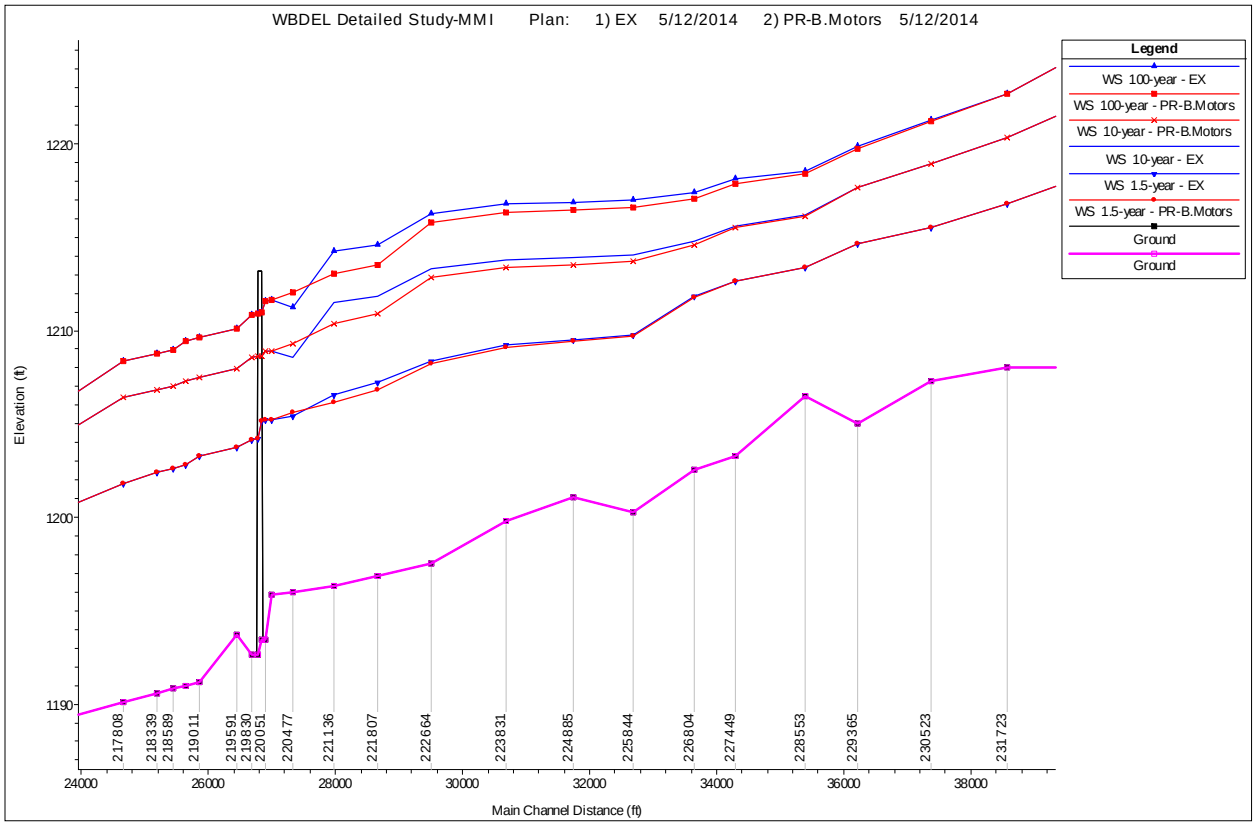
- The existing channel constriction at this location raises water surface elevations upstream but causes a dip in the water surface profile due to locally very high velocity. This hydraulic effect complicates the comparison of existing conditions and future conditions at cross section 220477.
- The combination of three actions on the Breakey Motors property was found to lower flood water surfaces: removing the Breakey Motors commercial building, lowering the property to match the 2-year modeled water surface elevation, and widening the channel to match the upstream and downstream active channel width. The Breakey Motors facility may be relocated to a site near the Subway restaurant outside the SFHA.
- The addition of floodplain enhancement at the church property across the river provided negligible incremental benefits to water surface elevations and was therefore not advanced further.
- The velocity at cross section 220477 was reduced to be consistent with upstream and downstream sections.
- Model results indicate that this alternative reduces water surface elevations approximately one foot along Delaware Street where floodwaters typically first leave the channel and travel down the road (at a location immediately upstream of Breakey Motors).

This alternative involving the Breakey Motors property was vetted and advanced for consideration in combination with several other aspects of the alternative:

- ❑ The modeled flood bench occurs on the right bank for 600 feet from STA 2203+50 to STA 2209+50 and would include excavation of fill approximately 2.5 feet deep across the property.
- ❑ The channel widening occurs on the right bank for 510 feet from STA 2204+00 to STA 2209+10 to match the adjacent natural channel widths.
- ❑ The channel widening would also include removal of approximately 125 feet of existing sheet piles that are currently constricting the river width.
- ❑ This alternative would remove approximately 10,000 CY of fill and create a compound channel at the site.
- ❑ The existing commercial structure at approximately 2205+00 would be removed from the right bank.

Figure 4-6 depicts the water surface profiles resulting from this alternative. The blue lines represent existing conditions and the red lines represent the future conditions if the above bullets were completed together.

FIGURE 4-6
Breakey Motors HEC-RAS Results Profile



4.6.4 Alternative # 4 – Floodplain Creation – Removal of Constriction between 239 Delaware Street and 15 More Avenue (STA 2179+00 to STA 2186+00)

Near the confluence of West Brook, the floodplain of the West Branch Delaware River is narrower than it is upstream or downstream. It was theorized that this narrow location in the floodplain could be constricting the flow and increasing upstream flooding. Floodplain creation was explored on properties on both sides of the river to see if lowering the land to create additional floodplain would reduce upstream flooding. Properties identified on both sides of the river that could provide additional flood capacity if lowered included #15 More Avenue (STA 2183+00 to STA 2186+00 on the left bank) and #239 Delaware Avenue (STA 2179+00 to STA 2183+00 on the right bank).

Figure 4-7 depicts the locations of the grading at 15 More Avenue and 239 Delaware Street. Table 4-7 provides water surface elevations at upstream cross sections.

TABLE 4-7
Comparison of Water Surface Elevations Upstream of the Floodplains (100-Year)
[feet NAVD88]

Alternative Description	218589 (near well)	218795 (end of Water St)	219011 (DPW)	219591 (Dollar General)	219830 (DS side of bridge)
Existing Conditions	1209.0	1209.5	1209.7	1210.1	1210.8
#15 More Avenue floodplain creation	1208.8	1209.3	1209.5	1210.0	1210.8
#239 Delaware Street floodplain creation	1208.9	1209.4	1209.6	1210.1	1210.8

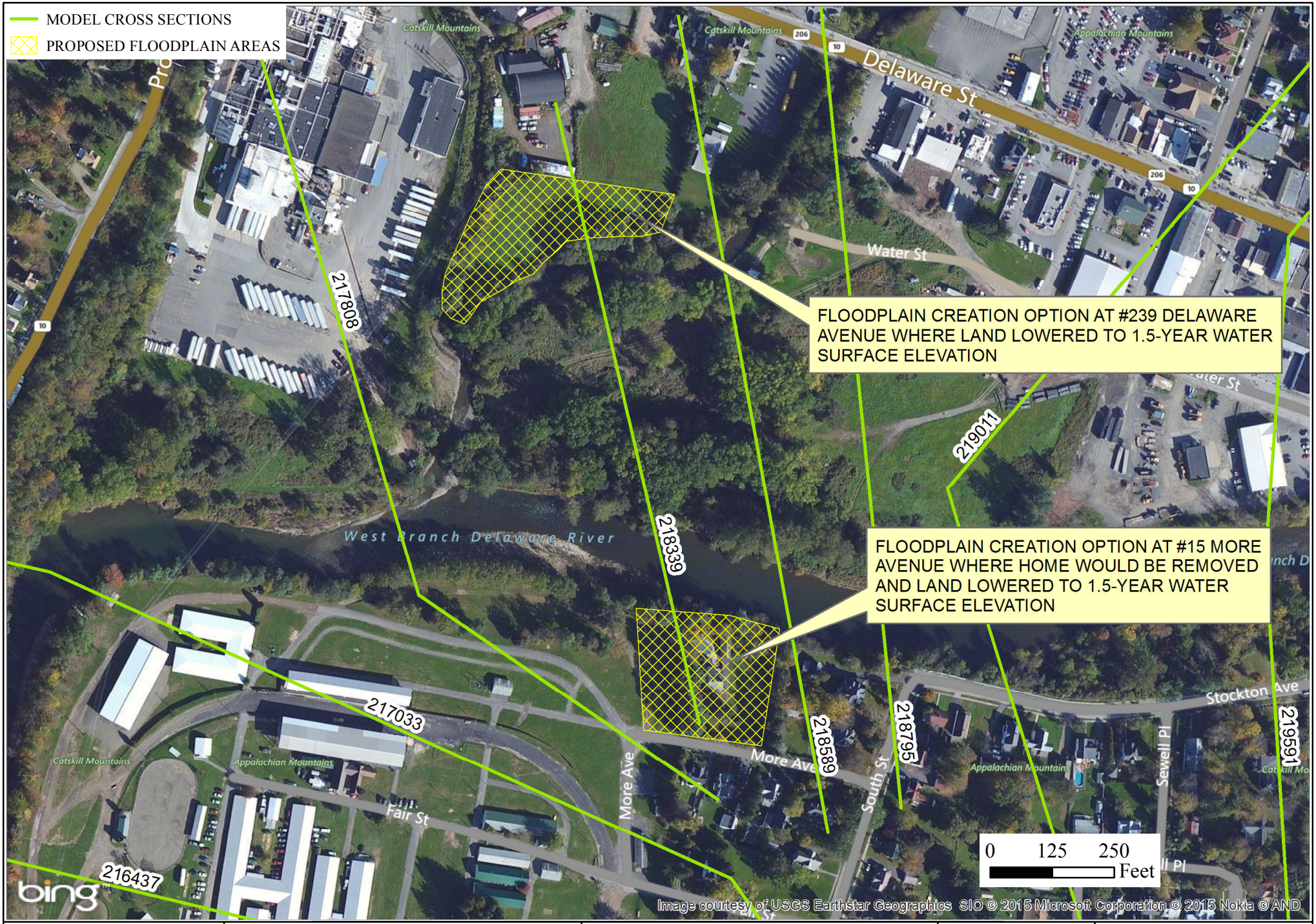
Modeling demonstrated the following:

- The floodplain option at 15 More Avenue appeared to create small flood reductions of 0.2 feet to 0.01 feet for the 100-year flood from the new floodplain area to the bridge.
- The floodplain option at 239 Delaware Avenue had negligible water surface elevation benefits.

The CVS Pharmacy is an example of a property on Delaware Street that benefits most from the floodplain creation. The water surface elevation was reduced 0.1 feet for the 10-year flood and 0.2 feet for the 100-year flood.

Initially it was believed that the #15 More Avenue floodplain option may produce incremental compounded benefits to water surface elevations when combined with other alternatives, but this was not the case. Neither option was pursued further[5].

[5] In the meeting notes and presentations, the alternatives that include removal of this constriction are designated with the letter "B" such as "Short Term B."



SOURCE(S): BING MMI HECRAS	N MXD: Y:\5197-02\Maps\Report Figures\4-7-Alts-CONSTRICTION.mxd	**Figure 4-7: CONSTRICTION ALTERNATIVES** **LOCAL FLOOD ANALYSIS** **WEST BRANCH DELAWARE RIVER** **LOCATION: WALTON, DELAWARE COUNTY, NY**	**Map By:** JCL **MMI#:** 5197-02 **Original:** 4/2/2015 **Revision:** **Scale:** 1 in = 250 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com

4.6.5 Alternative # 5 – Floodplain Enhancement at Fairgrounds (STA 2184+00 to STA 2190+00)



The Delaware County fairgrounds occupy a large section of the floodplain of the West Branch Delaware River. The fairground has been flooded many times. Refer to a picture of the 2006 flood to the right.

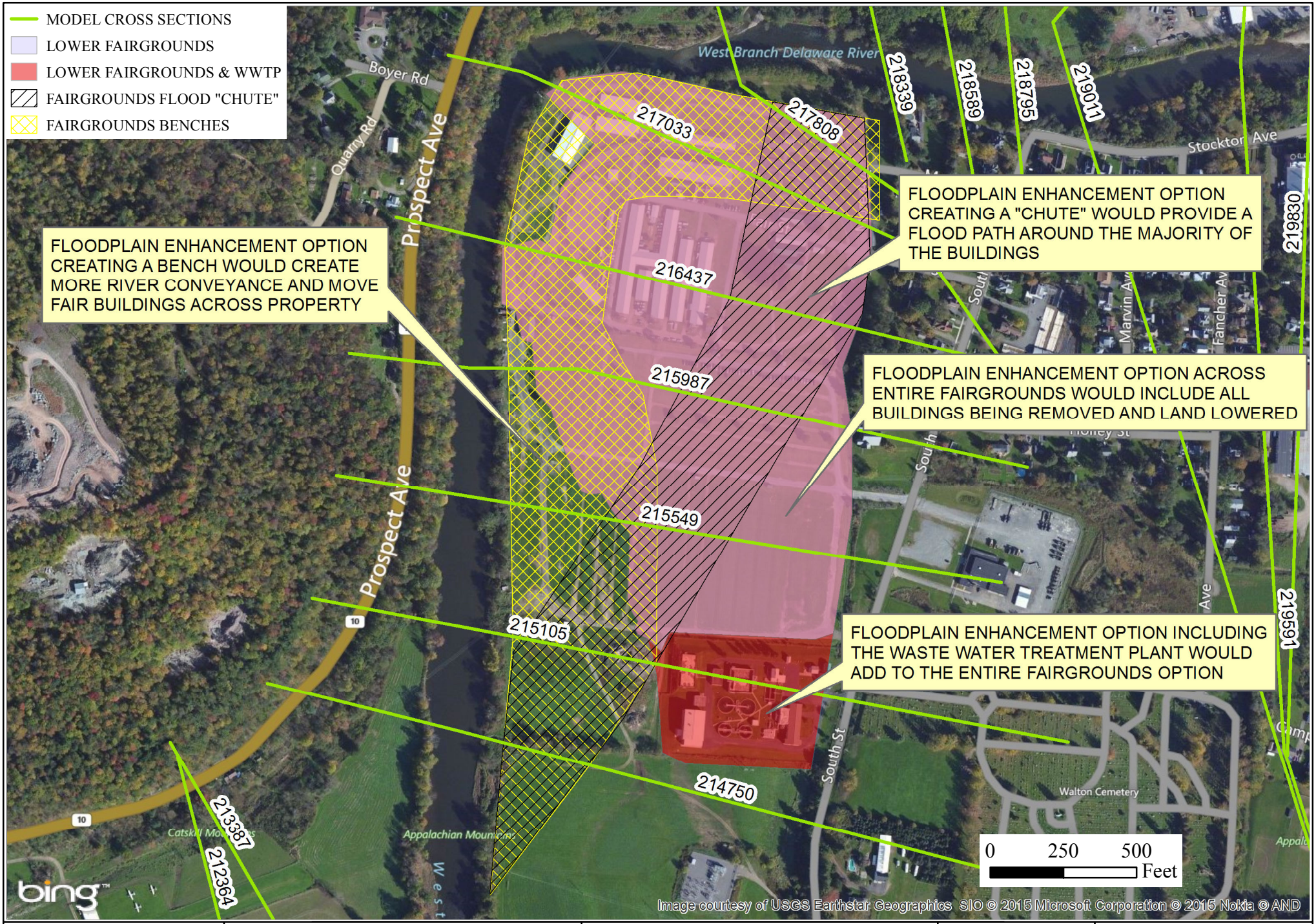
Although the damages incurred during the flood of 2006 seem moderate at approximately $32,000, a flood that interrupted the annual fair would be catastrophic to the local economy[6]. It is not feasible to remove all flood risk from the fairgrounds, and a flood occurring during the fair would shut down the event. However, it may be possible to re-configure the fairgrounds to achieve two things: (1) reduced flood water surface elevations upstream along Delaware Street, and (2) reduced recovery and cleanup time at the fairgrounds site. The second benefit is attractive because there may be instances that future floods occur only weeks or days prior to the fair.

MMI modeled the following options related to the fairgrounds:

- Fairgrounds existing conditions
- Lower the fairgrounds to 2-yr flood elevation and remove all buildings
- Lower the fairgrounds and the WWTP to 2-year flood elevation and remove all buildings
- Fairgrounds flood "chute" at 1.5-year flood elevation situated to the east of the buildings
- Fairgrounds floodplain benches along river at 1.5-year flood elevation and move some fair buildings away from the river on but remaining on the site

Figure 4-8 depicts the fairgrounds alternatives. Table 4-8 provides water surface elevations at the nearest upstream cross sections and Table 4-9 provides water surface elevations upstream along Delaware Street.

[6] According to the report Statewide Summary of Agricultural Fairs: Economic and Fiscal Impacts (2013, Camoin Associates), the Delaware County fair creates 123 jobs, sales of $5.7 million, and $251,466 in tax revenue.



SOURCE(S):

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Figure 4-8: FAIRGROUNDS ALTERNATIVES

LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 4/2/2015
Revision:
Scale: 1 in = 423 ft

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TABLE 4-8
Comparison of Water Surface Elevations at Fairgrounds (100-Year) [feet NAVD88]

Alternative Description	215105 (WWTP)	215549 (Fair Parking)	215987 (Fair Parking)	216437 (Fair "H" Buildings)	217033 (Fair Buildings)
Existing Conditions	1200.3	1202.3	1203.3	1204.5	1206.6
Lower Fairgrounds	1200.3	1202.3	1203.1	1203.8	1205.5
Lower Fairgrounds and WWTP	1200.3	1201.7	1202.8	1203.6	1205.5
Fairgrounds Flood "chute"	1200.2	1202.4	1203.2	1204.3	1205.9
Fairgrounds Benches and move buildings	1200.2	1202.1	1203.1	1204.0	1205.7

TABLE 4-9
Comparison of Water Surface Elevations along Delaware Street (100-Year) [feet NAVD88]

Alternative Description	217808 (Kraft)	218795 (end of Water St)	219011 (DPW)	219591 (Dollar General)	219830 (DS side of bridge)
Existing Conditions	1208.4	1209.5	1209.7	1210.1	1210.8
Lower Fairgrounds	1206.8	1208.4	1208.7	1209.5	1210.4
Lower Fairgrounds and WWTP	1206.8	1208.4	1208.7	1209.5	1210.4
Fairgrounds Flood "chute"	1207.2	1208.7	1209.0	1209.6	1210.5
Fairgrounds Benches and move buildings	1206.3	1208.0	1208.4	1209.3	1210.3

Modeling demonstrated the following:

- Some of the existing fairgrounds ground surface and buildings block a significant portion of the floodplain, raising flood water surface elevations upstream and causing a direct flood risk to the fair facilities.
- Each of the floodplain options reduce flooding at the fairgrounds and the Kraft Factory, and benefits extend through the Village upstream of the Bridge Street Bridge. The best alternative for the community will balance the needs of the community with the flood benefits.
- The Waste Water Treatment Plant building and fill downstream of the fairgrounds only locally increases water surface elevation in the fairgrounds parking area. Moving this facility out of the floodplain was not considered further.
- Flood benefits may be obtained while retaining the functions of the fairgrounds site by rearranging the location of the buildings and providing additional floodplain along the river.

The Kraft Factory is an example of a property that benefits most from the flood bench at the Fairgrounds. The water surface elevation was reduced 1.7 feet for the 10-year flood and 2.0 feet for the 100-year flood.

The variations of floodplain alternatives in the fairgrounds area were vetted and the long term vision for this area is to potentially rearrange the site to create low flood benches along the river and move the building farther from the river on the site. This alternative would provide flood reduction to the fairgrounds and Village while allowing the functions of the fairgrounds to continue.

4.7 Combinations of Hydraulic Alternatives

Alternatives were combined to determine the cumulative benefits of multiple actions. The individual alternatives described above were vetted through multiple public meetings including meetings of the Walton Flood Commission listed in Table 1-2. Individual alternatives were discussed and prioritized based on the perceived community support and ability to implement the alternatives. Not all of the intermediate combinations of alternatives presented at Walton Flood Commission meetings are described in this report, because many included minor variations of this final section of combined alternatives. Short-term and long-term combinations were identified by the Walton Flood Commission:

Short-Term

- ❑ Lower the floodplain south of Water Street on publicly owned lands
- ❑ Relocate Breakey Motors and restore the site to more natural floodplain conditions

Long-Term

- ❑ Extend the lowered floodplain south of Water Street through Dollar General to Bridge Street
- ❑ Replace bridge with a 380' span and two piers
- ❑ Additional floodplain work on the left bank related to bridge

These short and long term alternatives were tested in three scenarios including:

A. Just the above listed alternatives;
B. Combined with grading north of More Avenue; and
C. Combined with floodplain creation at the fairgrounds.

The "B" alternative including grading north of More Avenue was not found to have significant benefit beyond the short-term alternatives and this option was not advanced for implementation or carried through for inclusion in the long-term alternatives.

Figures 4-9 through 4-12 depict the A and C alternatives. Tables 4-10, 4-11, and 4-12 provide the water surface elevations at 15 cross sections extending from the wastewater treatment plant to upstream of High Street.

TABLE 4-10
Comparison of Water Surface Elevations at Fairgrounds (100-Year) [NAVD88]

Alternative Description	215105 (WWTP)	215549 (Fair Parking)	215987 (Fair Parking)	216437 (Fair "H" Buildings)	217033 (Fair Buildings)
Existing Conditions	1200.3	1202.3	1203.3	1204.5	1206.6
Short-Term A	1200.3	1202.3	1203.3	1204.5	1206.6
Short-Term C	1200.2	1202.1	1203.1	1204.0	1205.7
Long-Term A	1200.3	1202.3	1203.3	1204.5	1206.6
Long-Term C	1200.2	1202.1	1203.1	1204.0	1205.7

TABLE 4-11
Comparison of Water Surface Elevations in Village Downstream of Bridge (100-Year) [NAVD88]

Alternative Description	217808 (Kraft)	218795 (end of Water St)	219011 (DPW)	219591 (Dollar General)	219830 (DS side of bridge)
Existing Conditions	1208.4	1209.5	1209.7	1210.1	1210.8
Short-Term A	1208.4	1209.4	1209.6	1209.4	1210.4
Short-Term C	1206.3	1208.1	1208.4	1208.3	1209.9
Long-Term A	1208.4	1209.4	1209.6	1209.8	1210.1
Long-Term C	1206.3	1208.0	1208.4	1208.7	1209.2

TABLE 4-12
Comparison of Water Surface Elevations in Village Upstream of Bridge (100-Year) [NAVD88]

Alternative Description	220051 (US side of bridge)	220136 (Ford)	220477 (Breakey Motors)	221136 (High/ Griswold)	221807 (US of High)
Existing Conditions	1211.6	1211.7	1211.2	1214.3	1214.6
Short-Term A	1211.2	1211.3	1211.8	1212.9	1213.4
Short-Term C	1210.7	1210.8	1211.5	1212.7	1213.3
Long-Term A	1210.7	1210.6	1211.0	1212.5	1213.1
Long-Term C	1210.0	1209.9	1210.5	1212.3	1213.0



SOURCE(S):

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Figure 4-9: SHORT TERM A COMBINATION OF ALTERNATIVES

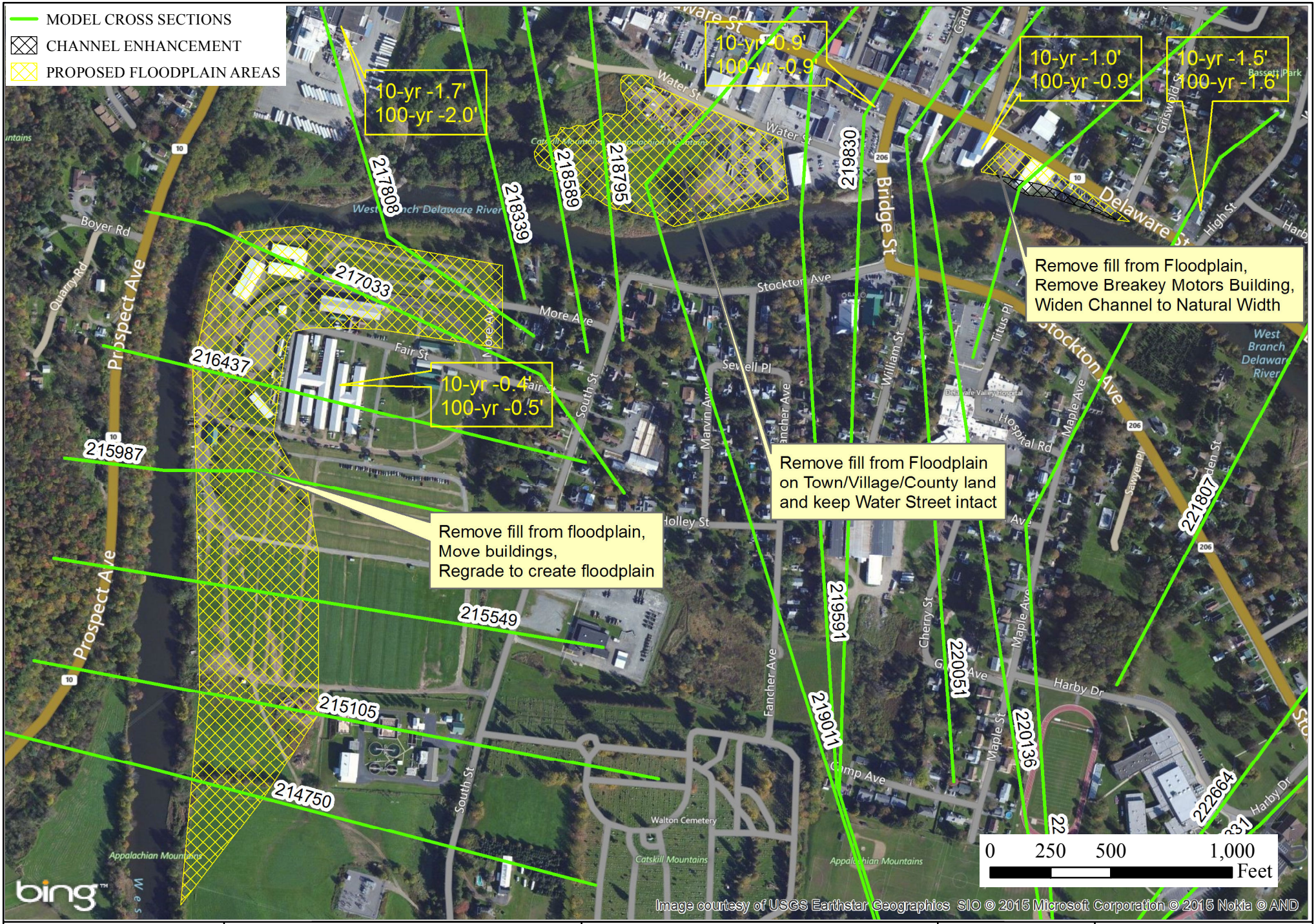
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LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By:	JCL
MMI#:	5197-02
Original:	4/2/2015
Revision:	
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Figure 4-10: SHORT TERM C COMBINATION OF ALTERNATIVES

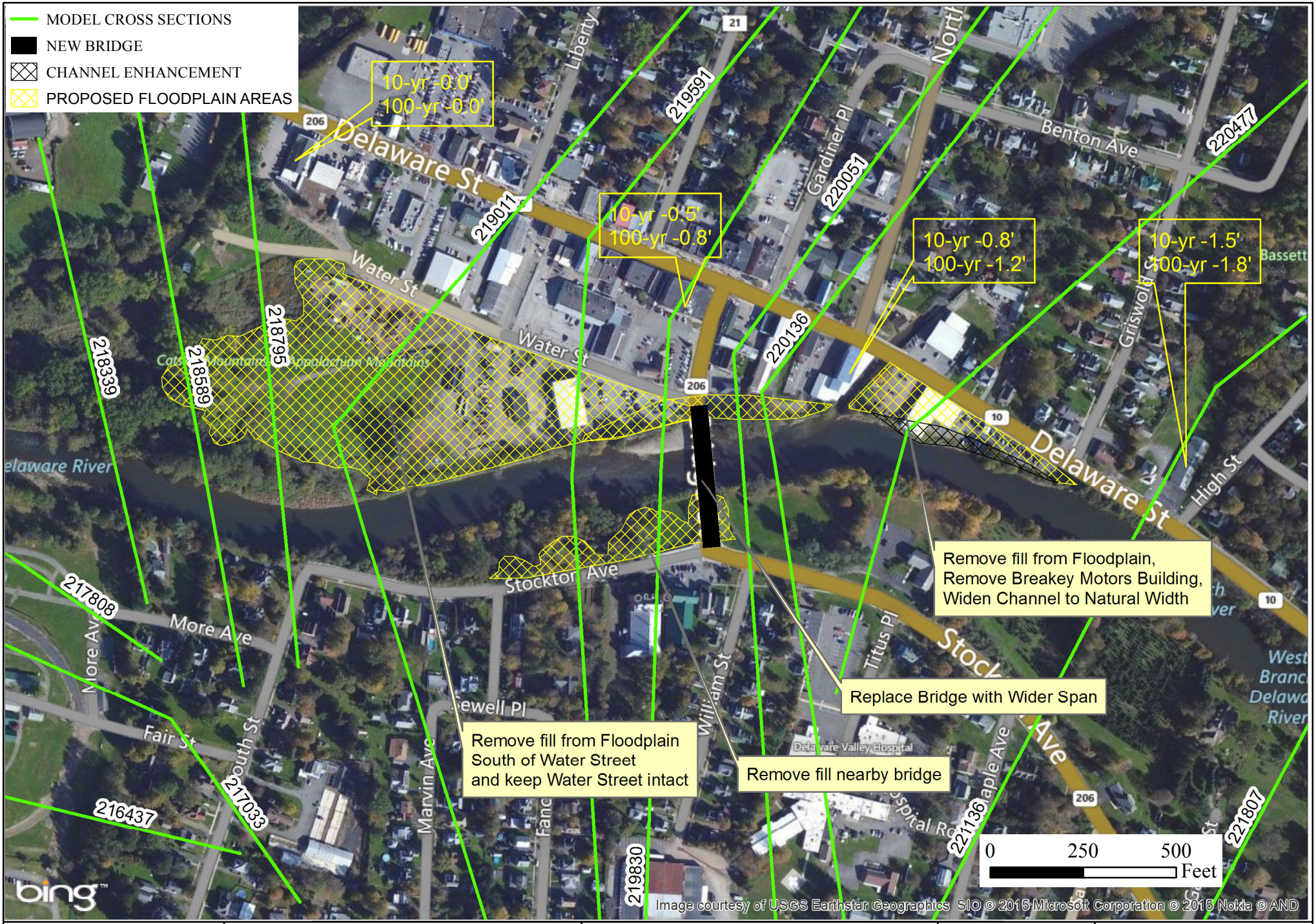
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LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 4/2/2015
Revision:
Scale: 1 in = 513 ft

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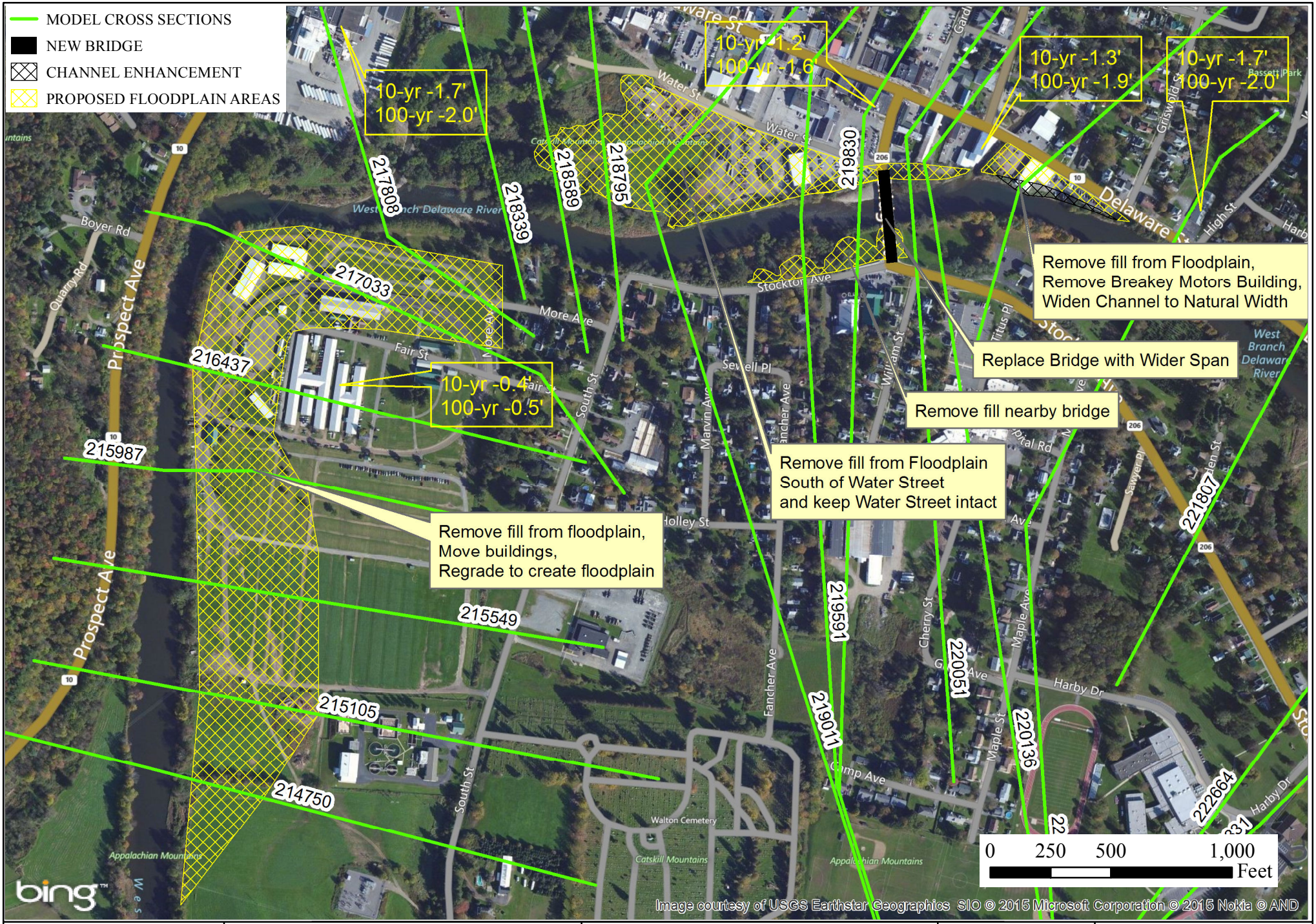
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Figure 4-11: LONG TERM A COMBINATION OF ALTERNATIVES

LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER
LOCATION: WALTON, DELAWARE COUNTY, NY

Map By:	JCL
MMI#:	5197-02
Original:	4/2/2015
Revision:	
Scale:	1 in = 333 ft

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SOURCE(S): BING MMI HECRAS	N **Figure 4-12: LONG TERM C COMBINATION OF ALTERNATIVES** MXD: Y:\5197-02\Maps\Report Figures\4-12-LongTermC.mxd	**LOCAL FLOOD ANALYSIS** **WEST BRANCH DELAWARE RIVER** **LOCATION: WALTON, DELAWARE COUNTY, NY**	**Map By:** JCL **MMI#:** 5197-02 **Original:** 4/2/2015 **Revision:** **Scale:** 1 in = 513 ft	MILONE & MACBROOM 99 Realty Drive Cheshire, CT 06410 (203) 271-1773 Fax: (203) 272-9733 www.miloneandmacbroom.com

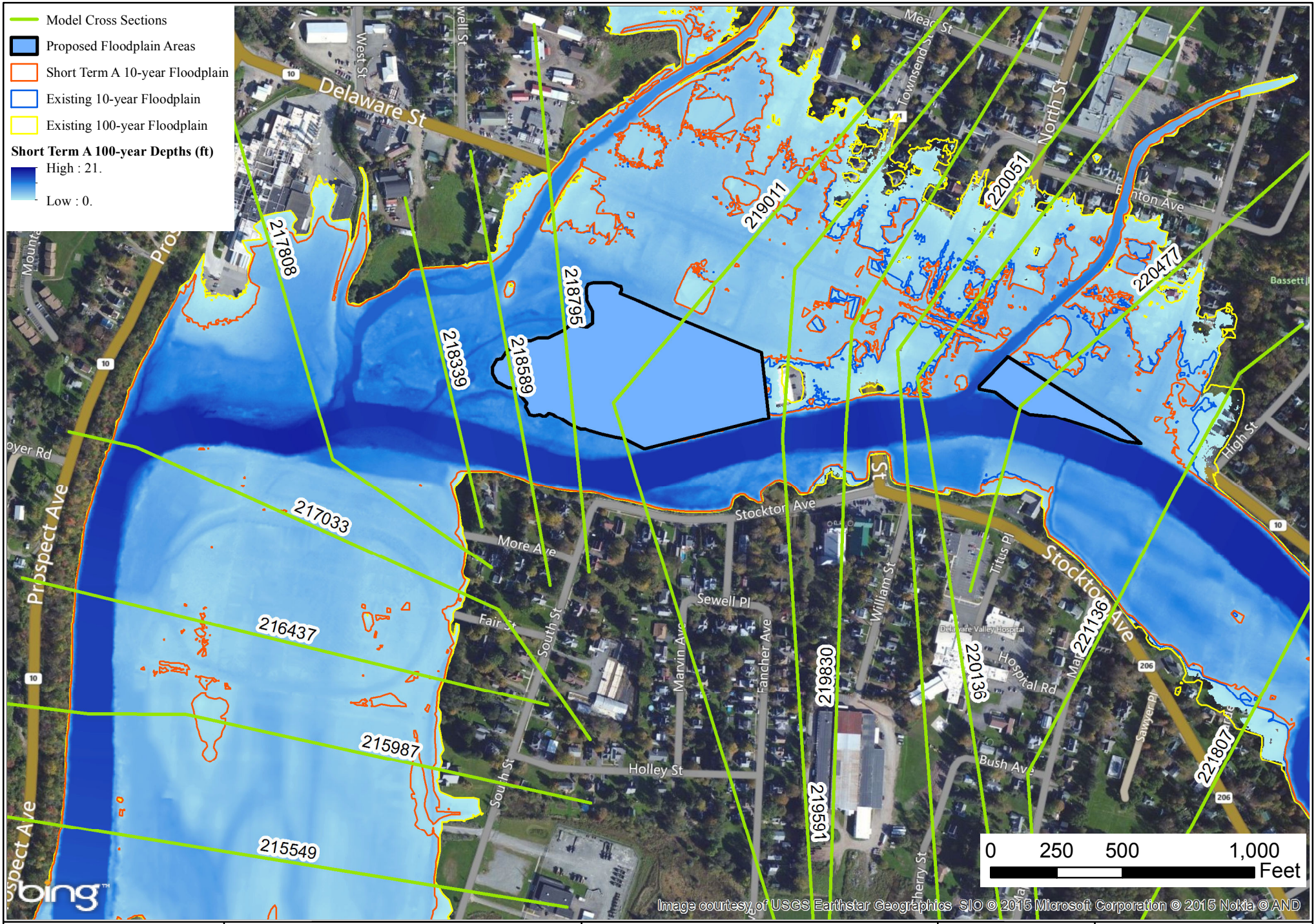
Modeling demonstrated the following:

- The breakdown of alternatives into short-term and long-term implementation shows the incremental benefits of constructing projects over time.
- The short term "A" results show a reduction of flood depths in the Village of 0.7 feet near Dollar General and 1.4 feet upstream where water first enters Delaware Street for the 100-year flood.
- Reduction of flooding at the Kraft factory occurs when downstream alternatives are implemented, such as the "C" alternatives that include floodplain enhancement at the Fairgrounds.
- Adding the fairgrounds alternative reduces backwater effects from the downstream area and allows water to more easily exit the Village. 100-year water surface reductions in the Village are on the order of 1.5 to 2.0 feet.
- Some of the alternatives cause very slight local water surface *increases* in locations where the water surface elevation was dipping under existing hydraulic conditions.

The apartment house at 64 Delaware Street is an example of a property on Delaware Street that benefits most from the Long-Term A combination. The water surface elevation was reduced 1.6 feet for the 10-year flood and 1.9 feet for the 100-year flood.

Kraft is an example of a property at the west end of Delaware Street that benefits most from the Long-Term C combination. The water surface elevation was reduced 1.7 feet for the 10-year flood and 2.0 feet for the 100-year flood. West Branch Collision is an example of a property at the east end of Delaware Street that benefits most from the Long-Term C combination. The water surface elevation was reduced 1.7 feet for the 10-year flood and 2.0 feet for the 100-year flood (similar to Kraft).

Floodplain delineations and water depth mapping (Figures 4-13 through 4-16) have been created for the combinations of alternatives to best represent the changes that are expected in both flood extent and depth. Existing Conditions mapping has been provided as a baseline for comparisons of the results of the alternatives. The extents of the Existing Conditions 10-year and 100-year floodplains are also included on each map to faciliatate comparison of results. Flood depths in the areas where floodplain enhancement and lowering are specified (hatched areas) will be deeper than depicted on maps.



SOURCE(S):

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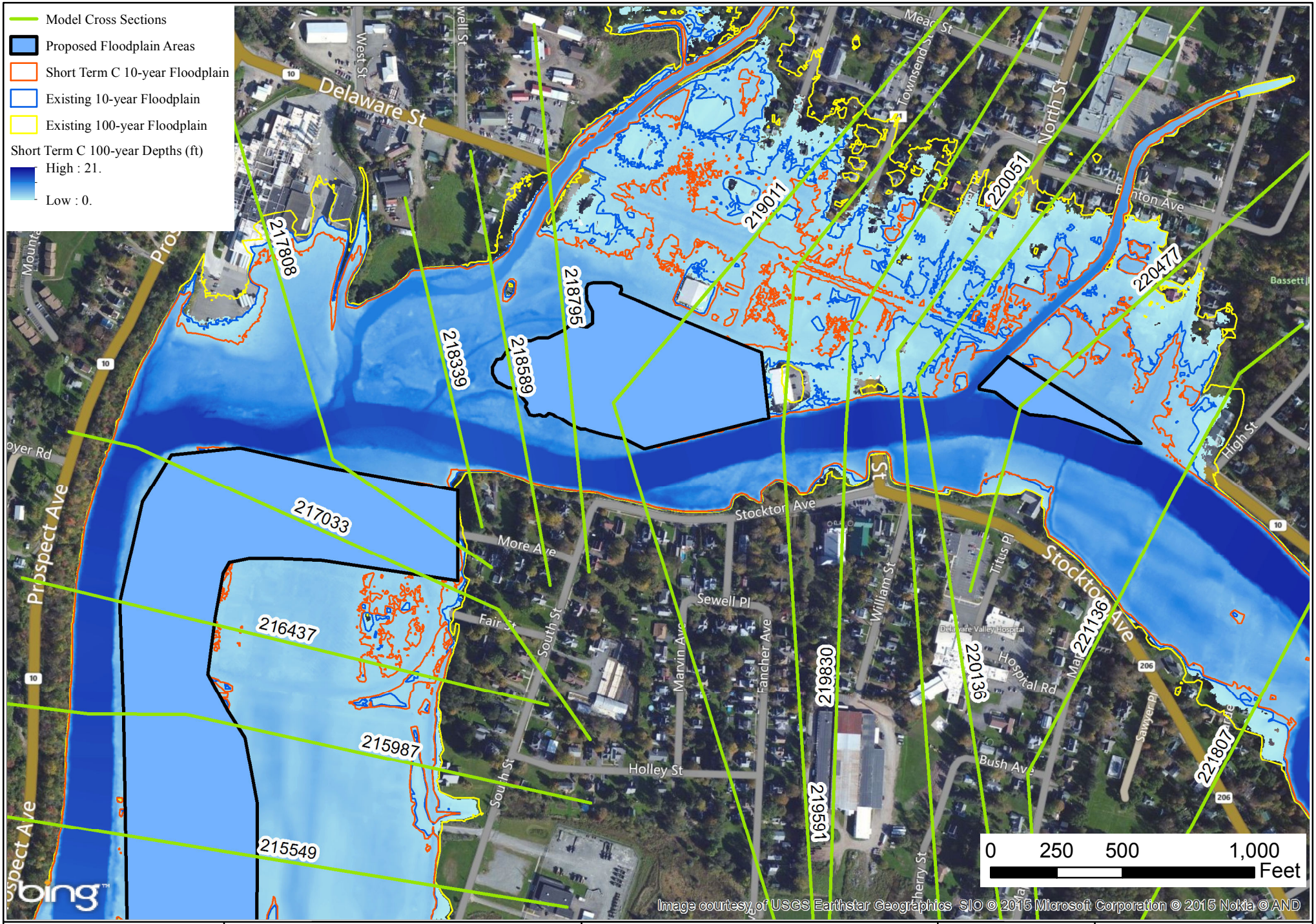
Figure 4-13: SHORT TERM A DEPTH MAPPING

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LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER
LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 1/14/2015
Revision:
Scale: 1 in = 470 ft

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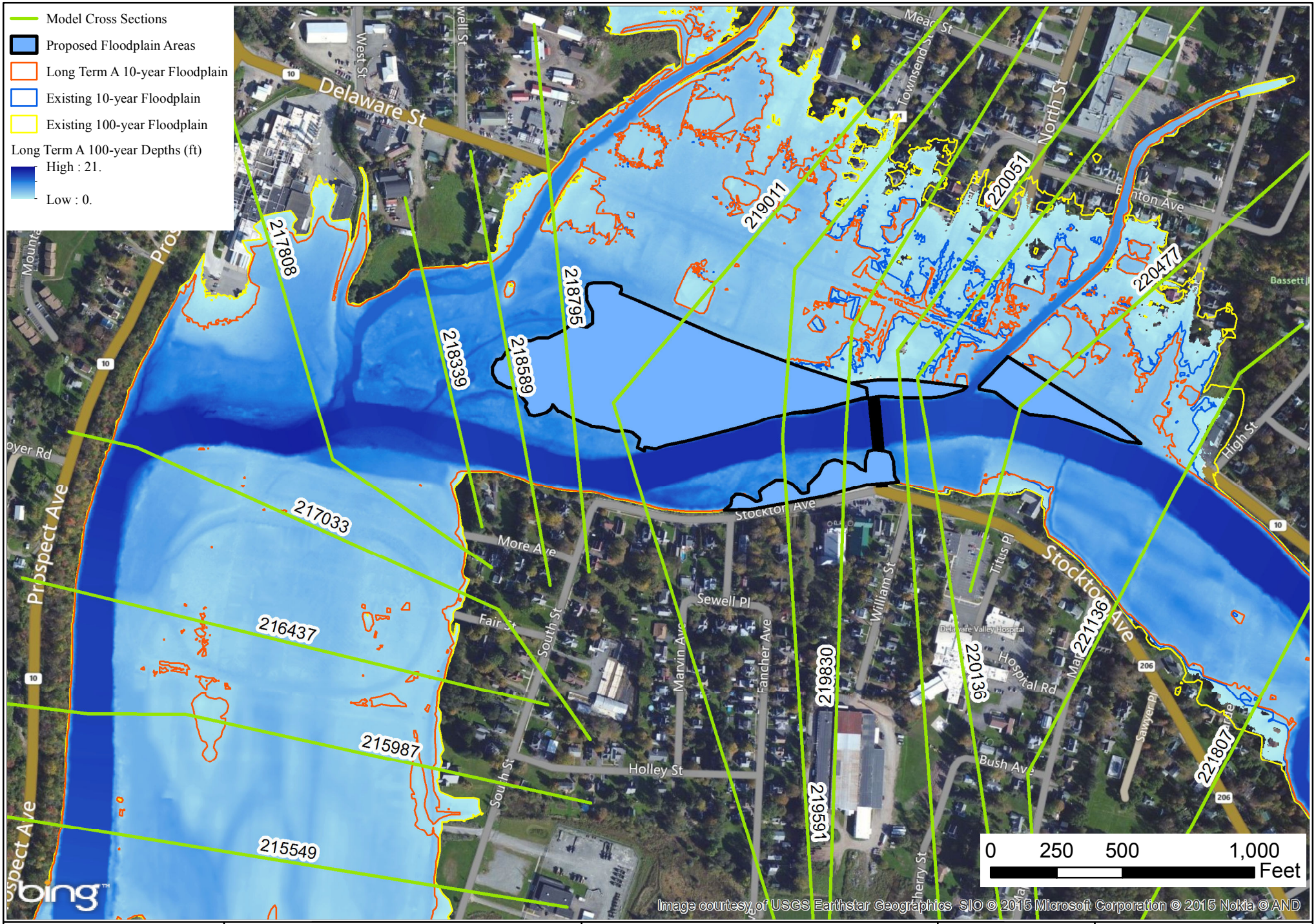
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Figure 4-14: SHORT TERM C DEPTH MAPPING

LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER
LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 1/14/2015
Revision:
Scale: 1 in = 470 ft

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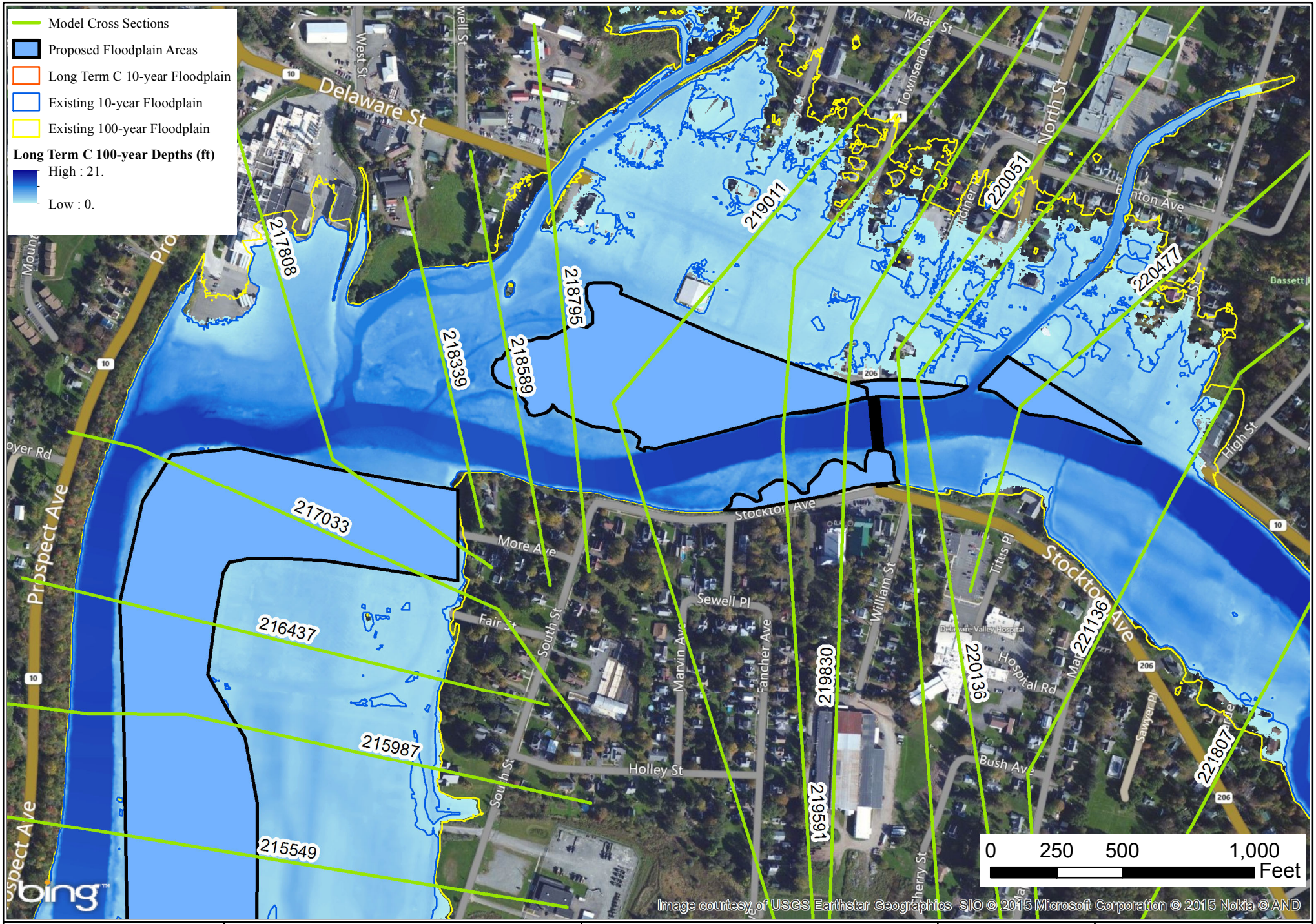
Figure 4-15: LONG TERM A DEPTH MAPPING

LOCAL FLOOD ANALYSIS
WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 1/14/2015
Revision:
Scale: 1 in = 470 ft

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SOURCE(S):

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MXD: Y:\5197-02\Maps\Report Figures\4-16-LongTermC-Depth.mxd

Figure 4-16: LONG TERM C DEPTH MAPPING

LOCAL FLOOD ANALYSIS WEST BRANCH DELAWARE RIVER

LOCATION: WALTON, DELAWARE COUNTY, NY

Map By: JCL
MMI#: 5197-02
Original: 4/2/2015
Revision:
Scale: 1 in = 470 ft

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The combinations of alternatives presented reduce flooding, but do still predict water reaching Delaware Street for storms as low at the 10-year recurrance interval. It has been determined that there may not be any sustainable actions to the river or floodplains that can accomplish the goal of preventing all floodwater on Delaware Street for the 10, 25, 50, 100-year storms. Actions such as levees or flood walls could potentially keep floodwaters from reaching Delaware Street but are not desired actions because they would cut off the river from the community, displace numerous commercial buildings, and are not funded by local, state, and federal agencies. They can also be overtopped in large floods, and present significant maintenance costs for communities.

A trial was run to see how much additional flood capacity would be required to prevent flooding on Delaware Street for the 10-year storm. In addition to alternatives included in Long Term C, the floodplain near the fairgrounds would need to be significantly expanded to remove the entire fairground and create new floodplain along the entire terrace beyond South Street where existing neighborhoods currently exist. This is not considered a feasible alternative and still would not prevent the 25-year flood from entering Delaware Street.

4.8 Hydrologic Alternatives

Hydrologic alternatives were not a significant consideration for the Walton LFA, as there is no feasible method of retaining or detaining significant volumes of water upstream of Walton to reduce flooding in Walton.

However, a specific hydrologic flood problem is of great interest to the Walton Flood Commission. Concentrated flows down the side streets (Liberty Street, Townsend Street, Gardiner Place, and North Street) toward Delaware Street are a considerable problem during certain flood events, and especially when the tributaries are in flood stage and overflowing. In addition, water from the overflowing main stem of the river becomes trapped along Delaware Street by the grade and topography. Conveyance of the water from roadways to the West Branch Delaware River could be facilitated by removing some of the buildings in the path of this water, such as the 181 Delaware Street building. If this building were removed, it may be possible to create a conveyance channel in its footprint. Another option could be to utilize side yards such as a strip of the McDonald's property to return floodwaters to the river.

The conveyance of tributary floodwaters and main stem floodwaters back to the river were not addressed using modeling. This is because the steady-state 1-dimensional HEC-RAS model used for this study creates a water surface profile along the West Branch Delaware River but does not track and account for water trapped along Delaware Street

as floodwaters recede. Nevertheless, observations from the community support the need to address the contributions to flooding that are not directly addressed by the modeling[7]. The flood mitigation alternatives described above should include project components to facilitate conveyance back to the river.

4.9 Property-Specific Building Flood Mitigation

A number of residential properties may be removed from the 1% annual chance flood risk zone if the Short-Term and Long-Term C mitigation projects are constructed. These properties are visible on Figure 4-15 and Figure 4-17 in the margin between the thin yellow line and the edge of the light blue depth mapping where these areas intersect with Liberty, Townsend, North, and Griswold Streets and Gardiner Place; a snapshot of this area is depicted below as Figure 4-18.

Commercial properties will not be removed from the SFHA as a result of the A and C mitigation projects with the exception of West Branch Collision which may shift out of the SFHA; and with the exception of businesses that would be relocated for the A and C alternatives such as Breakey Motors and Dollar General.

The majority of the properties in the Walton study that are currently in the SFHA associated with the West Branch Delaware River *will remain* in the SFHA, and therefore will be subject to continued flood risk and flood insurance coverage requirements[8]. However, the reduction of flood water surface elevations has two benefits:

1. Depth of actual flooding may decrease in future floods, leading to reduced damages and reduced time and costs for clean-up and recovery.
2. Reduced water surface elevations can be used to support a Letter of Map Revision (LOMR[9]) or physical map revision (PMR[10]), which would formally reduce the BFE and may reduce flood insurance premiums for some properties.

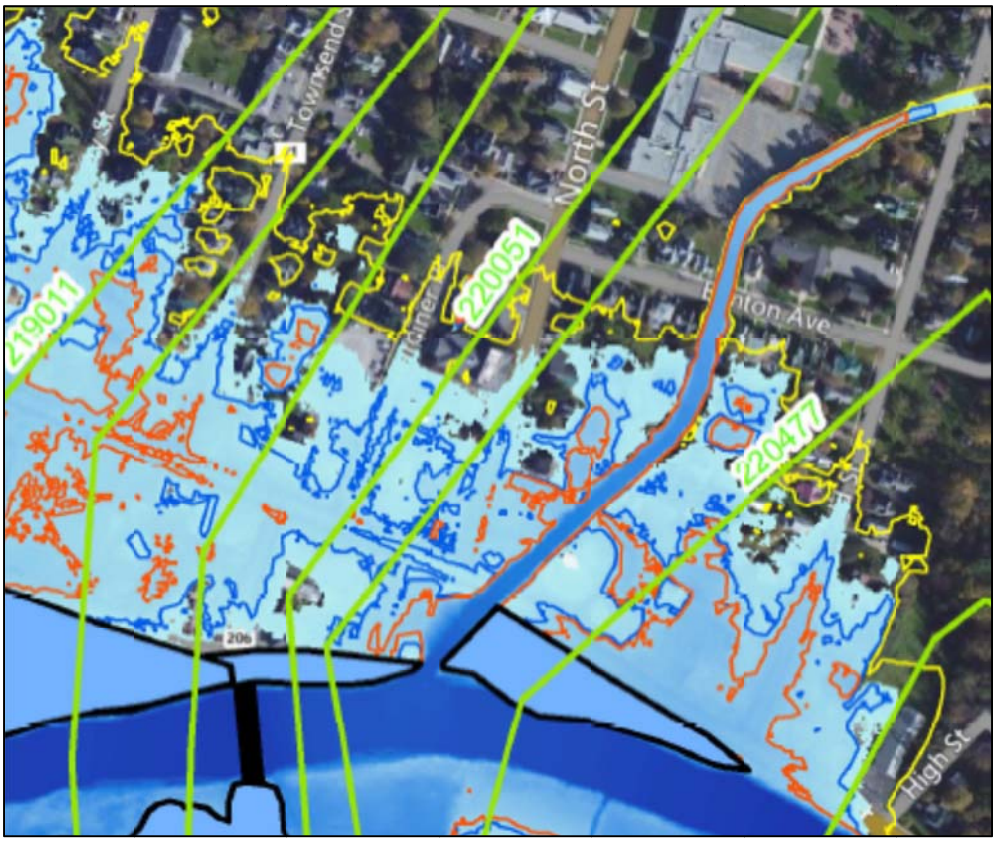
[7] Future efforts of the Walton Flood Commission may include modeling of the tributaries and identification of options to help prevent tributary floodwaters from overflowing onto side streets.

[8] Flood insurance requirements are dependent on status of the property relative to loans, mortgages, or other factors that are outside the scope of this plan.

[9] A LOMR is FEMA's modification to a FIRM. LOMRs are generally based on the implementation of measures that affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective BFEs, or the SFHA. The LOMR officially revises the FIRM without causing FEMA to re-publish the FIRM. The LOMR is generally accompanied by an annotated copy of the affected portions of the FIRM.

[10] A PMR is an action whereby one or more FIRM or DFIRM map panels are physically revised and republished. A PMR is used to change flood risk zones, floodplain and/or floodway delineations, flood elevations, and/or planimetric features. A LOMR accomplishes some of the same changes as the PMR, but the FIRM or DFIRM panels are not republished with the LOMR.

Figure 4-17
Snapshot of Areas that may Benefit from Shift of the SFHA



Because most of the properties along Delaware Street and the lower portions of Liberty, Townsend, North, and Griswold Streets and Gardiner Place will remain in the SFHA, property owners may wish to conduct site-specific mitigation actions to reduce flood risks. The basic choice is to determine whether a building should be removed and the parcel converted to open space; or mitigated through elevation, floodproofing, elevating utilities, etc. as described in Section 4.4 of this document[11].

If homes are elevated, they will need to be elevated two feet above the BFE. However, this will present an important question to property owners as they work with local authorities – should the current BFE be applied, or should the work be postponed to take advantage of a future (and lower) BFE defined by a LOMR or PMR? In many cases a property owner may not have time available to delay a building elevation, floodproofing

[11] Substantial damage or a substantial improvement will trigger elevation of residential buildings and either dry floodproofing or elevation of non-residential buildings.

project, or utility elevation. However if the property owner can delay a mitigation project until after the Village of Walton has secured a LOMR or PMR, then the design elevation may be lower. Other important considerations include the following:

- FEMA and many other grant funds will allow elevations in SFHAs but will not allow elevations in floodways.
- If mitigation is funded by the property owner then an elevation in a floodway is acceptable as long as the footprint of the structure is not expanded.
- If elevation or floodproofing is not a substantial improvement or is not the result of substantial damage, then it can be allowed in a floodway but the owner will see no benefit on flood insurance premiums.

The discussion in this section and the figures in Tables 4-12 through 4-18 provides a reasonable description of the options that may be available to property owners under current conditions and potential future conditions if the A and C options are pursued. However, individual property owners should always work with the Village Code Enforcement official to determine what is legally required when an improvement is planned.

With the significant spatial variation in properties relative to the mitigation projects and their benefits, there are multiple possibilities that could occur throughout the village center if property owners choose to mitigate their own structures. To explore the different possibilities, seven properties have been selected to represent residential and non-residential land uses. From downstream to upstream, they are Kraft, Big M Supermarket, the house at 9 Liberty Street, the house at 21 Townsend Street, the house at 29 Gardiner Place, Brandow's Feed and Seed, and the house at 10 Griswold Street. Tables 4-13 through 4-19 summarize the appropriate elevations for each under existing and potential future conditions if the A and C mitigation projects were pursued and subsequently resulted in a LOMR or PMR.

Table 4-13
Property Mitigation Considerations at Kraft (Cross Section 217808)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE estimate	**1204**		
In Floodway?	No		
Basement?	No		
Current BFE	1208.35	1210.35	6.35'
Short Term A	1208.35	1210.35	6.35'
Long Term A	1208.35	1210.35	6.35'
Short Term C	1206.31	1208.31	4.31'
Long Term C	1206.31	1208.31	4.31'

The two C options will reduce flooding at Kraft, but the property will remain in the SFHA and the FFE at the rear of the facility will remain below the BFE. Without implementing the C options, floodproofing would need to be at least 6.35 feet (vertical) if the owners determined that floodproofing was appropriate. Floodproofing would be at least 4.31 feet if the C options were implemented. Floodproofing would not protect assets outside the building, but a flood wall could be built for this purpose.

Table 4-14
Property Mitigation Considerations at Big M (Cross Section 219011)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE estimate	**1208**		
In Floodway?	No		
Basement?	No		
Current BFE	1209.59	1211.59	3.59'
Short Term A	1209.58	1211.58	3.58'
Long Term A	1209.58	1211.58	3.58'
Short Term C	1208.27	1210.27	2.27'
Long Term C	1208.23	1210.23	2.23'

The supermarket will remain in the SFHA and the FFE will remain below the BFE. Floodproofing may be 2.23 to 3.59 feet (vertical) depending on the future conditions. Therefore future options for Big M will be similar to those for Kraft, except that construction of a flood wall around the supermarket would not likely be feasible given the use of the building and the high customer traffic it enjoys.

Table 4-15
Property Mitigation Considerations at 9 Liberty Street (Cross Section 219011)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE estimate	**1210**		
In Floodway?	No		
Basement?	Likely		
Current BFE	1209.63	1211.63	1.63'
Short Term A	1209.61	1211.61	1.61'
Long Term A	1209.61	1211.61	1.61'
Short Term C	1208.33	1210.33	0.33'
Long Term C	1208.30	1210.30	0.30'

The house will remain in the SFHA under either the A or C options, but the FFE may already be above the current BFE of 1209.63 and the A and C options would help reduce flood risk further. However, the basement is not consistent with flood damage prevention building codes. A substantial damage or substantial improvement determination would require the homeowner to abandon the basement and elevate 0.3 to 1.63 feet. The elevation process may be significantly easier if a LOMR were filed after alternative C, because 0.3 feet is a nominal vertical lift for a home.

Table 4-16
Property Mitigation Considerations at 21 Townsend Street (Cross Section 219591)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE estimate	**1212**		
In Floodway?	No		
Basement?	Likely		
Current BFE	1209.92	1211.92	--
Short Term A	1209.51	1211.51	--
Long Term A	1209.73	1211.73	--
Short Term C	1208.35	1210.35	--
Long Term C	1208.56	1210.56	--

The house will remain in the SFHA under the A options, but the FFE may already be above the current BFE of 1209.92 and the A options would help reduce flood risk further. The house may shift outside the SFHA for the C options (the SFHA may shrink here). The basement is not consistent with flood damage prevention building codes but may be allowable under the C alternatives if the house is no longer in SFHA.

Table 4-17
Property Mitigation Considerations at 29 Gardiner Place (Cross Section 219830)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE estimate	**1213**		
In Floodway?	No		
Basement?	Likely		
Current BFE	1211.00	1213.00	--
Short Term A	1210.61	1212.61	--
Long Term A	1210.21	1212.21	--
Short Term C	1210.11	1212.11	--
Long Term C	1209.42	1211.42	--

For 29 Gardiner Place, the FFE appears to be at the BFE of 1213 feet based on the LiDAR topography that was used to estimate elevations for most of the residential buildings. An elevation certificate (EC) dated August 2, 2003 was available for this house. The EC states that the building is floodproofed to an elevation of 1213.93 NGVD, which is equal to 1213.46 NAVD88 (the datum used throughout this report). Similar to the house at 21 Townsend Street described above, the house at 29 Gardiner Place may shift outside the SFHA for the C options (the SFHA may shrink here).

Table 4-18
Property Mitigation Considerations at Brandow's Feed and Seed (Cross Section 220136)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE (surveyed)	**1207.36**		
In Floodway?	Yes (partly)		
Basement?	No		
Current BFE	1211.97	1213.97	6.61'
Short Term A	1211.47	1213.47	6.11'
Long Term A	1210.76	1212.76	5.40'
Short Term C	1211.07	1213.07	5.71'
Long Term C	1210.10	1212.12	4.76'

The store will remain in the SFHA and the FFE will remain below the BFE under the A and C options, although floor risks would be reduced. Floodproofing may be 4.76 to 6.11 feet (vertical) depending on which alternatives are pursued, whereas floodproofing of nearly seven feet would be required under existing conditions with a substantial damage or substantial improvement determination. The building is in a floodway, so federal funding may not be used for flood mitigation improvements to the building.

Table 4-19
Property Mitigation Considerations at 10 Griswold Street (Cross Section 221136)

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
FFE estimate	**1212**		
In Floodway?	No		
Basement?	Likely		
Current BFE	1213.63	1215.63	3.63'
Short Term A	1212.55	1214.55	2.55'
Long Term A	1212.07	1214.07	2.07'

	Elevation (ft NAVD88)	Required floodproofing with 2' Freeboard	Height Above FFE
Short Term C	1212.33	1214.33	2.33'
Long Term C	1211.79	1213.79	1.79'

The property at 10 Griswold Street will remain in the SFHA under the A and C options, but the FFE may be above a future BFE for Long Term C. This is a good example of a property that would experience lower insurance rates from the implementation of Long Term C followed by a LOMR or PMR. However, the basement is not consistent with flood damage prevention building codes and would continue to contribute to a higher flood insurance rate than a similar building without a basement.

The Walton Flood Commission will need to consider the above scenarios when pursuing the short and long-term flood mitigation options evaluated in this document.

4.10 Relocations

Breakey Motors, the two highway garage buildings south of Water Street, and the Delaware Reporter buildings are structures that are assumed to be demolished as part of the A and C options. Dollar General is the additional structure that would be demolished for the long-term variations of A and C. In these cases, the businesses would be relocated in the village and the highway garages would either be relocated or the functions moved to existing facilities. Only the function of the Delaware Reporter building (currently vacant) would not be replaced in kind.

Aside from the A and C options, there may be other anchor businesses or critical facilities in Walton that can be relocated from the zone of flood risk. The school bus maintenance facility is a good example. The two A options do not reduce water surface elevations according to the hydraulic model. The two C options reduce water surface elevations less than 0.3 feet. The facility will remain at risk for flooding, and the Village and Walton Central School District may determine that relocation is prudent. Anchor businesses like CVS and the Big M supermarket are other examples of buildings that will remain at risk for flooding, and the property owners may one day determine that relocation is prudent.

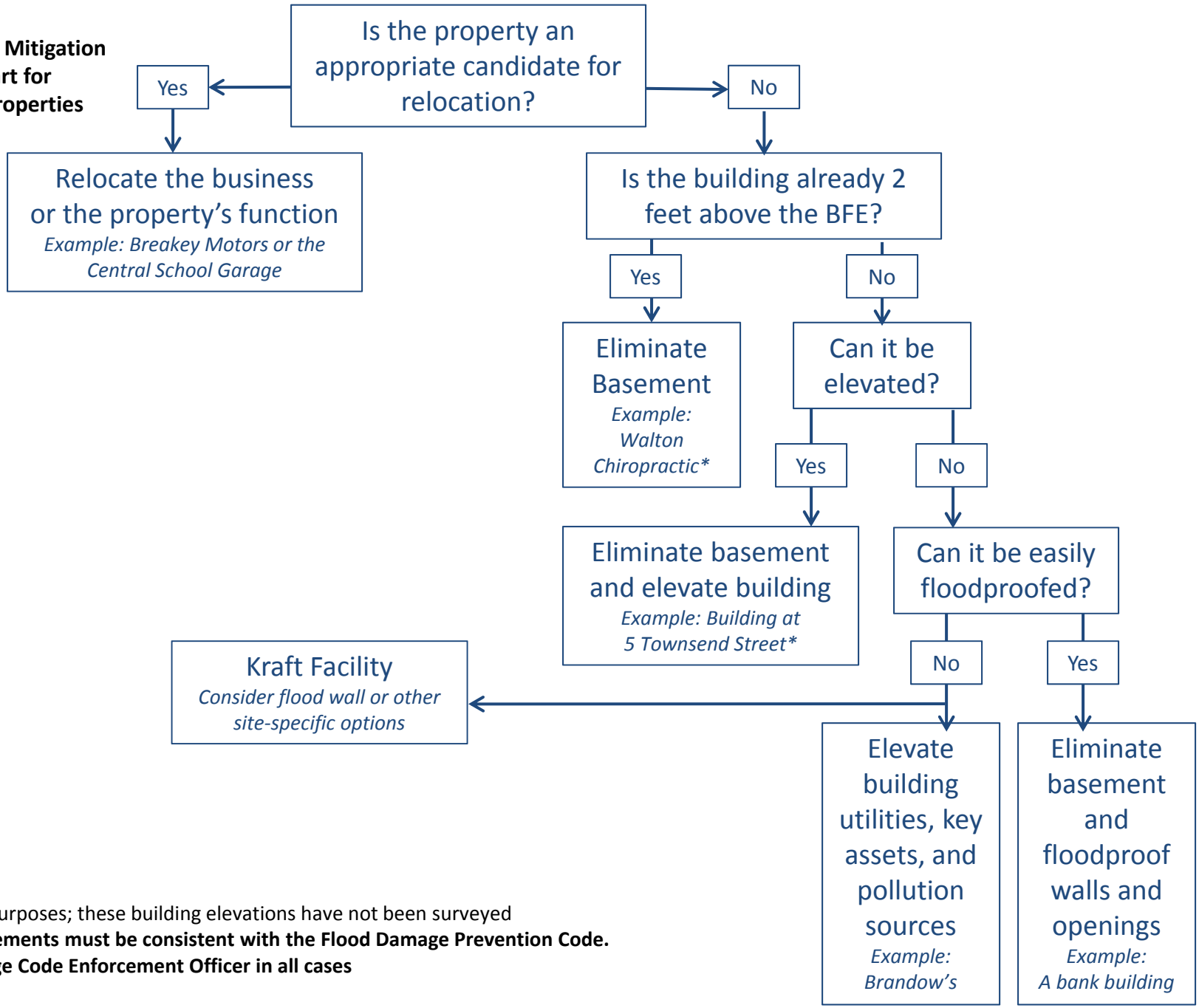
If property owners are interested, the Walton Flood Commission should help facilitate relocations that are not part of the A and C projects. These may include critical facilities such as the school bus maintenance facility and key businesses such as CVS.

4.11 Decision Support for Property-Specific Building Flood Mitigation and Relocations

To aid the selection of future property-specific mitigation actions such as elevations and relocations, two decision support flowcharts are offered. The first chart (Figure 4-18) is applicable to non-residential properties and the second (Figure 4-19) is applicable to residential properties. In both cases, the underlying assumption is that properties are located in the SFHA associated with the West Branch Delaware River. The specific design elevation (for example, the height of floodproofing) should always be determine on a case-by-case basis with reference to the BFE and whether a LOMR or PRM has been obtained in connection with the Short-Term and Long-Term A and C mitigation projects.

Figure 4-18

Property-Specific Mitigation Decision Flowchart for Nonresidential Properties

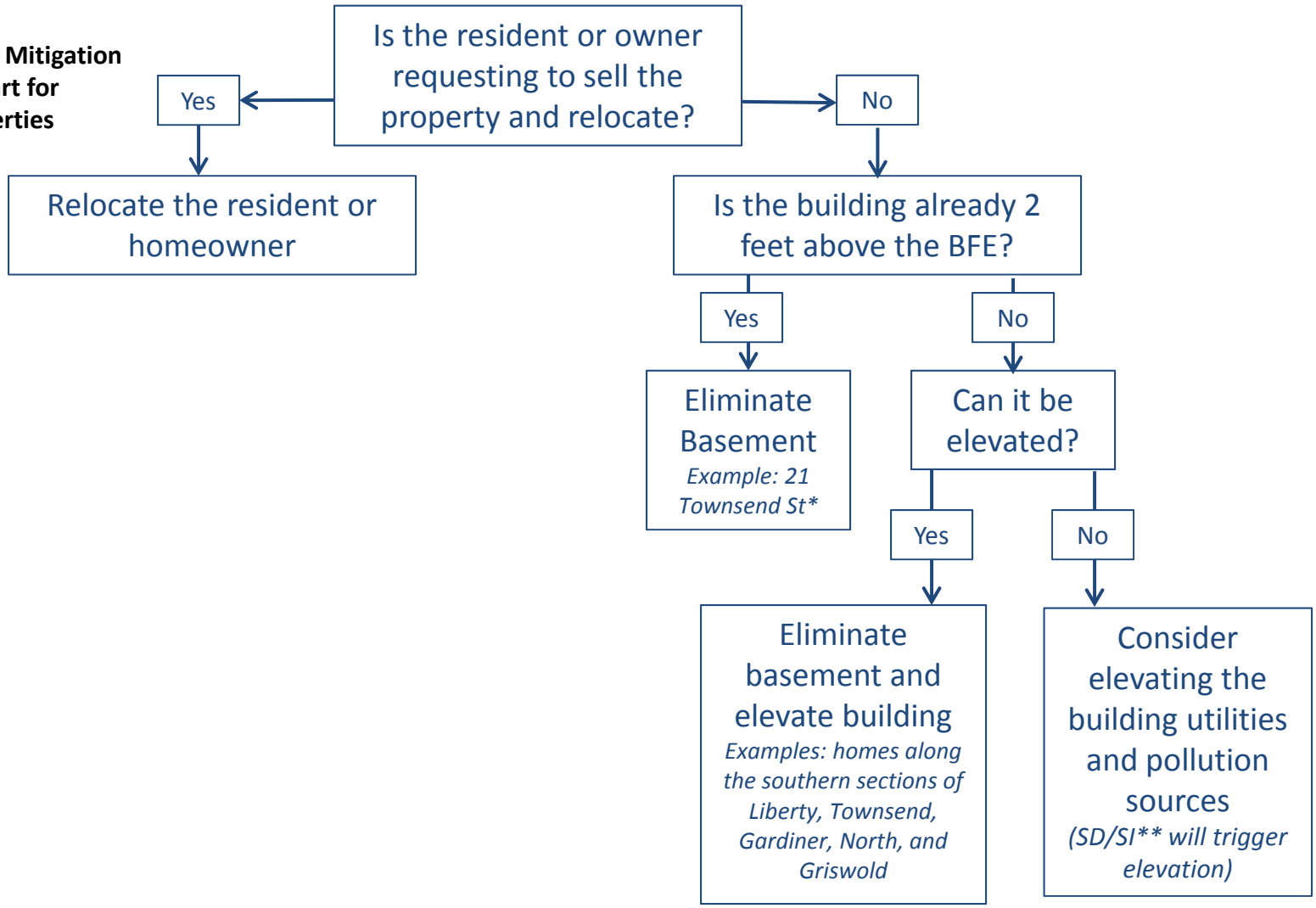


*For illustrative purposes; these building elevations have not been surveyed

Note: All improvements must be consistent with the Flood Damage Prevention Code. Consult the Village Code Enforcement Officer in all cases

Figure 4-19

Property-Specific Mitigation Decision Flowchart for Residential Properties



*For illustrative purposes; this building elevation has not been surveyed

**Substantial Damage/Substantial Improvement

Note: All improvements must be consistent with the Flood Damage Prevention Code. Consult the Village Code Enforcement Officer in all cases

5.0 BENEFIT COST ANALYSIS

5.1 Overview

A Benefit-Cost Analysis (BCA) is used to validate the cost-effectiveness of a proposed hazard mitigation project. A BCA is a method by which the future benefits of a project are estimated and compared to its cost. The end result is a benefit-cost ratio (BCR), which is derived from a project's total net benefits divided by its total project cost. The BCR is a numerical expression of the cost effectiveness of a project. A project is considered by FEMA to be cost effective when the BCR is 1.0 or greater, indicating the long-term benefits of the project are sufficient to justify the up-front and long-term costs.

A BCA was conducted for the proposed A and C alternatives. Given the number of properties involved, the BCA methodology relied on the determination of four sets of benefits for each property (benefits associated with Short Term A, Long Term A, Short Term C, and Long Term C). The benefits were then summed outside of the BCA program and compared to the costs of Short Term A, Long Term A, Short Term C, and Long Term C. The only weakness to this method is that it neglects the maintenance costs for mitigation projects, which are typically estimated (for example, $500 per year for floodplain bench "maintenance") and assigned a present value by the BCA program. However, the magnitude of the benefits and costs in Walton (discussed below) are so much greater than the present value of maintenance costs that they can be neglected.

Other factors and assumption for the BCA include the following:

- Benefits for acquired/relocated properties were determined as "acquisitions" in the BCA program. An acquisition benefit is computed by comparing the current condition (flood damage could occur) to a future condition where damage cannot occur because the building has been removed.
- Benefits for all other properties (the majority of those considered) were generated as local flood reduction projects. A local flood reduction benefit is computed by comparing the current condition (flood damage could occur) to a future condition where damage is lower because a mitigation project has been completed.
- Lost revenue was included only for businesses that provided such information.
- Default depth-damage curves were used in the program.
- Existing and future water surface elevations were determined from the HEC-GeoRAS surfaces created for Short Term A, Long Term A, Short Term C, and Long Term C.
- First floor elevations were estimated using LiDAR topographic mapping for most properties, except for (1) the buildings included in the survey prepared for the Water

Street area (provided by DCSWCD) and (2) the lowest floor elevation for Brandow's Feed and Seed (provided by DCSWCD)[12].

- ❑ Adjustments to the LiDAR topography were made for buildings based on direct observations of first floors relative to adjacent grades.
- ❑ Building replacement values were based on the assessed values and square footages provided by the Delaware County Planning Department's GIS database[13].

The benefits generated for each property in the SFHA are provided in Appendix B. The BCA does not include benefits that could have been generated for avoiding future street cleanup, avoided detours, avoided emergency response, etc. Also, this report recognizes that the contents of the Kraft building and some other buildings may not be well-represented by defaults in the BCA program, but an effort to construct site-specific damage functions was not believed appropriate.

5.2 Property Acquisitions

The first critical piece of the benefits generation was to determine the benefits associated with the act of removing buildings with flood risk. The five buildings listed in Table 5-1 are proposed to be removed in conjunction with the floodplain enhancement projects. Note that the removal of Dollar General is only associated with the two long-term options.

TABLE 5-1
Benefits Provided by Acquisitions/Relocations

Acquisition Benefits	Short Term A	Short Term C	Long Term A	Long Term C
Breakey Motors	$548,341	$548,341	$548,341	$548,341
Highway Garage	$13,129	$13,129	$13,129	$13,129
Salt Shed	$21,067	$21,067	$21,067	$21,067
Reporter	$214,577	$214,577	$214,577	$214,577
Dollar General	---	---	$26,398	$26,398
Totals	**$797,114**	**$797,114**	**$823,512**	**$823,512**

The benefits are greater for the buildings with the lowest elevations and greatest flood damage potential (Breakey Motors) and lower for the smaller buildings located at higher elevations (the highway garage). The low benefit for Dollar General is due to its relatively

[12] Surveyed building elevations will be needed for any application developed for FEMA mitigation programs.
[13] Property appraisals will be needed for any application developed for FEMA mitigation programs.

high elevation. The figures in Table 5-1 were advanced for use in computing total benefits for the A and C projects.

5.3 Benefits Associated with Floodplain Enhancement and Creation Projects

As noted on page 5-1, revenue losses were included for businesses that provided such information. Daily revenue figures were determined by dividing the revenue lost after the 2006 flood by the number of days that each business was shut down. Closure of seven days was assumed for most of the businesses, with the exception of three businesses that provided longer durations of shut-downs. Table 5-2 lists the businesses that were addressed using this method in the BCA.

TABLE 5-2
Businesses that Provided Flood of 2006 Revenue Losses

Business	Number of Days of Closure	Business	Number of Days of Closure
Tony's Shoes	7	Danny's Restaurant	7
Emporium	7	2 North Street	7
Big M Supermarket	19	Walton Hardware	7
Breakey Motors	7	Kraft	15
Auto Plus	7	McDonalds	150
Walton Deli	7	Elizabeth Hair	7
Community Bank	7	CVS	7
Brandow's Feed and Seed	7	Underwoods/Muffler Masters	7
Napa Auto	7		

Total benefits for Short Term A, Long Term A, Short Term C, and Long Term C were then summed. Table 5-3 presents these figures.

TABLE 5-3
Summary of Benefits

Type of Benefits	Short Term A	Short Term C	Long Term A	Long Term C
Acquisition Benefits	$797,114	$797,114	$823,512	$823,512
Residential Benefits	$604,784	$1,073,916	$752,152	$1,238,264
Non-Residential Benefits	$2,419,939	$493,282,052	$3,714,991	$494,796,101
Total Benefits	**$3,821,837**	**$495,153,082**	**$5,290,655**	**$496,857,877**

The benefits for the C options are heavily influenced by the benefits attached to Kraft (approximately $484,000,000 for losses projected out over 50 years). Without Kraft, the

total benefits would be $10.8 million for Short-Term C and $12.5 million for Long-Term C. Big M, Brandow's, McDonald's, and Community Bank provide many of the larger sets of benefits for the C options (greater than $1 million each). On the other hand, benefits contributing to the A options are much lower and distributed along Delaware Street upstream of Dollar General.

5.4 Costs Associated with Floodplain Enhancement and Creation Projects

Conceptual cost estimates were prepared for the components of the A and C mitigation projects. Cost estimate documentation is provided in Appendix C. Table 5-4 lists the individual costs.

TABLE 5-4
Summary of Costs for Individual Components

Item	Individual Cost Estimate	Alternatives that Include Cost
Lower the floodplain south of Water Street	$2.2M	ST-A, ST-C, LT-A, LT-C
Relocate Breakey Motors and restore site	$0.8M	ST-A, ST-C, LT-A, LT-C
Extend the lowered floodplain through Dollar General	$1.1M	LT-A, LT-C
Replace bridge with a 380' span and two piers	$5.0M	LT-A, LT-C
Replace bridge in kind	$3.5M	LT-A, LT-C
Additional floodplain work related to bridge and connecting through to Water Street area	$0.7M	LT-A, LT-C
Fairgrounds floodplain enhancements	$5.1M	ST-C, LT-C

In all cases, the cost estimates should not be construed as likely construction costs. These are strictly for planning purposes and evaluating cost effectiveness.

5.5 Comparison of Benefits and Costs

The individual cost estimates in Table 5-4 were summed and are listed in the third column of Table 5-5 below. The individual benefits in Table 5-3 were summed and are listed in the fourth column of Table 5-5. When benefits exceed costs, the alternative is considered to have a BCR greater than 1.0.

For LT-A, two costs are provided. The first include a full replacement of the bridge with a longer, higher bridge that reduces effects on floodwater conveyance. The second cost includes only the incremental cost for the longer, higher bridge relative to an in-kind replacement. The second cost was an important consideration because mitigation

programs should consider the incremental cost rather than the full cost when future infrastructure replacements are inevitable. However, in this particular case, using the incremental cost does not lead to a BCR greater than one.

TABLE 5-5
Comparison of Costs and Benefits

Alternative		Cost Estimates	Total Benefits	BCR > 1?
ST-A	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site	$3.0M	$3.8M	Yes
ST-C	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site ❑ Create/lower the fairgrounds floodplain	$8.1M	$495.1M	Yes
LT-A	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site ❑ Extend the lowered floodplain through Dollar General ❑ Replace bridge with a 380' span and two piers ❑ Additional floodplain work related to bridge and connecting through to Water Street area	$9.8M[1] $6.3M[2]	$5.3M	No
LT-C	❑ Lower the floodplain south of Water Street ❑ Relocate Breakey Motors and restore site ❑ Extend the lowered floodplain through Dollar General ❑ Replace bridge with a 380' span and two piers ❑ Additional floodplain work related to bridge and connecting through to Water Street area ❑ Create/lower the fairgrounds floodplain	$14.9M	$496.9M	Yes

1. Includes the full cost of bridge replacement to include a longer/higher bridge
2. Includes the incremental cost for a longer/higher bridge compared to a bridge replacement in kind

The BCA does not include consideration of water quality benefits that would be provided by flood mitigation projects. Water quality benefits should be used to increase benefits when the BCR is poorly represented by the flood reduction benefits generated by the BCA program or when stratification or prioritization of mitigation projects is difficult due to a calculation of similar BCRs.

Although reduced flood damage in Walton would undoubtedly lead to improved water quality during floods, inclusion of water quality benefits was not considered necessary for this LFA because the BCRs are well represented by flood reduction benefits and because the BCRs are sufficiently different than one another. If the Walton Flood Commission determines that option LT-A should be pursued immediately, prior to the eventual replacement of the bridge due to its age and/or condition, then water quality benefits may be useful for improving the BCR for LT-A. Appendix D includes a memorandum that discusses two potential approaches that can be used by the Walton Flood Commission to include water quality benefits in future BCA.

WATER QUALITY BENEFITS

Depending on the timing of flood mitigation projects, consideration of water quality benefits may be needed in the future. For example, consider a scenario where Kraft has made improvements on its property to reduce flood damage. In this case, benefits associated with the C options would decrease significantly because the floodplain enhancement projects would no longer provide reduced flood damage at Kraft (although they would provide reduced flood risk to the property). In this case, the total benefit for Long-Term C would be about $12.5 million, which is lower than the cost estimate of $14.9 million. An appropriate and reasonable argument could be made that the village-wide water quality benefits associated with Long-Term C – which benefits most of the properties on Delaware Street – should offset this decrease in the total benefits and provide justification for Long-Term C.

5.6 Benefit Cost Analysis for Individual Property Mitigation

Section 4.9 of this document discusses property-specific flood mitigation through elevations and floodproofing. Many of these projects may be eligible for grants, but cost-effectiveness is required to secure certain grant funds. The FEMA BCA program can be used in a straightforward manner to evaluate BCRs associated with property-specific elevations and floodproofing. The required information includes pertinent land surface and building elevations, the flood elevations published in the FIS and noted on the FIRM, the stream channel elevation published in the FIS, and project costs for elevating or floodproofing buildings.

Like all projects evaluated through BCA, the highest benefits will be generated for projects that reduce flooding from frequent events and infrequent events, as opposed to projects that reduce flooding from only infrequent events. Therefore, higher BCRs will tend to be calculated for the buildings at lower elevations along Delaware Street and side streets. This will favor BCRs exceeding 1.0 for homes located at the south ends of Liberty, Townsend, North, and Griswold Streets and Gardiner Place while the homes located further north may not generate BCRs above 1.0.

One potential pathway toward rapid cost effectiveness determination is to utilize the interpretation from FEMA that was effective as of August 15, 2013. Under this relatively new interpretation, acquisitions and elevations are considered cost-effective if the project costs are less than $276,000 and $175,000, respectively. To be eligible for this automatic determination, structures must be located in SFHAs. The figure of $175,000 for a building elevation is likely sufficient for elevating many of the residential buildings in Walton.

Costs for floodproofing of individual non-residential buildings could vary widely in Walton. Consider the following:

- A low door shield costs approximately $1,500[14]. Dewberry[15] reports a range of $500-$1,500 for door gaskets and seals. Fully floodproofed doors can cost more, up to $4,000 per door, but may be excessive given many of the existing door elevations in the downtown area.

- Dewberry reports a range of $500-$1,500 to elevate an electrical service and meter, a range of $500-$1,500 to floodproof electrical service and meter, a range of $500-$1,500 to elevate HVAC equipment, and a range of a range of $500-$1,500 (and up) to floodproof HVAC equipment. FEMA reports a range of $1,500-$2,000 to include outlets and switches in the elevation of electric service and meter in a house. Given the uncertainty related to actions that business owners may choose, a range of $1,500-$2,000 is reasonable for all utility-related costs.

Total costs to retrofit a single business to make it more flood-resilient in the long term are rarely reported in the literature. In the New York Rising Community Reconstruction Plan[16] for the Red Hook section of Brooklyn, New York, total cost estimates per small business in this close-knit community ranged from $6,000 to $50,000 for implementing a variety of floodproofing measures. Given the number of doors, openings, and utilities

[14] Typical vendor "PS Doors" (http://www.psdoors.com/)
[15] http://www.sbidc.org/documents/RedHookCaseStudyFindingsReportFINAL.pdf
[16] http://stormrecovery.ny.gov/sites/default/files/crp/community/documents/redhook_nyrcr_plan_20mb_0.pdf

associated with some of the businesses in Walton, this range may be reasonable for a group of buildings along Delaware Street.

6.0 FINDINGS, RECOMMENDATIONS, AND IMPLEMENTATION

6.1 Summary of Findings

The LFA completed for Walton has demonstrated that several flood mitigation projects have merit because they will reduce flood water surface elevations in the village along Delaware Street and extending north along the lower portions of the side streets. These projects – grouped into two timeframes (short term and long term) and two combinations (A and C) – largely depend on the enhancement of existing floodplains and creation of lower floodplains coupled with a handful of strategic building removals and business relocations such as Breakey Motors and the highway garage buildings. Floodwater return pathways would be created leading from Delaware Street past Water Street and back to the West Branch of the Delaware River. The river would be widened slightly at the current site of Breakey Motors, as well.

Creation of extensive floodwalls and levees is not supported by this LFA, nor is extensive sediment removal from the river. Widespread removal of buildings from the downtown area is also not supported by the LFA, as the community would suffer from the disruption to its central business district.

Individual property owners will be required to elevate or floodproof their properties over time as substantial damage or substantial improvement thresholds are triggered. However, optional elevations and floodproofing may be desired in strategic locations where unacceptable flood risk remains after the A and C projects are implemented. This will have the dual benefit of reducing flood risks while reducing flood insurance premiums for those properties that are insured.

Finally, key anchor businesses and critical facilities may wish to relocate out of zones of unacceptable flood risk. Examples include CVS and the school bus maintenance facility, both of which are located at relatively low elevations on the west end of Delaware Street where flood mitigation options ST-A and LT-A will produce only moderate benefits.

6.2 Recommendations

The following flood mitigation recommendations are offered:

1. Proceed with implementation of the A and C mitigation projects as funding allows. Refer to Section 6.3 below for additional discussion about implementation.

2. Pursue floodproofing of commercial buildings along Delaware Street. Floodproofing should include sealing of lower portions of buildings including doors and other

openings, and elevation of building utilities. Ensure that floodproofing is viable under a set of potential future conditions (for example, designed according to the higher of future flood elevation based on A or C).

3. Pursue elevation of homes on a case-by-case basis as property owners approach the Walton Flood Commission and/or the Village about mitigation. Ensure that elevations are conducted in accordance with the effective BFE at the time of the work.

4. If property owners are interested, pursue relocations that are not part of the A and C projects. These may include critical facilities such as the school bus maintenance facility and key businesses such as the CVS.

5. Seek funding for a flood mitigation feasibility study and master plan for the county fairgrounds property (this will help facilitate recommendation #1).

The following procedural recommendations are offered:

- ❑ Continue to gather and file revenue information as provided by businesses. This may help improve future BCA determinations.

- ❑ During and after future floods, record and compile municipal, county, and state costs related to clean-up and recovery in Walton. This may help improve future BCA determinations.

- ❑ During and after future floods, record high water marks throughout the village. Track and record flood damage over time for anchor businesses and critical facilities.

- ❑ Identify opportunities to include water quality benefits in future BCA determinations. This may be particularly helpful when costs exceed standard flood mitigation benefits by narrow margins. Refer to Appendix D for additional discussion.

- ❑ Continue to evaluate the cost effectiveness and viability of constructing a flood wall for Kraft as described in the Third Brook Watershed Management Plan.

6.3 Implementation Plan

Figure 6-1 presents a general overview of three potential pathways that can be taken in Walton for flood mitigation through the A and C projects described in this LFA.

Figure 6-1
Implementation Framework

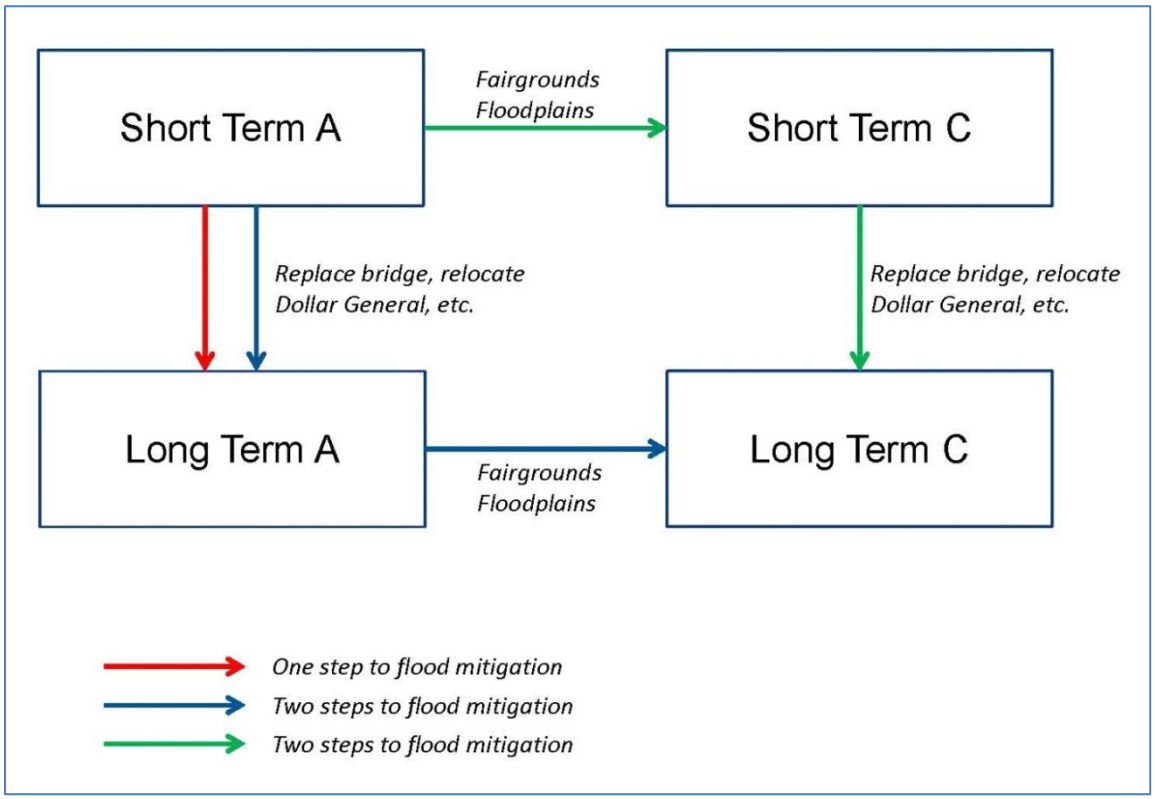


Figure 6-1 depicts the two desired outcomes of flood mitigation projects: either Long-Term A (floodplain improvement and enhancement without the fairgrounds included) or Long-Term C (floodplain improvement and enhancement with the fairgrounds included). In both cases, mitigation will begin with Short-Term A, as it involves village and county-owned land as well as a business owner that is reportedly willing to relocate. The long-term options rely on bridge replacement, which will occur sometime in the future although the date is not known.

In general, there are three potential pathways to the long-term outcomes:

- ST-A then LT-A: Fairgrounds floodplain enhancement does not occur in this outcome, and total flood mitigation benefits of $5.3 million are possible.
- ST-A then LT-A then LT-C: the bridge is replaced and Dollar General is relocated in favor of floodplain work *prior to* the fairgrounds work, but total flood mitigation benefits of $496.8 million are possible. If Kraft chooses to pursue flood mitigation on its own terms, total flood mitigation benefits of $12.5 million are possible.

- ST-A then ST-C then LT-C: the bridge is replaced and Dollar General is relocated in favor of floodplain work *subsequent to* the fairgrounds work, but total flood mitigation benefits of $496.8 million are possible. If Kraft chooses to pursue flood mitigation on its own terms, total flood mitigation benefits of $12.5 million are possible.

In practice, there may be several discrete steps that occur within each of these three potential pathways. For example, the floodplain enhancement at the fairgrounds site may take several years to implement, with the work paused at times to accommodate funding or logistical issues such as the occurrence of the annual Delaware County fair. It will be important to proceed in a manner that ensures continued cost-effectiveness. For example, if half of the fairgrounds floodplain enhancement is completed and then the remainder is held, the half that is completed should provide reasonable flood mitigation benefits along Delaware Street.

6.4 Descriptions of Funding Sources

Several funding sources may be available to the Walton Flood Commission, the Village and Town of Walton, and Delaware County and its departments for the implementation of recommendations of this plan.

Local Flood Analysis (LFA) and Stream Management Program (SMP)

The LFA program that funded this study and report is likely to be the primary funding vehicle for some of the projects described in this report through the SMP. As described in the LFA rules, "Stream Management Programs in the NYC water supply watersheds and the Catskill Watershed Corporation are supporting the analysis of flood conditions and the identification of hazard mitigation projects. The process consists of two steps: 1) an engineering analysis of flood conditions and identification of potential flood mitigation projects articulated in a plan and 2) project design and implementation. The engineering analysis and plan are termed 'Local Flood Analysis.' These program rules (Section C) define the process for municipalities to apply for funding to complete a Local Flood Analysis (LFA). These program rules (Section D) also define the process for municipalities to seek funding from the Stream Management Program [managed by the DCSWCD] to implement projects that involve streams, floodplains and adjacent infrastructure to reduce flood hazards."

NYCDEP Buyout Program

The buyout program is used to acquire individual properties in the water supply watersheds and convert them to open space in order to reduce future flood damages.

Although large-scale buyouts in Walton are not supported by this LFA at the present time, several properties have been identified in this LFA as targeted for acquisition. The buyout program could potentially be used for some of these acquisitions.

Catskills Watershed Corporation (CWC) Flood Hazard Mitigation Implementation Program (FHMIP)

The Catskill Watershed Corporation is a not-for-profit local development corporation established to protect the water resources of the New York City watershed west of the Hudson River (WOH); to preserve and strengthen communities located in the region; and to increase awareness and understanding of the importance of the NYC water system. CWC administers a number of programs under this mission, such as:

- Septic Repair and Maintenance – Funds residential septic system repairs, replacements, and maintenance.
- Stormwater Planning and Control – Funds planning, assessment, design, and implementation of stormwater and erosion controls for existing conditions, as well as stormwater requirements for new construction.
- Education – Provides grants to schools and organizations.
- Community Wastewater Management – Funds a program to evaluate and build community-specific wastewater solutions, which may include septic maintenance districts, community septic systems, or wastewater treatment plants.
- Local Technical Assistance Program – Provides grants to communities conducting watershed protection and land use planning initiatives.

The FHMIP is a new CWC program that is open for applications beginning in 2015. This program specifically allows funding of certain categories of projects identified in LFA reports, subject to various restrictions that are listed in the CWC's FHMIP rules (revised through October 7, 2014).

Emergency Watershed Protection Program (EWP)

Through the EWP program, the U.S. Department of Agriculture's NRCS can help communities address watershed impairments that pose imminent threats to lives and property. Most EWP work is for the protection of threatened infrastructure from continued stream erosion. NRCS may pay up to 75% of the construction costs of emergency measures. The remaining costs must come from local sources and can be made in cash or in-kind services. EWP projects must reduce threats to lives and property; be economically, environmentally, and socially defensible; be designed and implemented according to sound technical standards; and conserve natural resources.

The A and C projects described in this LFA report are not ideal matches for the NRCS EWP program. However, future use of the EWP program should be considered if the program rules change.

FEMA Pre-Disaster Mitigation (PDM) Program



The Pre-Disaster Mitigation Program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through pre-disaster mitigation planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of pre-disaster plans and projects is meant to reduce overall risks to populations and facilities.

The PDM program is subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds. In 2014, funds were extremely limited and FEMA provide strict constraints to the states on how many projects could be submitted for consideration. Although many of the projects described in this report are eligible for consideration under PDM – and meet the BCA requirements – it is unlikely that PDM funding levels and the national competitiveness of the program will result in funding for the A and C projects.

FEMA Hazard Mitigation Grant Program (HMGP)



The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

The HMGP is one of the FEMA programs with the greatest potential fit to potential projects in this LFA. However, it is available only in the months subsequent to a federal disaster declaration in the State of New York. Because the state administers the HMGP directly, application cycles will need to be closely monitored after disasters are declared in New York.

FEMA Flood Mitigation Assistance (FMA) Program



The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs and made the following significant changes to the FMA program:

- The definitions of repetitive loss and severe repetitive loss properties have been modified.
- Cost-share requirements have changed to allow more federal funds for properties with repetitive flood claims and severe repetitive loss properties.
- There is no longer a limit on in-kind contributions for the non-federal cost share.

One limitation of the FMA program is that it is used to provide mitigation for *structures* that are insured or located in SFHAs. Therefore, the individual property mitigation options described in this LFA are best suited for FMA funds. Like PDM, FMA programs are subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds.

NYS Department of State

The Department of State may be able to fund some of the projects described in this report. In order to be eligible, a project should link water quality improvement to economic benefits. An example from this plan would be flood mitigation of the Kraft facility as this would reduce damages to an important local employer while reducing the potential for water quality impairments that could occur when the facility is flooded.

U.S. Army Corps of Engineers

The Corps provides 100% funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services Program (FPMS). Specific programs used by the Corps for mitigation are listed below.

- Section 205 – Small Flood Damage Reduction Projects: This section of the 1948 Flood Control Act authorizes the Corps to study, design, and construct small flood control projects in partnership with non-Federal government agencies. Feasibility studies are 100% federally-funded up to $100,000, with additional costs shared equally. Costs for preparation of plans and construction are funded 65% with a 35% non-federal match. In certain cases, the non-Federal share for construction could be as high as 50%. The maximum federal expenditure for any project is $7 million.

- Section 14 – Emergency Streambank and Shoreline Protection: This section of the 1946 Flood Control Act authorizes the Corps to construct emergency shoreline and streambank protection works to protect public facilities such as bridges, roads, public buildings, sewage treatment plants, water wells, and non-profit public facilities such as churches, hospitals, and schools. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $1.5 million.

- Section 208 – Clearing and Snagging Projects: This section of the 1954 Flood Control Act authorizes the Corps to perform channel clearing and excavation with limited embankment construction to reduce nuisance flood damages caused by debris and minor shoaling of rivers. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $500,000.

- Section 206 – Floodplain Management Services: This section of the 1960 Flood Control Act, as amended, authorizes the Corps to provide a full range of technical services and planning guidance necessary to support effective floodplain management. General technical assistance efforts include determining the following: site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Types of studies conducted under FPMS include floodplain delineation, dam failure, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, floodproofing, and inventories of floodprone structures. When funding is available, this work is 100% federally funded.

In addition, the Corps provides emergency flood assistance (under Public Law 84-99) after local and state funding has been used. This assistance can be used for both flood response and post-flood response. Corps assistance is limited to the preservation of life and improved property; direct assistance to individual homeowners or businesses is not permitted. In addition, the Corps can loan or issue supplies and equipment once local sources are exhausted during emergencies.

Other Potential Sources of Funding

- Community Development Block Grant (CDBG) – The Office of Community Renewal administers the CDBG program for the State of New York. The NYS CDBG program provides financial assistance to eligible cities, towns, and villages (including the Village and Town of Walton) in order to develop viable communities by providing affordable housing and suitable living environments, as well as expanding economic opportunities, principally for persons of low and moderate income. It is possible that CDBG funding program could be applicable for floodproofing and elevating residential and non-residential buildings, depending on eligibility of those buildings relative to the program requirements.

- Delaware County Industrial Development Agency (IDA) – The IDA works in conjunction with the Delaware County Department of Economic Development to "build a sustainable future for Delaware County" by meeting the needs of new and existing businesses through expertise, financial assistance, and continued support. The IDA offers a variety of programs and performance based incentives to encourage businesses to expand or locate within Delaware County and create new jobs. The program primarily helps secure low-interest loans and Industrial Revenue Bonds (tax-exempt financing alternatives for large-scale investments in facilities and equipment). It is possible that the program could be applicable for floodproofing, elevating, or relocating non-residential buildings, depending on eligibility of those businesses relative to the program requirements.

- Empire State Development – The State's Empire State Development program offers loans, grants and tax credits, as well as other financing and technical assistance, to support businesses and encourage their growth. It is possible that the program could be applicable for floodproofing, elevating, or relocating non-residential buildings, depending on eligibility of those businesses relative to the program requirements.

- Private Foundations – Private entities such as foundations are potential funding sources in many communities. The Walton Flood Commission will need to identify the foundations that are potentially appropriate for some of the actions proposed in this report.

6.5 Potential Funding Sources for Mitigation Projects

Table 6-1 lists potential funding sources for the components of mitigation projects A and C. The demolition of the Delaware Reporter building is not included in the table because a grant has been obtained for this purpose. Note that in all cases, federal funds cannot be duplicated for any particular project. Potential funding sources described under the heading "Other Potential Sources of Funding" (above) have not been listed, as additional evaluation may be needed to determine their applicability.

Table 6-1
Potential Funding Sources for Components of Mitigation Projects A and C

Alternative		Federal	State	Other
ST-A	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	None	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
ST-C	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
	Create/lower the fairgrounds floodplain	ACOE	NYSDOS	DCSWCD SMP, CWC
LT-A	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Dollar General	FEMA	None	NYCDEP Buyout, CWC
	Extend the lowered floodplain through Dollar General	ACOE	NYSDOS	DCSWCD SMP, CWC
	Replace bridge with a 380' span and two piers	None	NYSDOT	DCSWCD SMP, CWC

Alternative		Federal	State	Other
	Additional floodplain work related to bridge and connecting through to Water Street area	ACOE	NYSDOS	DCSWCD SMP, CWC
LT-C	Remove and relocate the highway garage buildings	FEMA	NYSDOS	NYCDEP Buyout, CWC
	Lower the floodplain south of Water Street	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Breakey Motors	FEMA (note that BCR may exceed 1.0 on its own)	None	NYCDEP Buyout, CWC
	Restore Breakey Motors site	ACOE	NYSDOS	DCSWCD SMP, CWC
	Relocate Dollar General	FEMA	None	NYCDEP Buyout, CWC
	Extend the lowered floodplain through Dollar General	ACOE	NYSDOS	DCSWCD SMP, CWC
	Replace bridge with a 380' span and two piers	None	NYSDOT	DCSWCD SMP, CWC
	Additional floodplain work related to bridge and connecting through to Water Street area	ACOE	NYSDOS	DCSWCD SMP, CWC
	Create/lower the fairgrounds floodplain	ACOE	NYSDOS	DCSWCD SMP, CWC

Table 6-2 lists potential funding sources for property mitigation and relocations.

Table 6-2
Potential Funding Sources for Other Mitigation Projects

Option	Federal	State	Other
Floodproofing of individual non-residential buildings	FEMA	NYSDOS	None
Elevation of individual non-residential buildings in floodway	None	None	None
Elevation of individual residential buildings in floodway	None	None	None
Elevation of individual non-residential buildings outside of floodway	FEMA	NYSDOS	None
Elevation of individual residential buildings outside of floodway	FEMA	None	None
Relocation of anchor businesses and critical facilities such as CVS, Big M, and the school bus maintenance facility	FEMA	NYSDOS	NYCDEP Buyout, CWC*

*CWC funding may be available only if off-site flood levels are reduced as a result of the action

As this LFA plan is implemented, the Walton Flood Commission will need to work closely with potential funders to ensure that the best combinations of funds are secured for mitigation options A and C, and for the property-specific mitigation such as floodproofing, elevations and relocations. The Walton Flood Commission may also work closely with local lenders and the chamber of commerce to facilitate the provision of loan services for property mitigation and floodproofing. Because FEMA's mitigation funds are limited by Congress (PDM and FMA) or dependent on disaster declarations (HMGP), the State hazard mitigation officer should be kept apprised of Walton's efforts for mitigating flooding and flood damage.

7.0 REFERENCES

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APPENDICES

APPENDIX A

MEETING PRESENTATIONS AND NOTES

MILONE & MACBROOM



Local Flood Analysis
Initial Project Discussion

Walton Flood Commission Meeting
Village and Town of Walton

David Murphy, P.E., CFM





Delaware County Soil & Water Conservation District | March 20, 2014

Agenda

- Review Available Data
- Review FEMA Mapping and Model
- Preliminary Alternatives
- Future Data Collection and Modeling
- Approach for Initial Public Meeting
- Set Future Meeting Dates

MILONE & MACBROOM

Available Data

- FEMA Flood Insurance Study (FIS):
  - 10% annual chance = 17,793 cfs
  - 2% annual chance = 25,031 cfs
  - 1% annual chance = 28,137 cfs
  - 0.2% annual chance = 35,526 cfs
- FEMA Hydraulic Model
- LiDAR Topography from NYCDEP (2009 with recent updates)
- USGS Report of 2006 Flood and Other Reports
  - Flood Discharge = 28,600 cfs (RI = 86 years)
- Stream Management Plan

MILONE & MACBROOM

FEMA Mapping and Model



MILONE & MACBROOM

FEMA Mapping and Model

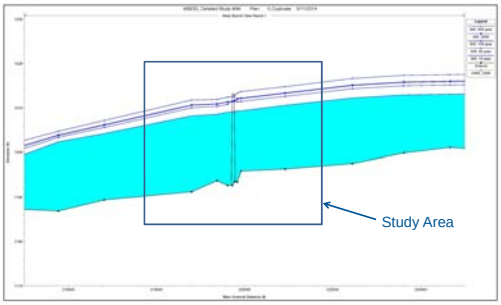
Cross Sections:

- 217033 – Fairgrounds
- 219011 – Family Dollar
- 219591 – Dollar General and Bluestone Biliards
- 219830 – Bank Buildings
- 219959 – Bridge (US side)
- 220051 – Gardiner Street
- 220136 – Old Ford / Another Mans' Treasure
- 221136 – Upstream of downtown



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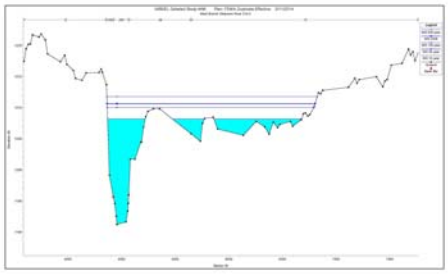
FEMA Mapping and Model



MILONE & MACBROOM

FEMA Mapping and Model

Cross Section 219011 - Family Dollar



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FEMA Mapping and Model

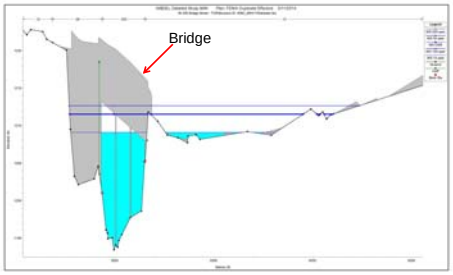
Cross Section 219591 – Dollar General & Bluestone Billiards



Milone & MacBroom

FEMA Mapping and Model

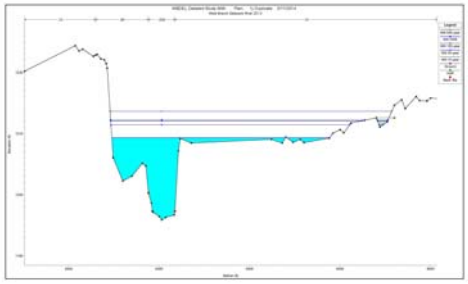
Cross Section 219959 – Bridge



Milone & MacBroom

FEMA Mapping and Model

Cross Section 220136 – Old Ford

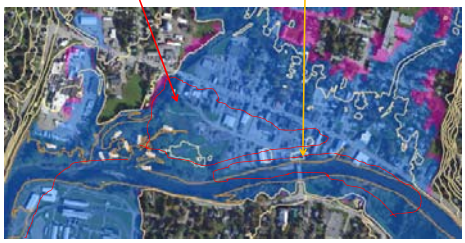


Milone & MacBroom

Preliminary Alternatives

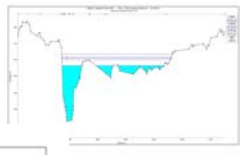
Re-grade the floodplain south of Water Street maximizing the potential to lower WS elevations on Delaware Street

Re-grade the floodplain north and south of the bridge. Remove bridge to see effects of bridge and filled approach on the south side.



Re-Grade Floodplain South of Water Street

Cross Section 219011 – Family Dollar

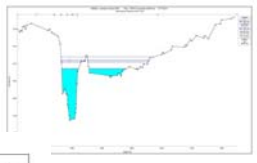


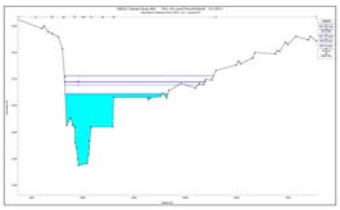


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Re-Grade Floodplain South of Water Street

Cross Section 219591 – Dollar General & Bluestone Billiards

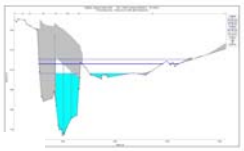


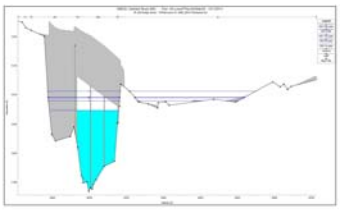


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Re-Grade Floodplain South of Water Street

Cross Section 219959 – Bridge

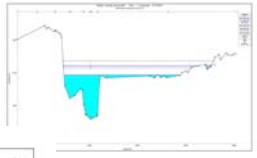


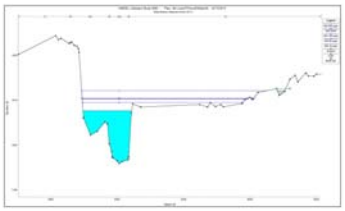


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Re-Grade Floodplain South of Water Street

Cross Section 220136 – Old Ford





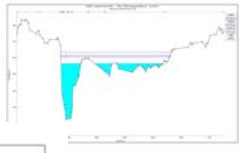
MILONE & MACBROOM

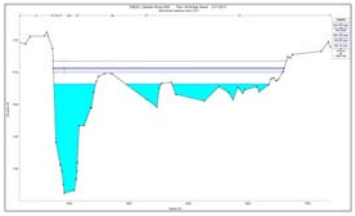
Re-Grade Floodplain South of Water Street



Remove Bridge and Associated FP Grading

Cross Section 219011 – Family Dollar

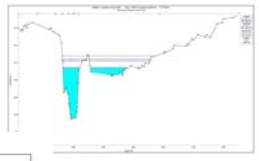




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Remove Bridge and Associated FP Grading

Cross Section 219591 – Dollar General & Bluestone Billiards

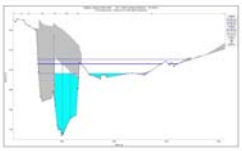




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Remove Bridge and Associated FP Grading

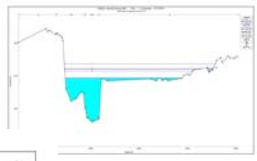
Cross Section 219959 – Bridge

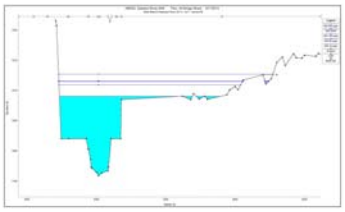


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Remove Bridge and Associated FP Grading

Cross Section 220136 – Old Ford





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Preliminary Alternatives



Future Data Collection and Modeling

- Building elevations and types
- Bridge characteristics and specific elevation data
- Refine boundaries of alternatives – for example, leave Water Street emergency access or remove the road?
- Other ideas from Walton Flood Commission

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Approach for Initial Public Meeting

- Cover basic information about rivers and flooding?
- Jump right in with introduction to the LFA process?
- Describe flood mitigation methods? (see next two slides)
- Other ideas from Walton Flood Commission

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Flood Mitigation Strategies



Flood Mitigation



Structural Projects

- Replace Bridges and Culverts
- Remove In-Stream Dams
- Remove Obstructions
- Upstream Detention
- Install Stormwater Systems
- Create Floodways
- Enlarge Channels
- Reduce Flow Resistance
- Install Levees
- Install Flood Walls

Property Protection

- Wet Floodproofing
- Dry Floodproofing
- Elevate Buildings
- Relocate Buildings
- Secure Utilities
- Anchor Floatables
- Remove Hazardous Materials
- Re-Grade Properties
- Purchase Flood Insurance
- Join the Community Rating System (CRS)

Prevention

- Modify Zoning
- Modify Comp Plan
- Stormwater Management Regulations
- Increase Flood Damage Prevention Standards
- Freeboard
- Low Impact Development
- Minimize Impervious Cover

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Flood Mitigation Strategies



Flood Mitigation

Natural Resources

- Acquire or Preserve Floodplain Land
- Acquire and Remove Structures from Floodplains and Convert to Open Space
- Acquire or Preserve Other Lands
- Increase Wetland Storage
- Re-Connect Streams to Floodplains

Emergency Services

- Build Local Capacities to Respond
- Move Critical Facilities from Flood Risk Areas
- Establish Emergency Shelters
- Elevate Roads or Bridges to Ensure Egress
- Develop Community Evacuation Plans
- Develop Site-Specific Evacuation Plans
- Establish Satellite Facilities in Areas Subject to Isolation

Public Education

- Newsletters
- Community Meetings
- Information Kiosks
- Web Site with Flood Risk Maps
- Education of Municipal Staff
- Leverage State and FEMA Education Programs
- Establish a Standing Committee or Board to Oversee Outreach

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Future Meeting Dates

- Walton Flood Commission
- Public Meetings – 1 in beginning and 1 near the end
- Others – Town and Village officials and staff

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Walton Flood Commission
March 20, 2014
Meeting Minutes

A meeting of the Walton Flood Commission was held on March 20, 2014 at 10 AM at the office of the DCSWCD. A sign-in sheet was circulated and the list of attendees was retained by DCSWCD.

Mr. David Murphy, P.E., CFM presented a power point slide show and then turned over the meeting for a general discussion. Discussion points during the power point presentation included the following:

- Water Street is the only access to the public water supply well. If the road were lost, new access to the well would be needed.
- A mobile phone tower is also located in the Water Street area.
- In general, the attendees would rather not lose Water Street, although the analysis could evaluate grading northward through the road.
- Attendees discussed the merits of having specific building information such as elevations and foundation/basement characteristics. This information could help determine whether a particular flood mitigation alternative is sufficient from one building to the next. For example, the boundary of inundation may move past one property but not its neighbor. A review of the building elevation data may show that this is acceptable. A grant may be available to complete elevation certificates, but that will not happen with sufficient time for this study. Stephen Dutcher may have some limited information, and will check.

Discussion points after the presentation included the following:

- The main goal of the project is to keep water off Delaware Street.
- A secondary goal is to figure out how to keep floodwaters from *diverting onto* Delaware Street upstream of the downtown area near Breaky Motors. Once the water gets onto Delaware Street, it has trouble getting back to the river.
- Concentrated flows down the side streets (Liberty Street, Townsend Street, Gardiner Place, and North Street) are also a problem during certain flood events. It would be good to find a way to convey this water to the river by removing some of the buildings in the path of this water, such as the 181 Delaware Street building. If this building were removed, it may be possible to create a conveyance channel in its footprint.
- Above a certain flood discharge and water surface elevation in the river, stormwater drainage near Breaky Motors will reverse direction as the outlet become more submerged.
- The Breaky Motors parking lot is reportedly fill material, and the rear of the building is also likely on fill material. One of the alternatives should involve re-grading this property.
- Long narrow buildings aligned perpendicular to the river are believed to be a problem. The bend in the floodway at the old Ford building and the pawn shop may be related to flood discharge hitting these buildings.
- In general, the project should attempt to mitigate river flooding before working up the tributaries.
- The school is in the East Brook SFHA.
- Flood depth grids are requested for this analysis.

- The Mayor would like the study to show where the future floodway might be. Similar to the main goal of the project (keeping water off Delaware Street), the commission would like to move the floodway off Delaware Street.
- The commission would like to look at lower floodplain elevations downstream of Kraft, as an effort to reduce flooding at Kraft. Mr. Murphy stated that could be done, but believes that a flood wall is the best option for Kraft.
- The Town and Village would like to move forward with some grading as soon as possible, in order to show progress with flood mitigation. Cost estimates are needed, as well as a location to move the material. About 17 acres are municipally owned and could be graded first.
- All agreed that a phased approach would be acceptable as long as the initial phases are effective and beneficial on their own.

The approach for the public meeting was discussed:

- The meeting does not need to include the basics of rivers and flooding. The public will understand most of that material, and if they don't understand it, DCSWCD can help with education.
- The public meeting should not show floodplain grading north of Water Street. Only grading south of Water Street should be discussed. Later meetings could discuss additional grading near Water Street.
- Specific businesses should not be mentioned at the initial public meeting.

Future meeting dates were set:

- April 10 – Walton Flood Commission
- April 24 – Public meeting (that week seems to be best, and Wednesday is not available)
- May 1 – Walton Flood Commission
- June 5 – Walton Flood Commission

After the meeting, the following discussions took place:

- Depiction of the 10, 50, and 100-year inundation areas will be helpful for the public meeting
- Additional cross sections should be cut between the sewer treatment plant and the Water Street businesses to help evaluate alternatives (especially those that affect Kraft). LiDAR could be used.
- A 200-foot radius of undisturbed land needs to be left around the well located at the end of Water Street.

MILONE & MACBROOM



Local Flood Analysis
Review of Alternatives

Walton Flood Commission Meeting
Village and Town of Walton

David Murphy, P.E., CFM





Walton Flood Commission and Delaware County Soil & Water Conservation District | May 1, 2014

Agenda

- Review Available Data
- Review FEMA Mapping and Model
- Preliminary Alternatives
- Future Data Collection and Modeling
- Approach for Initial Public Meeting
- Set Future Meeting Dates

MILONE & MACBROOM

FEMA Mapping and Model



MILONE & MACBROOM

FEMA Mapping and Model



MILONE & MACBROOM

FEMA Mapping and Model



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FEMA Mapping and Model

Cross Sections:

- 217033 – Fairgrounds
- 219011 – Family Dollar
- 219591 – Dollar General and Bluestone Biliards
- 219830 – Bank Buildings
- 219959 – Bridge (US side)
- 220051 – Gardiner Street
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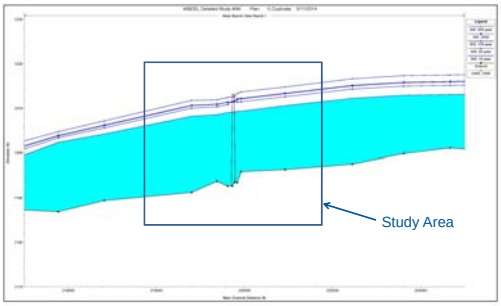
MILONE & MACBROOM

FEMA Mapping and Model



MILONE & MACBROOM

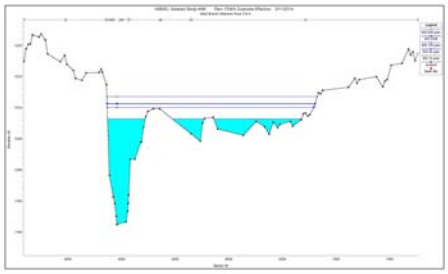
FEMA Mapping and Model



MILONE & MACBROOM

FEMA Mapping and Model

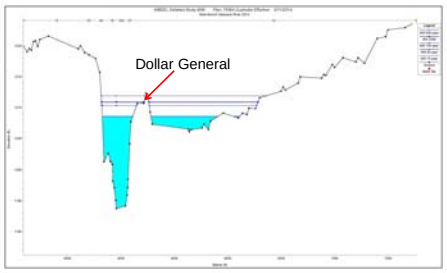
Cross Section 219011 - Family Dollar



MILONE & MACBROOM

FEMA Mapping and Model

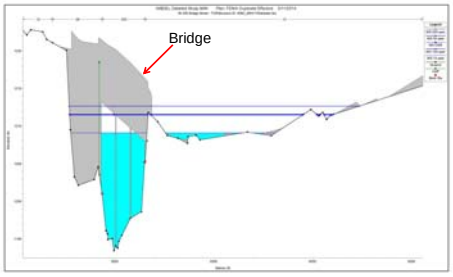
Cross Section 219591 – Dollar General & Bluestone Billiards



MILONE & MACBROOM

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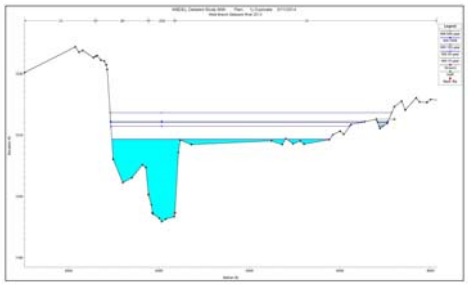
Cross Section 219959 – Bridge



MILONE & MACBROOM

FEMA Mapping and Model

Cross Section 220136 – Old Ford



MILONE & MACBROOM

Future Meeting Dates

- Walton Flood Commission?
- Public Meeting?
- Others – Town and Village officials and staff?

Milone & MacBroom

Alternative A

- Walton



Milone & MacBroom

Alternative A

- Walt



Milone & MacBroom

Alternative A

- Walt



Milone & MacBroom

Alternative A

- Walt



Milone & MacBroom

Alternative A

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Alternative A

- Walto



MILONE & MACBROOM

Alternative A

- Waltc



MILONE & MACBROOM

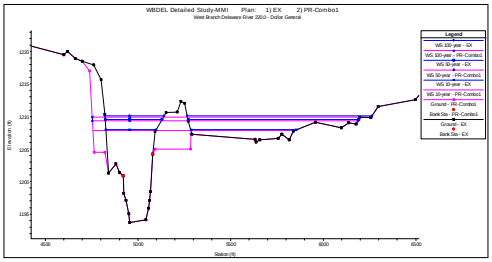
Combination 1



MILONE & MACBROOM

Combination 1

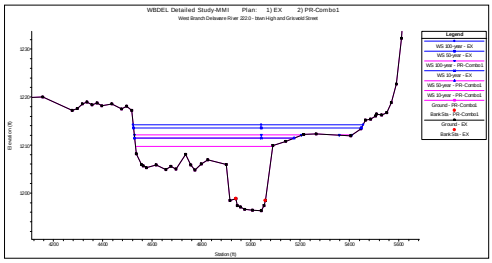
Cross Section 219591- Dollar General



MILONE & MACBROOM

Combination 1

Cross Section 221136 – Upstream of Breaky Motors



MILONE & MACBROOM

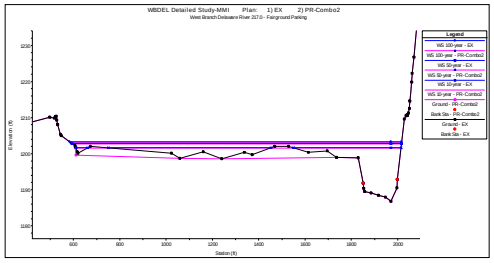
Combination 2



MILONE & MACBROOM

Combination 2

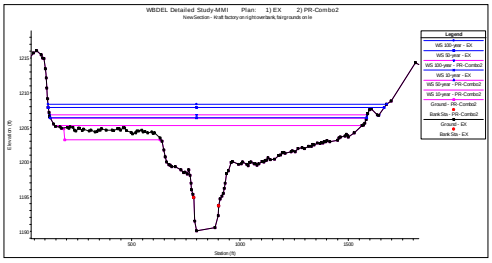
Cross Section 215987- Fairground Parking



MILONE & MACBROOM

Combination 2

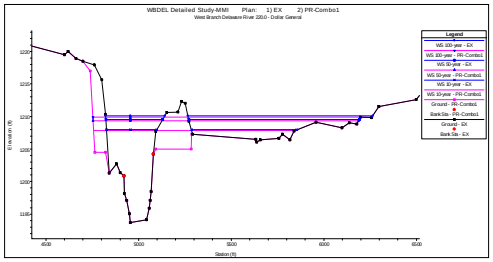
Cross Section 217808- Kraft Factory



MILONE & MACBROOM

Combination 2

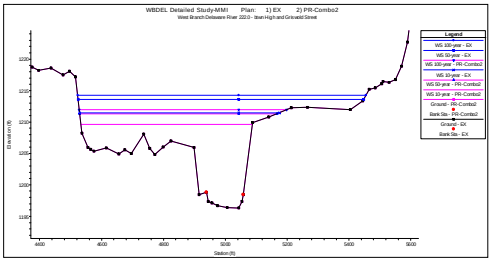
Cross Section 219591- Dollar General



MILONE & MACBROOM

Combination 2

Cross Section 221136- Upstream of Breaky Motors



MILONE & MACBROOM

Close Look at Dollar General

219591 WSE at Dollar General (immediately DS of Bridge Street)	Current/Existing	Combination 1	Combination 2
10-yr WSE	1207.97	1207.83	1207.32
50-yr WSE	1209.54	1209.34	1208.67
100-yr WSE	1210.11	1209.89	1209.17

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Close Look Where Water Leaves the River

221136 WSE near Griswold Street (where floodwaters may flow onto Delaware Street)	Current/Existing	Combination 1	Combination 2
10-yr WSE	1211.49	1209.75	1209.59
50-yr WSE	1213.57	1211.49	1211.33
100-yr WSE	1214.26	1212.10	1211.95

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Walton Flood Commission
May 1, 2014
Meeting Minutes

A meeting of the Walton Flood Commission was held on May 1, 2014 at 10 AM at the town hall. A sign-in sheet was circulated and the list of attendees was retained by DCSWCD.

Mr. David Murphy, P.E., CFM presented a power point slide show and then turned over the meeting for a general discussion. Discussion points included the following:

- Attendees requested that one more cross section be added; this section would correspond with the village/county parcel line immediately west of Dollar General.
- The town/village/county-owned land south of Water Street can be lowered below the water surface elevation of the 2-year storm. In this location, the water surface elevation of the 1.5-year storm would be acceptable. Anything lower could jeopardize the river channel.
- Attendees asked to check whether the flows from the tributaries were included in the discharges routed through the model.
- Alternatives may be grouped into short, intermediate, and long-term solutions as follows:
  - Short-Term:
    - Grading south of Water Street, not including Dollar General, to the 1.5-year water surface elevation
    - Flood relief culverts in bridge abutments
    - Return flow channels extending south from Delaware Street
  - Intermediate-Term:
    - Breaky Motors relocation and site modifications
  - Long-Term:
    - Dollar General relocation and grading
    - Bridge replacement
    - Lower fairgrounds to the 2-year water surface elevation
- Return flow channels may be possible in existing paved areas. The McDonalds parking lot is a good example.
- The Breaky Motors owner reportedly would like to be relocated to a site near the Subway restaurant outside the SFHA.
- Phil requested that we evaluate/model removal of the gravel bar at the bridge, and a high-flow channel through the east side of the fairgrounds.

After the meeting, the following discussions took place during field reconnaissance with Graydon and Phil:

- The eroding riverbank just upstream of the fairgrounds might be mentioned during the public meeting. Stabilizing the bank could be done in connection with grading south of Water Street.
- An eroding bank was also viewed at the fairgrounds.
- Various combinations of making channels through the fairgrounds were discussed.
- Ideally, grading at the fairgrounds could be balanced (cut and fill).
- East Brook and West Brook were viewed. Floodplain benches will be helpful for these tributaries.

DRAFT

- A re-alignment of the river at Breaky Motors should be evaluated. The sheet pilings could be removed and the river width could be increased. The remainder of the Breaky Motors site would then be lowered to the 2-year flood water surface elevation.
- The gravel bar at the bridge was viewed. Removal should be modeled.
- Graydon would like the modeler to determine which possible combinations of projects will keep floodwaters off Delaware Street for the 10, 25, 50, and 100-year storms. If the answer is that nothing can accomplish this goal, then the study should explain that.

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Local Flood Analysis
Public Information Meeting

Village and Town of Walton

David Murphy, P.E., CFM





Walton Flood Commission and Delaware County Soil & Water Conservation District | May 1, 2014

Purpose of Tonight's Workshop

- Explain the Local Flood Analysis (LFA) process
- Review the study area
- Introduce modeling concepts
- Review flood mitigation options
- Present preliminary modeling
- Gather any other ideas for flood mitigation
- Next steps

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The LFA Process

- Uniform across all communities yet able to be customized
- Collect input about flooding and flood damage from property owners, municipal officials and other stakeholders
- Build upon FEMA flood modeling efforts and the county hazard mitigation plan
- Identify and evaluate potential flood mitigation measures that protect water quality
- Through hydraulic modeling, assess potential magnitude of flood relief alternatives
- Refine alternatives through vetting of cost, feasibility, and public support
- Includes an implementation plan


Southbury plan could help flooded residents

Noting storm hazards can lead to federal aid



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Why Walton?

- Walton has been devastated by flooding, resulting in extensive damage
- Critical infrastructure, businesses, and homes remain vulnerable
- Located within the New York City public water supply watershed
- LFA funding provides a unique opportunity to assess the watershed under current conditions and plan for the future





Typical Water Quality Impacts of Flooding

- Mobilization of sediment
- Mobilization of pollutants
  - Basements and basement utilities
  - Gasoline service stations
  - Fuel oil
  - Swimming pools
  - Waste storage sites
  - Septic Systems
  - Vehicles
  - Materials stored at commercial and industrial sites




Project Advisory Committee

- Walton Flood Commission
  - Village
  - Town
  - Delaware County Soil & Water Conservation District
- New York City Department of Environmental Protection
- Milone & MacBroom, Inc. as consultant

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FEMA Mapping and Model



MILONE & MACBROOM

FEMA Mapping and Model



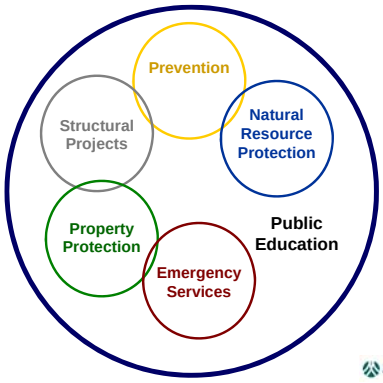
MILONE & MACBROOM

FEMA Mapping and Model



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Types of Flood Mitigation



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Flood Mitigation Strategies



Flood Mitigation



Structural Projects

- Replace Bridges and Culverts
- Remove In-Stream Dams
- Remove Obstructions
- Upstream Detention
- Install Stormwater Systems
- Create Floodways
- Enlarge Channels
- Reduce Flow Resistance
- Install Levees
- Install Flood Walls

Property Protection

- Wet Floodproofing
- Dry Floodproofing
- Elevate Buildings
- Relocate Buildings
- Secure Utilities
- Anchor Floatables
- Remove Hazardous Materials
- Re-Grade Properties
- Purchase Flood Insurance
- Join the Community Rating System (CRS)

Prevention

- Modify Zoning
- Modify Comp Plan
- Stormwater Management Regulations
- Increase Flood Damage Prevention Standards
- Freeboard
- Low Impact Development
- Minimize Impervious Cover

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Flood Mitigation Strategies

Flood Mitigation



Natural Resources

- Acquire or Preserve Floodplain Land
- Acquire and Remove Structures from Floodplains and Convert to Open Space
- Acquire or Preserve Other Lands
- Increase Wetland Storage
- Re-Connect Streams to Floodplains

Emergency Services

- Build Local Capacities to Respond
- Move Critical Facilities from Flood Risk Areas
- Establish Emergency Shelters
- Elevate Roads or Bridges to Ensure Egress
- Develop Community Evacuation Plans
- Develop Site-Specific Evacuation Plans
- Establish Satellite Facilities in Areas Subject to Isolation

Public Education

- Newsletters
- Community Meetings
- Information Kiosks
- Web Site with Flood Risk Maps
- Education of Municipal Staff
- Leverage State and FEMA Education Programs
- Establish a Standing Committee or Board to Oversee Outreach

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Main Goals in Walton

- 1. Keeping water from diverting onto Delaware Street at Breaky Motors
- 2. Keeping water from reaching Delaware Street from the Water Street area
- 3. Keeping water off Kraft

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Ideas for Flood Mitigation in Walton

- Modify bridges?
- Remove channel constrictions?
- Create floodplains and floodplain benches?
- Home or business relocation?
- Home or business elevation?
- Create bypass channels?
- Modify regulations or zoning?
- Join CRS and encourage purchase of insurance?

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Available Data

- FEMA Flood Insurance Study (FIS):
  - 10% annual chance = 17,793 cfs
  - 2% annual chance = 25,031 cfs
  - 1% annual chance = 28,137 cfs
  - 0.2% annual chance = 35,526 cfs
- FEMA Hydraulic Model
- LiDAR Topography from NYCDEP (2009 with recent updates)
- USGS Report of 2006 Flood and Other Reports
  - Flood Discharge = 28,600 cfs (RI = 86 years)
- Stream Management Plan

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FEMA Mapping and Model

Cross Sections:

- 217033 – Fairgrounds
- 219011 – Family Dollar
- 219591 – Dollar General and Bluestone Biliards
- 219830 – Bank Buildings
- 219959 – Bridge (US side)
- 220051 – Gardiner Street
- 220136 – Old Ford / Another Mans' Treasure
- 221136 – Upstream of downtown



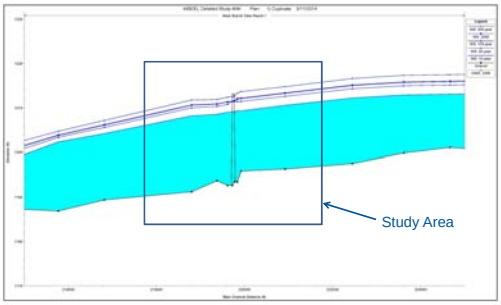
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FEMA Mapping and Model



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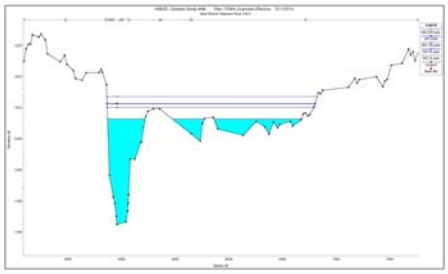
FEMA Mapping and Model



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FEMA Mapping and Model

Cross Section 219011 - Family Dollar



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FEMA Mapping and Model

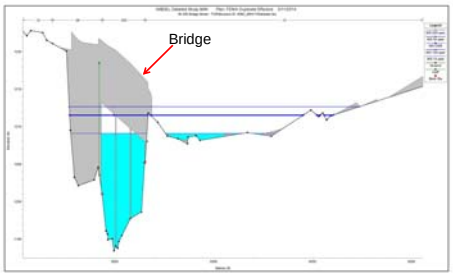
Cross Section 219591 – Dollar General & Bluestone Billiards



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FEMA Mapping and Model

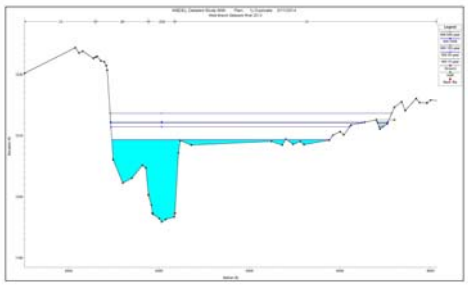
Cross Section 219959 – Bridge



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FEMA Mapping and Model

Cross Section 220136 – Old Ford

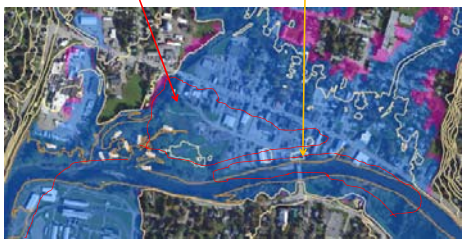


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Preliminary Alternatives

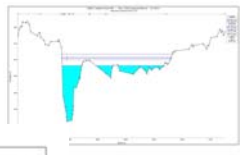
Re-grade the floodplain south of Water Street maximizing the potential to lower WS elevations on Delaware Street

Re-grade the floodplain north and south of the bridge. Remove bridge to see effects of bridge and filled approach on the south side.



Re-Grade Floodplain South of Water Street

Cross Section 219011 – Family Dollar

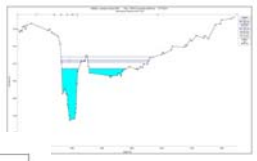


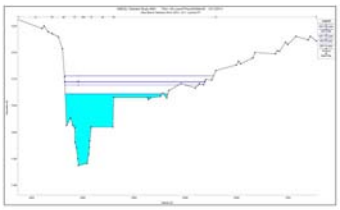


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Re-Grade Floodplain South of Water Street

Cross Section 219591 – Dollar General & Bluestone Billiards

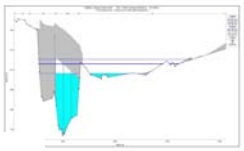


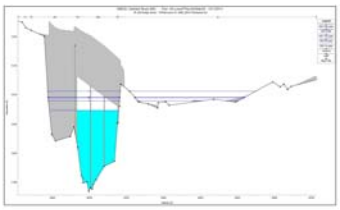


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Re-Grade Floodplain South of Water Street

Cross Section 219959 – Bridge

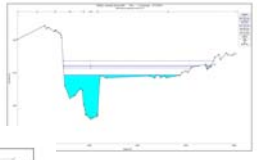


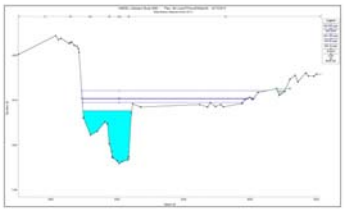


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Re-Grade Floodplain South of Water Street

Cross Section 220136 – Old Ford





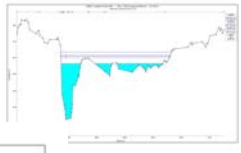
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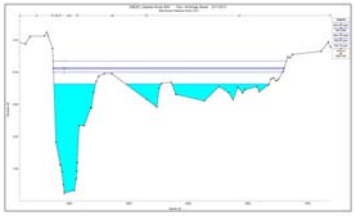
Re-Grade Floodplain South of Water Street



Remove Bridge and Associated FP Grading

Cross Section 219011 – Family Dollar

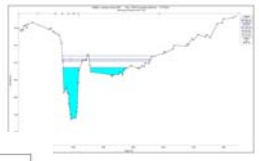




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Remove Bridge and Associated FP Grading

Cross Section 219591 – Dollar General & Bluestone Billiards

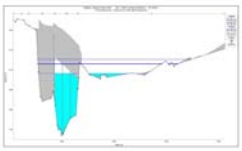




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Remove Bridge and Associated FP Grading

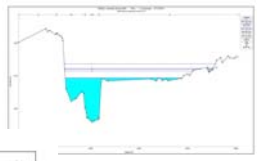
Cross Section 219959 – Bridge

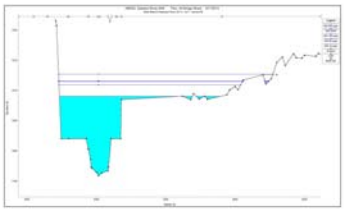


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Remove Bridge and Associated FP Grading

Cross Section 220136 – Old Ford





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Preliminary Alternatives



Future Data Collection and Modeling

- Building elevations and types
- Bridge characteristics and specific elevation data
- Refine boundaries of alternatives – for example, leave Water Street emergency access or remove the road?
- Other ideas from Walton Flood Commission

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Next Steps

- Walton Flood Commission
- Public Meetings – 1 in beginning and 1 near the end
- Others – Town and Village officials and staff

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Public Information Meeting
May 1, 2014
Meeting Minutes

A public meeting was held on May 1, 2014 at 6:30 PM at the Walton High School. Mr. David Murphy, P.E., CFM presented a power point slide show and then turned over the meeting for a general discussion. Discussion points included the following:

- An attendee asked for a definition of a floodplain bench and then asked why bridge replacement can help lower flood risk.
- An attendee asked whether lowering the floodplain on the south side of the river could benefit properties on the north side.
- The owner of Breaky Motors offered several comments:
  - Debris gets caught in bridges, which makes flooding worse.
  - The gravel bar at the main bridge block part of the opening of this bridge.
  - There has been a lack of maintenance in the tributaries. All of the bridges along the tributaries were blocked in the 2006 flood, making flood damage worse.
  - Although it is recognized that this is not cost effective, a bypass channel that cuts off the bend in the river would help the downtown area.
  - Insurance rates have increased sharply for his property.
  - Removing utilities from basements is a good idea, but filling basements may lead to increased heating costs.
  - Rainfall records were presented, with a conclusion statement that the amount wasn't as crucial as the intensity. Impervious surfaces have increased the "flush" and debris has made flooding worse.
- If stone walls are removed from the tributary banks, floodplain benches could be constructed. These benches would help debris to not become clogged in bridges.
- An attendee indicated that it was a good idea to relocate Breaky Motors and remove the obstruction in the river.
- Lower flood levels could help reduce flood insurance premiums.
- Walton Town Manager Bruce Dolph would like to find more ways to generate interest and boost attendance at meetings like this one.
- The appeals period for the new FEMA mapping in the Town of Walton is closing soon.
- An attendee asked what can be done to mitigate flooding of homes.
- An attendee asked if planting more trees could help reduce flooding by lowering groundwater levels through the evapotranspiration process.
- A suggestion was made to look in different places in the village to compare and contrast where changes in water surface elevations will matter most.
- Another suggestion was made to consider more frequent floods and see what the benefits of various projects might be. These results may be more important than the 100-year flood.
- Attendees briefly discussed the dates of previous floods in Walton.
- One attendee explained that the old railroad grade was on a berm. Did that berm affect flooding or reduce flooding in the downtown area?
- Attendees agreed that making floodplains might be the best approach for flood mitigation.
- Attendees asked whether any projects would be implemented this year.
- Could culverts be installed in the bridge rather than replacing the whole bridge?

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- Could the area south of Water Street be lowered and then made into ball fields? If so, people might have a stronger interest. Trails and river access are also possibilities. An attendee noted that a recreational plan was prepared for the land south of Water Street about 12 years ago. This plan could be reviewed.

In addition, Stephen Dutcher presented information about flood insurance reform and the Community Rating System (CRS).

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Walton Technical Group
June 17, 2014
Meeting Minutes

A meeting was held on June 17, 2014 at 10:30 AM at the office of the DCSWCD. Attendees included Graydon Dutcher, Jessica Rall, and Tom Mallory from DCSWCD; David Murphy and Jessica Louisis from Milone & MacBroom, Inc.; and Phil Eskeli from NYCDEP.

Attendees reviewed the modeling presented on March 20 and the modeling presented on May 1. Discussion points included the following:

- Water Street is likely acting like a berm and holding floodwaters that escape from the river onto Delaware Street. Flood waters cannot flow back to the river. A grading/floodplain bench project should include lowering the road as needed.
- A grant has been secured to demolish the "Reporter" building (181 Delaware Street). Once demolished, the flood relief channel can be constructed there. This will also help direct flood waters back to the river.
- The October 1 flood of 19,700 cfs is a well-documented event that caused water to spill onto Delaware Street near Breaky Motors. However, the inundation did *not* extend downstream past the old feed store. This is an important point that was not clear after the last meeting. MMI has been modeling to keep all water off Delaware Street for the 10-year storm, but a small lobe of inundation at 19,700 cfs may be acceptable.
- The "great restriction" in the floodplain was discussed:
  - This is the pinch point between Kraft and South Street.
  - Is it feasible to actually make grade changes here? It may be more feasible on the north side of the river than the south side.
  - However, the triangle of land on the north side of the river is the site where Breaky Motors may relocate. Would part of the new Breaky Motors site need to be acquired? Would it be feasible to approach the owner of the business and offer to relocate his business but also make it clear that the new site would be slightly smaller than originally anticipated, or that the rear of the new site would be re-graded to make a floodplain?
  - Another important consideration is whether multiple parcels of land would need to be acquired to smooth out the corner on the south side of the river at South Street.
  - Overall, minimizing land acquisitions may be prudent.
- Alternatives may be grouped into short and long-term solutions as follows[1]:
  - Short-Term:
    - Grading south of Water Street, not including Dollar General, to the 1.5-year water surface elevation
    - Lower Water Street so it does not act as a berm
    - Return flow channels extending south from Delaware Street
    - Breaky Motors site restoration
  - Long-Term:
    - Dollar General relocation and grading
    - Bridge replacement

[1] This list differs from the list developed at previous Walton Flood Commission meetings

DRAFT

- The fairgrounds buildings could be moved eastward and the lower floodplain could be created near the bend. Parking could be sited in the new lowered floodplain. Fairgrounds grading could be linked up with any of the short and long-term alternatives.
- Evaluations should continue as outlined in the table below.
- David reminded attendees that cost effectiveness could vary widely for some of the alternatives due to the high costs.
- Proposed conditions should be sketched on cross section 219011.

	Short Term	**Intermediate Term**	**Long Term**
A	Base alternatives	Base alternatives	Base alternatives
B	Base alternatives + grading to address the constriction*	Base alternatives + grading to address the constriction*	Base alternatives + grading to address the constriction*
C	Base alternatives + grading to address the constriction* + fairgrounds grading**	Base alternatives + grading to address the constriction* + fairgrounds grading**	Base alternatives + grading to address the constriction* + fairgrounds grading**

*If grading to relax the constriction does not help reduce water surface elevations, it should not be carried forward to the intermediate and long-term combinations

**Lower floodplain at the bend or lower floodplain on the east side of the property – both to be evaluated

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Local Flood Analysis
Review of Additional Alternatives







Walton Flood Commission Meeting

Village and Town of Walton

David Murphy, P.E., CFM

Walton Flood Commission and Delaware County Soil & Water Conservation District | July 17, 2014

Agenda

- Review Additional Alternatives
- Future Analysis
- Set Future Meeting Dates

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Alternatives Presented Today

- Short-Term
  - ✓ Lower the floodplain south of Water Street
  - ✓ Relocate Breaky Motors and restore site
- Long-Term
  - ✓ Lower the floodplain at Dollar General
  - ✓ Replace bridge with a 380' span and two piers
  - ✓ Additional floodplain work related to bridge and connecting through to Water Street area

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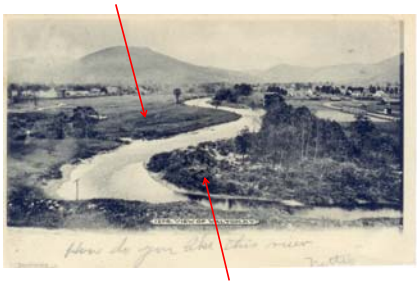
Variations of the Alternatives

- A
  - ✓ Short and Long-Term
- B
  - ✓ Short and Long-Term
  - ✓ Grading north of More Avenue
- C
  - ✓ Short and Long-Term
  - ✓ Grading north of More Avenue
  - ✓ Fairgrounds floodplain improvement

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But First, a Step Back in Time to 1906

Floodplain south of Water Street



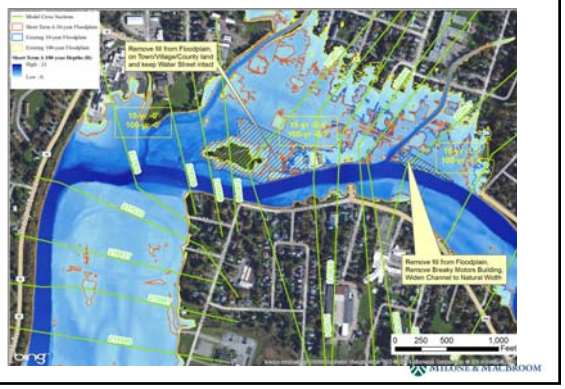
Floodplain at the Fairgrounds

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Short Term A



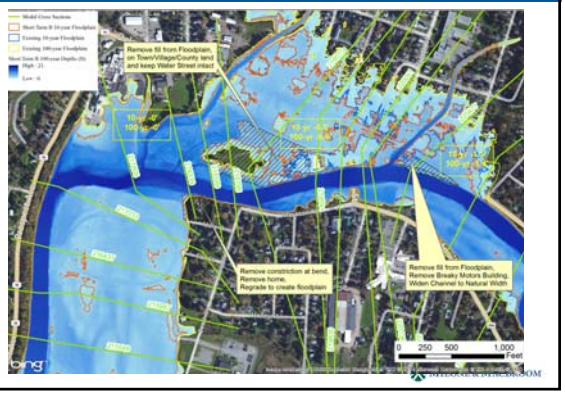
Short Term A



Short Term B



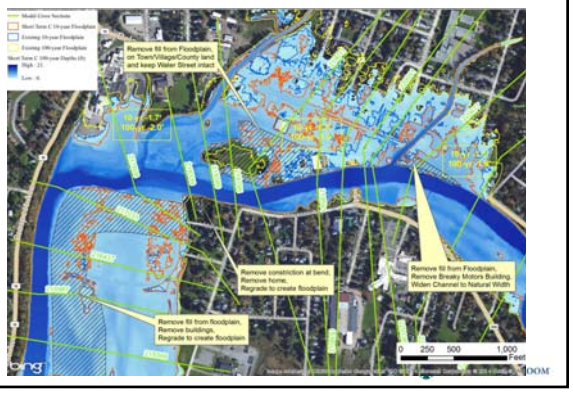
Short Term B



Short Term C



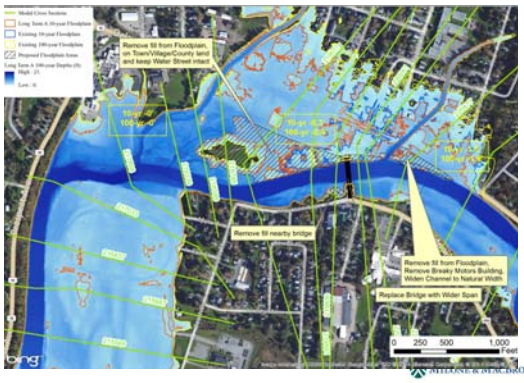
Short Term C



Long Term A (similar to "Combo 1" of 5/1/14)



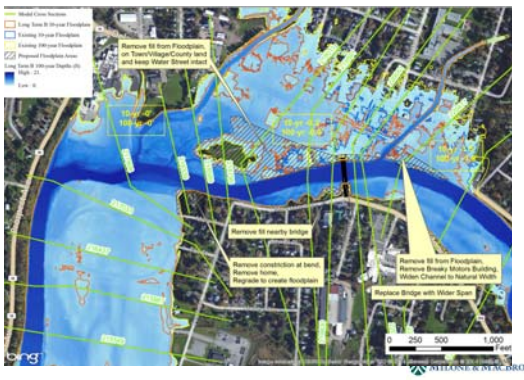
Long Term A (similar to "Combo 1" of 5/1/14)



Long Term B



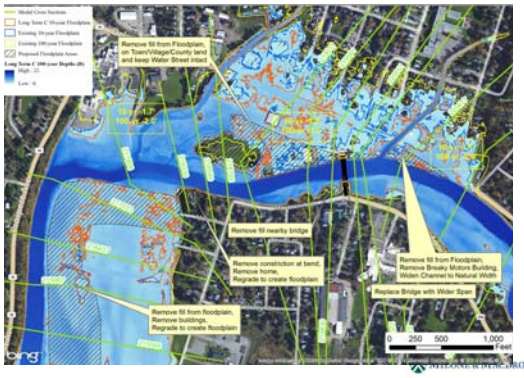
Long Term B



Long Term C (similar to "Combo 2" of 5/1/14)



Long Term C (similar to "Combo 2" of 5/1/14)



Close Look at Kraft Factory

Cross Section 217808 at Kraft Factory

WSE	EXISTING	SHORT TERM A	SHORT TERM B	SHORT TERM C	LONG TERM A	LONG TERM B	LONG TERM C
10-year	1206.41	1206.41	1206.41	1204.68	1206.41	1206.41	1204.68
50-year	1207.84	1207.84	1207.84	1205.87	1207.84	1207.84	1205.87
100-year	1208.35	1208.35	1208.35	1206.31	1208.35	1208.35	1206.31

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Close Look at Dollar General

Cross Section 219591 at Dollar General (immediately downstream of Bridge Street)

WSE	EXISTING	SHORT TERM A	SHORT TERM B	SHORT TERM C	LONG TERM A	LONG TERM B	LONG TERM C
10-year	1207.97	1207.56	1207.5	1206.72	1207.72	1207.66	1206.79
50-year	1209.54	1208.93	1208.83	1207.91	1209.24	1209.14	1208.14
100-year	1210.11	1209.41	1209.29	1208.32	1209.8	1209.68	1208.63

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Close Look Where Water Leaves the River

Cross Section 221136 Near Griswold Street (where water may flow onto Delaware Street)

WSE	EXISTING	SHORT TERM A	SHORT TERM B	SHORT TERM C	LONG TERM A	LONG TERM B	LONG TERM C
10-year	1211.49	1210.21	1210.19	1209.96	1210.01	1209.99	1209.76
50-year	1213.57	1212.15	1212.13	1211.97	1211.86	1211.83	1211.67
100-year	1214.26	1212.85	1212.83	1212.67	1212.48	1212.46	1212.3

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Future Meeting Dates

- Walton Flood Commission?
- Public Meeting?
- Others – Town and Village officials and staff?

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Walton Flood Commission
July 17, 2014
Meeting Minutes

A meeting of the Walton Flood Commission was held on July 17, 2014 at 10 AM at the DCSWCD office. A sign-in sheet was circulated and the list of attendees was retained by DCSWCD.

Mr. David Murphy, P.E., CFM presented a power point slide show and then turned over the meeting for a general discussion. Discussion points included the following:

- Attendees were interested in the benefit cost analysis (BCA) process. Mr. Murphy described how the process unfolded in Lexington and stated that the per-home benefits had considerable variation. In that town, only 20+ homes were providing the total benefit. However, it could be much greater in Walton with almost 200 buildings.
- Town Supervisor Bruce Dolph asked that the BCR for Breaky Motors be completed soon in order to maintain the momentum for relocating the business. The relocation cost will be minimal. He will provide damage figures from Breaky Motors.
- Supervisor Dolph provided some commentary about the buyout program and asked how water quality will be factored into the BCA. Mr. Murphy indicated that this would be a qualitative factor at this point. Supervisor Dolph noted that there will be significant water quality benefits from moving businesses like Breaky Motors, where cars are flooded. Mr. Murphy added that the new version of the BCA tool can provide benefits for open space rather than simply providing benefits from the removal of the building that was on the open space; this is similar to providing water quality benefits.
- Phil Eskeli reminded the attendees that floodproofing and elevations are also to be evaluated as part of the LFA. These are important tools for flood mitigation.
- Supervisor Dolph and Mayor Ed Snow discussed the need to keep tax base in the town and village.
- A discussion about the fairgrounds took place. Although the fairgrounds board may view this LFA as a key opportunity to do some master planning and make improvements, attendees understand that the board might initially balk at these ideas. Others noted that the fairgrounds board has been displeased with not being eligible for FEMA assistance, and that moving their buildings might eliminate that problem.
- Mayor Snow remains concerned that people do not see action. Graydon Dutcher said that the LFA will be wrapped up this fall. Grants would be forthcoming in the winter (probably after November). Floodplain creation south of Water Street could be underway in 2015. The demolition of the old Reporter building and construction of return channels could also happen in 2015. Supervisor Dolph has cost estimates for this demolition.
- Mayor Snow is concerned about the next flood. Progress needs to be made before then.
- Steven Dutcher asked about the feed store's risk changing after Breaky Motors has been relocated. The concern is that Breaky Motors served as a flood barrier. Mr. Murphy noted that the wider restored river channel might actually decrease velocities for more frequent floods, which would be a benefit to the feed store property. This could probably be addressed through design; the feed store property could be reinforced during the restoration of the river channel and banks.
- Mr. Murphy reminded the County Planning staff that assessor/parcel data was needed.
- The next meeting will be on August 21, 2014. The BCA will be discussed.
- A meeting with the fairgrounds board might be planned for mid-September.

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Local Flood Analysis Review of Benefit Cost Analysis







Walton Flood Commission Meeting

Village and Town of Walton

David Murphy, P.E., CFM

Walton Flood Commission and Delaware County Soil & Water Conservation District | August 21, 2014

Agenda

- Recap the alternatives that were advanced to Benefit Cost Analysis (BCA)
- Description of BCA
- BCA approach
- BCA results
- Comparison to potential costs
- Next steps

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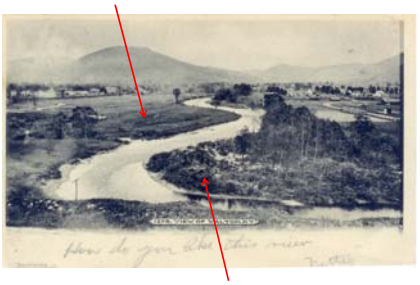
Alternatives Advanced to BCA

- Short-Term
  - ✓ Lower the floodplain south of Water Street
  - ✓ Relocate Breaky Motors and restore site
  - ✓ With and without fairgrounds floodplain
- Long-Term
  - ✓ Extend the lowered floodplain through Dollar General
  - ✓ Replace bridge with a 380’ span and two piers
  - ✓ Additional floodplain work related to bridge and connecting through to Water Street area
  - ✓ With and without fairgrounds floodplain

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Alternatives Advanced to BCA

Floodplain south of Water Street



Floodplain at the Fairgrounds

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Short Term A



Short Term C



Long Term A (similar to "Combo 1" of 5/1/14)



Long Term C (similar to "Combo 2" of 5/1/14)



Description of BCA

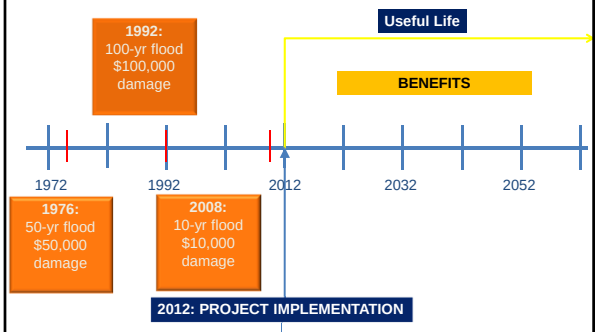
- What is BCA?
  - ✓ Process of determining the BCR
  - ✓ A mitigation project cannot be funded by FEMA unless it has a BCR greater than 1.0
    - Benefits = Damages Avoided, units of $
    - Benefits over the life span must exceed project cost
  - ✓ FEMA's BCA tool must be used

Description of BCA



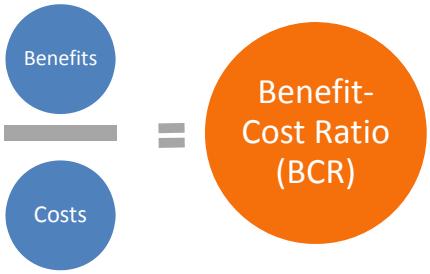
Graphic courtesy of CDM Smith

Description of BCA



Graphic courtesy of CDM Smith

Description of BCA



Graphic courtesy of CDM Smith

Description of BCA

- ✓ Many good projects that reduce flood damage and protect water quality do not have BCR >1.0
  - These projects can be funded by someone or something that is not FEMA
- ✓ However, we can also use BCA to evaluate projects that may not be appropriate for FEMA funding due to timing, logistics, project cost, or other factors
  - The Local Flood Analysis (LFA) process is a good example

Description of BCA

- The BCA tool includes six modules:
  - ✓ Flood
  - ✓ Hurricane Winds
  - ✓ Wildfire
  - ✓ Tornado
  - ✓ Earthquake
  - ✓ Damage Frequency



Description of BCA

- The Flood Module determines long-term benefits (reduced damages) from the frequency analysis that is embodied in the Flood Insurance Study, on its profiles, and on the FIRMs
- The Damage Frequency Module determines long-term benefits (reduced damages) by analyzing the damages from more than one event with different recurrence intervals (frequencies)

Description of BCA

General Guidelines

- For Flood module: we need the FIS, FIRM, and elevations
- For Damage Frequency module: we need knowledge of hydrology, recurrence intervals, and calculating precipitation event frequencies and flood event frequencies
- Benefits ($) = Avoided damages and loss of function ($)
- For the Damage Frequency module:
  - ✓ Reducing damage to utilities, roads, and critical facilities will help cost effectiveness
  - ✓ Damage must be frequent to generate BCRs >1.0
  - ✓ Damage from one extreme event will not typically help a BCR > 1

Think about it this way: would we design a project for the 500-year flood? If not, should a mitigation project be funded for an event this rare?

Description of BCA

General Guidelines

- When using the Damage Frequency Module:
  - ✓ Search for local and small-scale intense rain and flood events to help build a record of damage
  - ✓ Traffic counts and long detour times may help and should always be considered
  - ✓ Losses of functions may be substantial in small communities (public works, highway, or the limited utilities that may be available)
  - ✓ Consider tallying labor hours and expenses to recover from the previous damaging events





Description of BCA

Important Changes in 2013-2014

1. Standby power supplies are eligible
2. Acquisitions are automatically cost-effective if <$275,000 and located in the SFHA
3. Elevations are automatically cost-effective if <$176,000 and in located the SFHA
4. Open space and riparian area benefits can be included in the BCR once it reaches 0.75 or greater
5. Non-stationary hazards (i.e., progressive bank erosion) can be evaluated more effectively rather than waiting for the "failure/no failure" scenario
6. Volunteer time can be counted for tallying avoided response
7. Social benefits (avoided mental health issues) can be counted
8. Sea level rise can be considered

BCA Approach

- Breaky Motors was handled as an acquisition/relocation
- All other properties were handled as flood reductions with a project life span of 50 years
- Avoided damages at the fairgrounds were not used (this has the potential to add to total benefits)
- Annual revenue was included *when we had it available*
  - ✓ Breaky Motors
  - ✓ Big M Supermarket
- Building values = total assessed values – land assessments
- Default figures were used for all properties:
  - ✓ Depth-damage curves
  - ✓ Contents were figured as a percentage of building values for different kinds of non-residential buildings

BCA Approach

- Remember that the BCA tool tries to give us BCRs
- To derive benefits only, project costs were artificially entered as $1 for each building:

  BCR = Benefit/Cost
  Benefit = BCR by making Cost = 1

- *Then the benefits can be summed outside the BCA tool*

BCA Results

Breaky Motors

- The cost estimate is for the acquisition and basic site restoration
- Floodplain grading and riverbank restoration are not included, as these are components of the larger alternatives
- Main goal is to determine if simply moving the business is cost-effective
- Secondary goal is to derive the associated benefit of making the site vacant, so it can be added to the other benefits throughout the village
- The BCA does not need post-project water surface elevations; it needs only the current water surface elevations and the FFE of 1208'
- Other key inputs:
  - ✓ Assessed value is $376,772 (both parcels)
  - ✓ Annual revenue of $1.19 million from parts and service business was based on the figure of $99,000 for lost business after the 2006 flood
- BCR = 1.15

BCA Results

Big M Supermarket

- Handled as a reduction in flood water surface elevations
- The BCA needs post-project water surface elevations for each alternative
- Other key inputs:
  - ✓ Building value $1.46M
  - ✓ Lost revenue from 2006 flood was $750,000 for 19 days (annual $14M)
- Actual damage figures were available from Big M for a very rough verification (are the results reasonable?)
  - ✓ Lost inventory from 2006 flood was $700,000
  - ✓ Repairs to building and contents from 2006 flood totaled $631,000
  - ✓ Repairs to building and contents from 2011 flood were minimal
  - ✓ ***BCA program calculated average annual damages of $396,366 over a period of 50 years – this is in the ballpark between the 2006 and 2011 flood damages***

BCA Results

Big M Supermarket

- Benefits:
  - ✓ $3,545,983 for short term without fairgrounds floodplain
  - ✓ $4,813,532 for short term with fairgrounds floodplain
  - ✓ $3,545,983 for long term without fairgrounds floodplain
  - ✓ $4,879,328 for long term with fairgrounds floodplain
- Why?
  - ✓ 10-year flood WSE = 1207.47'
  - ✓ FFE = 1208'
  - ✓ 50-year flood WSE = 1209.07'
  - ✓ 100-year flood WSE = 1209.66'
  - ✓ 500-year flood WSE = 1211.01'

BCA Results

Other Non-Residential Properties

- Handled as a reductions in flood water surface elevations
- The BCA uses post-project water surface elevations for each alternative
- Annual revenue, lost income, etc. were not readily available
- Benefits for Kraft alone:
  - ✓ Negligible for short and long term without fairgrounds floodplain
  - ✓ $6.5M for short and long term with fairgrounds floodplain
- Benefits for all non-residential properties together:
  - ✓ $4.41M for short term without fairgrounds floodplain
  - ✓ $13.82M for short term with fairgrounds floodplain
  - ✓ $4.50M for long term without fairgrounds floodplain
  - ✓ $14.23M for long term with fairgrounds floodplain

BCA Results

Residential Properties

- Handled as a reductions in flood water surface elevations
- The BCA uses post-project water surface elevations for each alternative
- Benefits:
  - ✓ $0.84M for short term without fairgrounds floodplain
  - ✓ $1.40M for short term with fairgrounds floodplain
  - ✓ $1.05M for long term without fairgrounds floodplain
  - ✓ $1.61M for long term with fairgrounds floodplain

Summary Table of BCA Results

	Short Term without Fairgrounds	Long Term without Fairgrounds	Short Term with Fairgrounds	Long Term with Fairgrounds
Residential Totals	$844,637	$1,054,660	$1,399,179	$1,605,099
Non-Residential Totals	$4,406,665	$4,499,325	$13,815,116	$14,225,432
All Properties	**$5,251,302**	**$5,553,985**	**$15,214,295**	**$15,830,531**

Comparison to Potential Costs

Item	Individual Cost Estimate
Lower the floodplain south of Water Street	$2.2M
Relocate Breaky Motors and restore site	$0.8M
Extend the lowered floodplain through Dollar General	$1.1M
Replace bridge with a 380' span and two piers	$5.0M
Additional floodplain work related to bridge and connecting through to Water Street area	$0.7M
Fairgrounds floodplain	$5.1M

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Comparison to Potential Costs

Alternative	Cost Estimates	Total Benefits	BCR > 1?
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site	$3.0M	$5.25M	Yes
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Create/lower the fairgrounds floodplain	$8.1M	$15.21M	Yes
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area	$9.8M	$5.50M	No
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area Create/lower the fairgrounds floodplain	$14.9M	$15.83M	Yes

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What is NOT in the BCA?

- Lost revenue for all businesses except Big M and Breaky Motors
- Contents of Kraft may not be well-represented by defaults
- Benefits associated with relocating fairgrounds buildings to the east side of the site to avoid future damages
- Street cleanup and recovery
- Detours
- All of these things could increase benefits further

Next Steps and Future Meeting Dates

- Meetings
  - ✓ Walton Flood Commission?
  - ✓ Public Meeting?
  - ✓ Others?
- Report and Implementation Plan
- Overall schedule





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Walton Flood Commission
August 21, 2014
Meeting Minutes

A meeting of the Walton Flood Commission was held on August 21, 2014 at 10 AM at the DCSWCD office. A sign-in sheet was circulated and the list of attendees was retained by DCSWCD.

Mr. David Murphy, P.E., CFM presented a power point slide show focused on benefit-cost analysis (BCA) and the BCA results for the Walton flood mitigation alternatives that were advanced forward from the July 17 flood commission meeting. Questions and comments about the cost estimates, BCA, and the presentation include the following:

- The $2.2 million cost estimate for the Water Street floodplain excavation was discussed. Although it is much higher than the village and town had believed, DCSWCD advised that it be kept at the higher figure.
- The red cross-hatch in the graphics is difficult to see and needs to be changed.

General discussion points included the following:

- It is understood that some properties may be removed from the 1% annual chance flood risk zone if mitigation projects are constructed. However, the LFA will need recommendations for the properties that remain in the 1% annual chance floodplain.
- If homes are elevated, they will need to be elevated two feet above the base flood elevation (BFE).
- Will the existing regulatory BFE be used to guide elevations of buildings, or will a new SFHA be established through a letter of map revision (LOMR)?
- The grant for Delaware Street includes elevation of building utilities. The LFA could help advise this aspect of the grant.
- Attendees agree that it is time to meet with the County Fair Board. These meetings will be scheduled in September. The Walton Flood Commission plans to point out the many potential benefits associated with long-term potential flood mitigation projects on the fairgrounds. For example, the Fair Board could develop and implement a new master layout plan.
- The public meeting will occur after discussions with the Fair Board.
- The LFA document will follow the public meeting. The document will need to be adopted locally.

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Local Flood Analysis Project Review and Report Outline







Walton Flood Commission Meeting

Village and Town of Walton

David Murphy, P.E., CFM

Walton Flood Commission and Delaware County Soil & Water Conservation District | November 6, 2014

Agenda

- Recap the alternatives that were advanced to this point
- BCA discussion
- Individual property options
- Report outline
- Next steps

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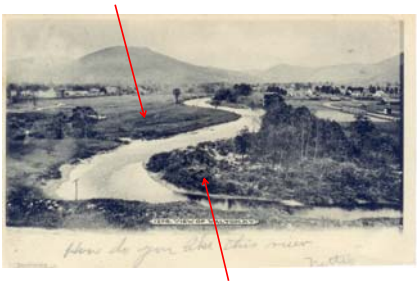
Alternatives Advanced to Consideration

- Short-Term
  - ✓ Lower the floodplain south of Water Street
  - ✓ Relocate Breaky Motors and restore site
  - ✓ With and without fairgrounds floodplain
- Long-Term
  - ✓ Extend the lowered floodplain through Dollar General
  - ✓ Replace bridge with a 380' span and two piers
  - ✓ Additional floodplain work related to bridge and connecting through to Water Street area
  - ✓ With and without fairgrounds floodplain

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Alternatives Advanced to BCA

Floodplain south of Water Street



Floodplain at the Fairgrounds

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Short Term A



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Short Term C



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Long Term A



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Long Term C



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Benefit-Cost Analysis (BCA) Approach

- Breaky Motors and the highway garage were handled as acquisitions/relocations
- Other properties were handled as flood reductions with a project life span of 50 years
- Avoided damages at the fairgrounds were not used (this has the potential to add to total benefits)
- Annual revenue was included *when we had it available*
  - ✓ Breaky Motors
  - ✓ Big M Supermarket
- Building values = total assessed values – land assessments
- Default figures were used for all properties:
  - ✓ Depth-damage curves
  - ✓ Contents were figured as a percentage of building values for different kinds of non-residential buildings

Potential Costs

Item	Individual Cost Estimate
Lower the floodplain south of Water Street	$2.2M
Relocate Breaky Motors and restore site	$0.8M
Extend the lowered floodplain through Dollar General	$1.1M
Replace bridge with a 380' span and two piers	$5.0M
Additional floodplain work related to bridge and connecting through to Water Street area	$0.7M
Fairgrounds floodplain	$5.1M

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Comparison of Benefits and Potential Costs

Alternative	Cost Estimates	Total Benefits	BCR > 1?
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site	$3.0M	$2.2M	No
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Create/lower the fairgrounds floodplain	$8.1M	$12.1M	Yes
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area	$9.8M	$2.6M	No
Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area Create/lower the fairgrounds floodplain	$14.9M	$12.8M	No

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What is NOT in the BCA? [A Path Forward…]

- Lost revenue for all businesses except Big M and Breaky Motors
- Contents of Kraft may not be well-represented by defaults
- Benefits associated with relocating fairgrounds buildings to the east side of the site to avoid future damages
- Street cleanup and recovery
- Detours
- All of these things could increase benefits further
- **Some of these figures should be compiled to help BCA**

What is NOT in the BCA? [A Path Forward…]

- Lost revenue for these businesses should be figured:
  - ✓ Kraft
  - ✓ McDonalds

Individual Property Mitigation

- Residential structures may be elevated.
- Non-residential structures maybe elevated or floodproofed.
- FEMA and HUD grant funds will allow elevations in SFHAs but will not allow elevations in floodways.
- If mitigation is "locally funded" then an elevation in a floodway is OK as long as the footprint of the structure is not expanded.
- If elevation or floodproofing is not a substantial improvement, or is not the result of substantial damage, then it can go forward in a floodway but the owner will see no benefit on flood insurance premiums.

Individual Property Mitigation

- Focus on seven properties (downstream to upstream):
  - ✓ Kraft
  - ✓ Big M Supermarket
  - ✓ House at 9 Liberty Street
  - ✓ House at 21 Townsend Street
  - ✓ House at 29 Gardiner Street
  - ✓ Brandow's Feed and Seed
  - ✓ House at 10 Griswold Street

Individual Property Mitigation

- Kraft – FEMA Cross Section 217808

	Elevation (ft)	Required floodproofing*	Height Above FFE
FFE estimate	1204		
In Floodway?	No		
Basement?	No		
Current BFE	1208.35	1210.35	6.35′
Short Term A	1208.35	1210.35	6.35′
Long Term A	1208.35	1210.35	6.35′
Short Term C	1206.31	1208.31	4.31′
Long Term C	1206.31	1208.31	4.31′

*With State-mandated 2′ freeboard

- Kraft will remain in the SFHA and the FFE will remain below the BFE
- Floodproofing may be 4-6 feet (vertical)
- This would not protect assets outside the building; consider flood wall

Individual Property Mitigation

- Big M Supermarket – FEMA Cross Section 219011

	Elevation (ft)	Required floodproofing*	Height Above FFE
FFE estimate	1208		
In Floodway?	No		
Basement?	No		
Current BFE	1209.66	1211.66	3.66′
Short Term A	1209.65	1211.65	3.65′
Long Term A	1209.65	1211.65	3.65′
Short Term C	1208.39	1210.39	2.39′
Long Term C	1208.36	1210.36	2.36′

*With State-mandated 2′ freeboard

- Supermarket will remain in the SFHA and the FFE will remain below the BFE
- Floodproofing may be 2-4 feet (vertical)

Individual Property Mitigation

- 9 Liberty Street – FEMA Cross Section 219011

	Elevation (ft)	Required FFE*	Height Above Current FFE
FFE estimate	1210		
In Floodway?	No		
Basement?	Likely		
Current BFE	1209.66	1211.66	1.66′
Short Term A	1209.65	1211.65	1.65′
Long Term A	1209.65	1211.65	1.65′
Short Term C	1208.39	1210.39	0.39′
Long Term C	1208.36	1210.36	0.36′

*With State-mandated 2′ freeboard

- House will remain in the SFHA, but the FFE may already be above the BFE
- The basement is not consistent with State flood damage building codes
- Elevation would be nominal under future conditions (long term C)

Individual Property Mitigation

- 21 Townsend Street – FEMA Cross Section 219591

	Elevation (ft)	Required FFE*	Height Above Current FFE
FFE estimate	1212		
In Floodway?	No		
Basement?	Likely		
Current BFE	1210.11	1212.11	0.11′
Short Term A	1209.41	1211.41	--
Long Term A	1209.8	1211.8	--
Short Term C	1208.32	1210.32	--
Long Term C	1208.72	1210.72	--

*With State-mandated 2′ freeboard

- The FFE may already be above the BFE
- House may shift outside the SFHA for the C options (the SFHA may shrink here)
- The basement is not consistent with State flood damage building codes but may be allowable under the C alternatives if the house is no longer in SFHA

Individual Property Mitigation

- 29 Gardiner Street – FEMA Cross Section 219830

	Elevation (ft)	Required FFE*	Height Above Current FFE
FFE estimate	1213		
In Floodway?	No		
Basement?	Likely		
Current BFE	1210.82	1212.82	--
Short Term A	1210.41	1212.41	--
Long Term A	1210.05	1212.05	--
Short Term C	1209.88	1211.88	--
Long Term C	1209.23	1211.23	--

*With State-mandated 2′ freeboard

- The FFE may already be above the BFE
- House may shift outside the SFHA for the C options (the SFHA may shrink here)
- The basement is not consistent with State flood damage building codes but may be allowable under the C alternatives if the house is no longer in SFHA

Individual Property Mitigation

- Brandow's Feed and Seed – FEMA Cross Section 220136

	Elevation (ft)	Required floodproofing*	Height Above FFE
FFE estimate	1208		
In Floodway?	Yes (partly)		
Basement?	No		
Current BFE	1211.65	1213.65	5.65′
Short Term A	1211.29	1213.29	5.29′
Long Term A	1210.61	1212.61	4.61′
Short Term C	1210.83	1212.83	4.83′
Long Term C	1209.88	1211.88	3.88′

*With State-mandated 2′ freeboard

- The store will remain in the SFHA and the FFE will remain below the BFE
- Floodproofing may be 4-6 feet (vertical)
- In floodway, so federal funding may not be used for improvements

Individual Property Mitigation

- 10 Griswold Street – FEMA Cross Section 221136

	Elevation (ft)	Required FFE*	Height Above Current FFE
FFE estimate	1212		
In Floodway?	No		
Basement?	Likely		
Current BFE	1214.26	1216.26	4.26′
Short Term A	1212.85	1214.85	2.85′
Long Term A	1212.48	1214.48	2.48′
Short Term C	1212.67	1214.67	2.67′
Long Term C	1212.31	1214.31	2.31′

*With State-mandated 2′ freeboard

- House will remain in the SFHA
- The basement is not consistent with State flood damage building codes
- Elevation would need to be 2-4 feet

LFA Report and Implementation Plan

- Outline:
  - ✓ Chapter 1 – Introduction
  - ✓ Chapter 2 – Watershed
  - ✓ Chapter 3 – Current Flood Hazards
  - ✓ Chapter 4 – Flood Mitigation Analysis
  - ✓ Chapter 5 – Benefit Cost Analysis
  - ✓ Chapter 6 – Implementation Plan

LFA Report and Implementation Plan

- Chapter 1 – Introduction
  - ✓ LFA Background
  - ✓ Study Area
  - ✓ Nomenclature

LFA Report and Implementation Plan

- Chapter 2 – Watershed
  - ✓ Data Collection
  - ✓ Field Assessment
  - ✓ Watershed Land Use
  - ✓ Watershed and Stream Characteristics
  - ✓ Infrastructure
  - ✓ Hydrology

LFA Report and Implementation Plan

- Chapter 3 – Current Flood Hazards
  - ✓ Flood History Along the West Branch Delaware River
  - ✓ Notable Floods (2006, etc.)
  - ✓ FEMA Mapping

LFA Report and Implementation Plan

- Chapter 4 – Flood Mitigation Analysis
  - ✓ Analysis Approach
  - ✓ Existing Conditions Analysis
  - ✓ Mitigation Approaches
    - ✓ Sediment Management
    - ✓ Bridge Replacement
    - ✓ Natural Channel and Floodplain Enhancements
    - ✓ Individual Property Mitigation
    - ✓ Drainage of Floodplain
  - ✓ Description of Alternatives

LFA Report and Implementation Plan

- Chapter 5 – Benefit Cost Analysis
  - ✓ Benefits Associated with Acquisitions/Relocations
  - ✓ Benefits Associated with WSE Reductions
  - ✓ Other Benefits
  - ✓ Estimated Costs
  - ✓ Comparison of Benefits and Costs

LFA Report and Implementation Plan

- Chapter 6 – Implementation Plan
  - ✓ Preferred Flood Mitigation Methods
  - ✓ Preferred Property Mitigation Methods
  - ✓ Funding Sources (CWC, LFA, FEMA, other)
  - ✓ Implementation Schedule

Next Steps and Future Meeting Dates

- Gather revenue figures by the end of November
- Finalize the BCA
- Public Meeting
- Report and Implementation Plan





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Walton Flood Commission
November 6, 2014
Meeting Minutes

A meeting of the Walton Flood Commission was held on November 6, 2014 at 10 AM at the DCSWCD office. A sign-in sheet was circulated and the list of attendees was retained by DCSWCD.

David Murphy, P.E., CFM presented a power point slide show focused on the revised benefit-cost analysis (BCA) for the Walton flood mitigation alternatives that were advanced forward from the July 17 flood commission meeting. Building-specific benefits were discussed, and an outline of the LFA report was presented. David explained why the BCA results had shifted over the last couple months and offered several pathways forward (refer to the bottom of this page).

General discussion points included the following:

- Alternative "Short Term A" needs to have a BCR as close to 1.0 (or above 1.0) as possible.
- County Planning Department staff inquired about the studies for the tributaries. Is it possible that tributary improvements could be a priority at the present time? Could tributary studies change the priorities for the Delaware River alternatives?
- Phil Eskeli requested that the LFA report should recommend future studies (such as evaluating the bridges over the tributaries) and future master planning as it relates to flood mitigation (such as the fairgrounds site).
- The grant for the Reporter building demolition is $100,000 but the work is tied up with back tax and legal issues.
- The fairgrounds committee annual meeting is in January. Many fairgrounds site components are "grandfathered" and would be challenging to change.
- Attendees discussed how the fairgrounds should be discussed in the public meeting. Pros and cons were discussed relative to showing conceptual changes to the fairgrounds site vs. using a narrative to describe changes. Similar concerns may be evident for businesses like Dollar General.
- Regardless of how the fairgrounds site is addressed in the public meeting, the conceptual alternatives that involve the site will be described in the LFA report.
- The forum for the public meeting was discussed. Should it be a workshop or an evening meeting?
- Beth Reichheld requested a draft of the LFA report prior to the meeting.
- Attendees discussed how the implementation plan part of the LFA report might appear.
- Phil reminded the attendees that the following non-structural alternatives needed to be included in the discussion: elevations, acquisitions, securing utilities, securing fuel tanks, etc. Building elevations and acquisitions were somewhat included in the day's presentation (building-specific benefits).
- Kraft was discussed. A flood wall is still a potential solution for the property. The Mayor indicated that Kraft is at risk of leaving Walton if the property is flooded again.

David committed to working with all attendees to revisit and improve the BCA. To date, lost revenue had only been included for Big M and Breaky Motors. Lost revenue will be obtained for approximately 20 more businesses (mainly on Delaware Street). Several first floor elevations will also be checked; for example the rear of Brandow's Feed is lower than the front.

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Local Flood Analysis Project Review and Report Discussion







Walton Flood Commission Meeting

Village and Town of Walton

David Murphy, P.E., CFM

Walton Flood Commission and Delaware County Soil & Water Conservation District | January 8, 2015

Agenda

- Recap the alternatives that were advanced to this point
- Update the BCA discussion
- Report
- Date for Public Meeting

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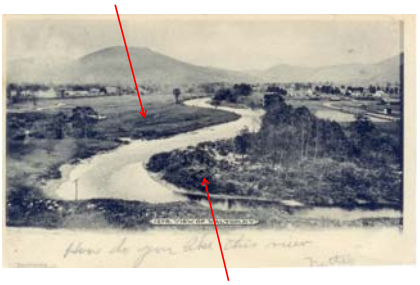
Alternatives Advanced to Consideration

- Short-Term
  - ✓ Lower the floodplain south of Water Street
  - ✓ Relocate Breaky Motors and restore site
  - ✓ With and without fairgrounds floodplain (“A” and “C”)
- Long-Term
  - ✓ Extend the lowered floodplain through Dollar General
  - ✓ Replace bridge with a 380’ span and two piers
  - ✓ Additional floodplain work related to bridge and connecting through to Water Street area
  - ✓ With and without fairgrounds floodplain (“A” and “C”)

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Alternatives Advanced to BCA

Floodplain south of Water Street



Floodplain at the Fairgrounds

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Short Term A



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Short Term C



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Long Term A



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Long Term C



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Benefit-Cost Analysis (BCA) Approach

- Breaky Motors, highway garage buildings, and the Reporter building were handled as acquisitions/relocations for all four options
- Dollar General was handled as an acquisition/relocation for the two long-term options

Acquisition Benefits	Short Term A	Short Term C	Long Term A	Long Term C
Breaky Motors	$548,341	$548,341	$548,341	$548,341
Highway Garage	$13,129	$13,129	$13,129	$13,129
Salt Shed	$21,067	$21,067	$21,067	$21,067
Reporter	$214,577	$214,577	$214,577	$214,577
Dollar General	---	---	$26,398	$26,398
Totals	**$797,114**	**$797,114**	**$823,512**	**$823,512**

Benefit-Cost Analysis (BCA) Approach

- All other properties were handled as flood reductions with a project life span of 50 years
- Annual revenue was included where we had it available

Business	Lost revenue in 2006
Tony's Shoes	Estimated $5,000
Emporium	$20,000
Big M Supermarket	$750,000
Breaky Motors	$150,000
Auto Plus	$50,000
Walton Deli	$14,000
Community Bank	$75,000
Brandow's Feed	$100,000
Napa Auto	$25,000
Danny's Restaurant	$78,000
2 North Street	$4,000
Walton Hardware	$28,000
Kraft	$20,000,000
McDonalds	$1,500,000
Elizabeth Hair	$2,000
CVS	$30,000
Underwoods/Muffler Masters	$15,000

Potential Costs

Item	Individual Cost Estimate
Lower the floodplain south of Water Street	$2.2M
Relocate Breaky Motors and restore site	$0.8M
Extend the lowered floodplain through Dollar General	$1.1M
Replace bridge with a 380' span and two piers	$5.0M
Additional floodplain work related to bridge and connecting through to Water Street area	$0.7M
Fairgrounds floodplain	$5.1M

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Comparison of Benefits and Potential Costs

Alternative	Cost Estimates	Total Benefits	BCR > 1?
ST-A: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site	$3.0M	$3.9M	Yes
ST-C: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Create/lower the fairgrounds floodplain	$8.1M	>$1B* $30.2M**	Yes
LT-A: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area	$9.8M	$5.4M	No
LT-C: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area Create/lower the fairgrounds floodplain	$14.9M	>$1B* $32.1M**	Yes

*Includes Kraft **Does not include Kraft

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What is still not in the BCA?

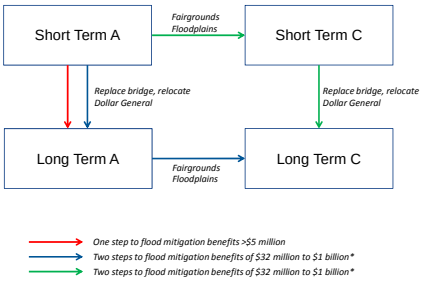
- Lost revenue for some businesses
- Contents of Kraft may not be well-represented by defaults
- Benefits associated with relocating fairgrounds buildings to the east side of the site to avoid future damages
- Street cleanup and recovery
- Detours

LFA Report and Implementation Plan

- Run through draft report

Implementation

- Three main pathways for implementation of mitigation options



*Benefit of $1 billion includes revenue figures from Kraft; benefits would not be counted if Kraft addressed flood mitigation with a flood wall

Next Steps and Future Meeting Dates

- Public Meeting
- Report and Implementation Plan





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Walton Flood Commission
January 8, 2015
Meeting Minutes

A meeting of the Walton Flood Commission was held on January 8, 2015 at 10 AM at the DCSWCD office. A sign-in sheet was circulated and the list of attendees was retained by DCSWCD.

David Murphy, P.E., CFM presented a power point slide show to provide an overall status report and kick off a discussion of the next steps for the LFA. General discussion points included the following:

- The timeframes of outages at Kraft and McDonalds need to be refined in order to make the revenue loss figures more accurate.
- Some attendees were concerned that fairgrounds projects might be done in steps or components, and each one should cause flood mitigation that is cost-effective. A similar concern is the case for projects involving Water Street, Dollar General, and Breakey Motors. It may be too difficult to break out the BCA in this manner, because it requires a presumption about how the mitigation project components could be broken into parts.
- Relocation of the central school bus garage should be considered. This is a critical community facility.
- Rick noted that the incremental cost of replacing the bridge with a longer span is more relevant than the total cost of replacing the bridge, because an in-kind replacement will be necessary anyhow. The incremental cost should be evaluated for the BCA.
- For the public meeting, the graphics should show flood reductions in plan view.
- The Delaware County Planning Department is applying for an EPA grant to study future opportunities for the area along Delaware Street.
- The $100,000 grant for the Reporter Building is the same grant for relocating the highway garage and beginning work south of Water Street.

Mate Hendrix from CWC presented the CWC rules for funding projects from LFAs. CWC currently has $17 million allocated for projects from LFAs.

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Local Flood Analysis
Public Information Meeting

Village and Town of Walton

David Murphy, P.E., CFM





Walton Flood Commission and Delaware County Soil & Water Conservation District | February 4, 2015

Purpose of Tonight's Workshop

- Review the Local Flood Analysis (LFA) process
- Review goals
- Review flood mitigation options considered for Walton
- Present the proposed hydraulic flood mitigation options and combinations
- Discuss hydrologic and building-specific options
- Describe benefit cost analysis
- Describe implementation of the LFA plan
- Next steps

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The LFA Process

- Uniform across all communities yet able to be customized
- Guided by the Walton Flood Commission
- Collect input about flooding and flood damage from property owners, municipal officials and other stakeholders
- Build upon FEMA flood modeling efforts and the county hazard mitigation plan
- Identify and evaluate potential flood mitigation measures that protect water quality
- Through hydraulic modeling, assess potential magnitude of flood relief alternatives
- Refine alternatives through vetting of cost, feasibility, and public support




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Why Walton?

- Walton has been devastated by flooding
- Critical infrastructure, businesses, and homes remain vulnerable
- Located within the New York City public water supply watershed
- LFA provides a unique opportunity to identify flood mitigation projects that can be funded by the DCSWCD SMP and the Catskill Watershed Corporation




FEMA Mapping: 100-Year (1% Chance) Flood



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Depth Map of 100-Year (1% Chance) Flood



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Depth Map of the 2-Year (50% Chance) Flood



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Main Goals for the Walton LFA

- Prevent floodwaters from diverting onto Delaware Street near Breaky Motors
- Allow floodwaters to flow back to the river south of Water Street
- Reduce flooding of Kraft, Brandow's, and other key businesses and municipal buildings
- Reduce flood insurance premiums for all properties in the FEMA SFHA

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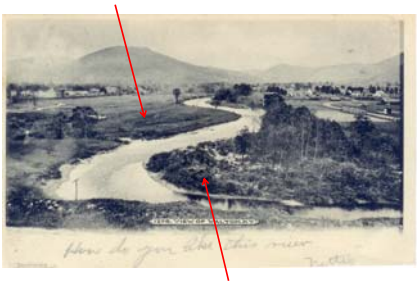
Options for Flood Mitigation in Walton

- Sediment removal
- Modify or replace the bridge
- Remove channel constrictions
- Remove floodplain constrictions
- Create floodplains and floodplain benches
- Home or business relocation
- Home or business elevation
- Business floodproofing methods
- ***These are grouped by location on the following slides***

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Options for Flood Mitigation in Walton

Floodplain south of Water Street

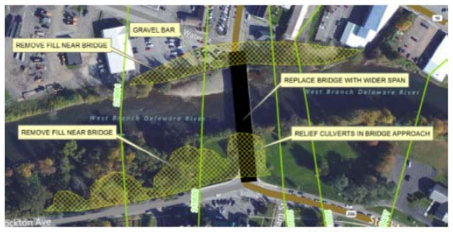


Floodplain at the Fairgrounds

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Alternatives at the Bridge

- Existing bridge
- Modify or replace the bridge with a higher, longer span
- Modify or replace the bridge with a higher, longer span and remove adjacent fill material
- Remove gravel bar beneath the bridge
- Relief culverts in the filled approaches



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Alternatives at the Bridge

- The bridge raises surface water elevations upstream of the crossing.
- Removing the bridge (representing a longer, higher bridge that would not cause hydraulic effects) will reduce flood water surface elevations upstream of the bridge by a maximum of 0.7 feet.
- The effect of removing the bridge and adjacent fill reduces water surface elevations and velocities in the vicinity of the bridge slightly more than improvements to the bridge alone.
- The effect of removing the gravel bar beneath the bridge provides no reduction in flooding.
- The effect of installing the relief culverts slightly increases water surface elevations because the higher conveyance area reduces water velocity.

Carried forward

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Floodplain Enhancement Near Water Street

- Village-owned 17 acres
- All village and county-owned land south of Water Street
- All land south of Water Street
- Extending up into the rear of buildings along Delaware Street



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Floodplain Enhancement Near Water Street

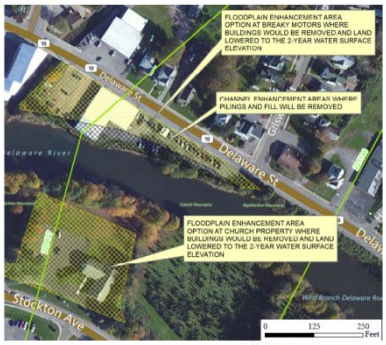
- All versions of the floodplain enhancement lower water surface elevations between Dollar General and Breaky Motors.
- Modeling confirms that as the floodplain enhancement area grows larger, the flood reduction benefits also grow larger.
- A secondary benefit to floodplain creation is to allow flood waters on Delaware Street to have a more direct path back to the river, alleviating the levee-like effect of the existing fill.

Carried forward but divided into short and long-term increments to reduce immediate impacts to private property owners

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Floodplain Enhancement Near Breaky Motors

- Remove channel constriction and enhance floodplain at Breaky Motors site
- Reduce floodplain constriction on church site across river
- Combination of the two



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Floodplain Enhancement Near Breaky Motors

- The combination of three actions on the Breaky Motors property was found to lower flood water surfaces: removing the Breaky Motors commercial building, lowering the property to match the 2-year flood elevation, and widening the channel to match the upstream and downstream channel width.
- This alternative reduces water surface elevations approximately one foot along Delaware Street where floodwaters leave the channel and travel down the road.
- Floodplain enhancement at the church property across the river provided negligible incremental benefits to water surface elevations.

Carried forward

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Reduce Floodplain Constriction

- Remove constriction at 239 Delaware Street
- Remove constriction at 15 More Avenue
- Combination of the two



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Reduce Floodplain Constriction

- The floodplain option at 15 More Avenue appeared to create small flood reductions of 0.2 feet to 0.01 feet for the 100-year flood upstream from the new floodplain area to the bridge.
- The floodplain option at 239 Delaware Avenue had negligible water surface elevation benefits.

Neither Carried forward

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Floodplain Enhancement at Fairgrounds

- Lower fairgrounds to 2-year flood water surface elevation and remove all buildings
- Lower fairgrounds and WWTP to 2-year flood water surface elevation and remove all buildings
- Create fairgrounds "chute" east of the buildings at the 1.5-year flood elevation
- Create fairgrounds floodplain benches along the river and relocate some buildings on the site

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Floodplain Enhancement at Fairgrounds



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Floodplain Enhancement at Fairgrounds

- Some of the existing fairgrounds ground surface and buildings block a significant portion of the floodplain, raising flood water surface elevations upstream and causing a direct flood risk to the fair facilities.
- Each of the options reduces flooding at the fairgrounds and Kraft, and benefits extend through the Village upstream of the bridge.
- The Waste Water Treatment Plant building and fill downstream of the fairgrounds only locally increases water surface elevation in the fairgrounds parking area.
- Flood benefits may be obtained while retaining the functions of the fairgrounds site by rearranging the location of the buildings and providing additional floodplain along the river.

Carried forward into the short and long-term alternatives as the "C" option

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Alternatives Advanced to Consideration

- Short-Term
  - ✓ Lower the floodplain south of Water Street
  - ✓ Relocate Breaky Motors and restore site
  - ✓ With and without fairgrounds floodplain
- Long-Term
  - ✓ Extend the lowered floodplain through Dollar General
  - ✓ Replace bridge with a 380' span and two piers
  - ✓ Additional floodplain work related to bridge and connecting through to Water Street area
  - ✓ With and without fairgrounds floodplain

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Short Term A



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Short Term C



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Long Term A



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Long Term C



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Comparison of Water Surface Elevations

Flood Water Surface Elevations Downstream of Bridge

Alternative Description	217808 (Kraft)	218795 (end of Water St)	219011 (DPW)	219591 (Dollar General)	219830 (DS side of bridge)
Existing Conditions	1208.4	1209.5	1209.7	1210.1	1210.8
Short-Term A	1208.4	1209.4	1209.6	1209.4	1210.4
Short-Term C	1206.3	1208.1	1208.4	1208.3	1209.9
Long-Term A	1208.4	1209.4	1209.6	1209.8	1210.1
Long-Term C	1206.3	1208.0	1208.4	1208.7	1209.2

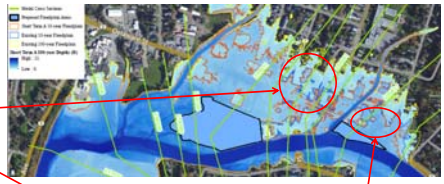
Flood Water Surface Elevations Upstream of Bridge

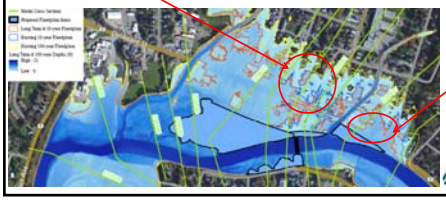
Alternative Description	220051 (US side of bridge)	220136 (Ford)	220477 (Breaky Motors)	221136 (High/ Griswold)	221807 (US of High)
Existing Conditions	1211.6	1211.7	1211.2	1214.3	1214.6
Short-Term A	1211.2	1211.3	1211.8	1212.9	1213.4
Short-Term C	1210.7	1210.8	1211.5	1212.7	1213.3
Long-Term A	1210.7	1210.6	1211.0	1212.5	1213.1
Long-Term C	1210.0	1209.9	1210.5	1212.3	1213.0

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Short Term A and Long Term A Depth Maps

No change in the extent of the 100-year flood or 10-year flood for ST-A; very minor change for LT-A



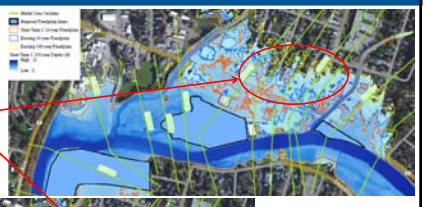


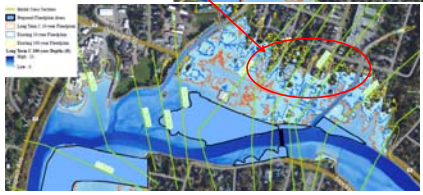
Depths are somewhat lower (lighter blue) in the graphic for LT-A as compared to ST-A

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Short Term C and Long Term C Depth Maps

Slight change in the extent of the 100-year flood and 10-year flood for ST-C and LT-C





Depths are somewhat lower (lighter blue) in the graphic for LT-C as compared to ST-C

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Summary of the A and C Alternatives

- The combinations of alternatives reduce flooding, but do still predict water reaching Delaware Street.
- There may not be any sustainable actions to the river or floodplains that can accomplish the goal of preventing all floodwater on Delaware Street.
- Actions such as levees or flood walls could potentially keep floodwaters from reaching Delaware Street but are **not considered desired actions because they would cut off the river from the community, displace numerous commercial buildings, and are not funded by local, state, and federal agencies.**
- How much additional flood capacity would be required to prevent flooding on Delaware Street?
  - *Significant floodplain creation and property disturbance would be required, and still **would not prevent the 25-year flood from entering Delaware Street.***

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Hydrologic Alternatives

- Hydrologic alternatives were not a significant consideration for the Walton LFA, as there is no feasible method of retaining or detaining significant volumes of water upstream of Walton.
- However, concentrated flows down the side streets toward Delaware Street are a problem during flood events.
- Conveyance of the water from roadways to the West Branch Delaware River could be facilitated by removing some of the buildings in the path of this water, such as the 181 Delaware Street building.
- Another option could be to utilize side yards such as a strip of the McDonald's property to return floodwaters to the river.
- These conveyance issues were not addressed using hydrologic or hydraulic models.
- Instead, the A and C alternatives should include project components to facilitate conveyance back to the river.

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Property-Specific Building Flood Mitigation

- Most of the properties in the study area will remain in the FEMA SFHA.
- Owners may wish to mitigate their own buildings.
- Options for residential buildings include relocation and elevation.
- Options for non-residential include relocation, elevation, and floodproofing.
- Other choices include elevating certain building utilities, electrical, etc.
- LFA discusses how changing flood elevations and limits of the SFHA may affect different properties in Walton.
- LFA supports strategic relocations such as the highway garage buildings, Breaky Motors, the school bus maintenance garage, and possibly businesses such as CVS. If these are mentioned in the report, they can be linked with funding in the future.



Manual Install Flood Door.
Image: UK Flood Barriers



Elevated home in Prattsville

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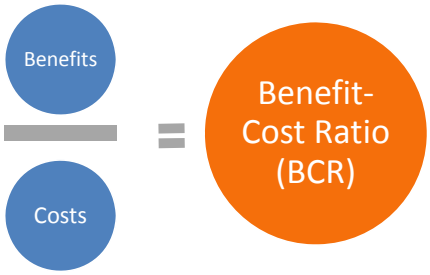
Benefit Cost Analysis (BCA)

- Mitigation projects are eligible for funding if long-term benefits exceed project costs.
- Benefits can come from a property being returned to a vacant open space in the floodplain, from a mitigation project reducing water surface elevations elsewhere in the village, or from a building elevation or floodproofing project.



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Benefit Cost Analysis (BCA)



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BCA: Summary of Benefits

Type of Benefits	Short Term A	Short Term C	Long Term A	Long Term C
Acquisition Benefits	$797,114	$797,114	$823,512	$823,512
Residential Benefits	$609,162	$1,025,095	$756,530	$1,188,339
Non-Residential Benefits	$2,419,939	$493,282,052	$3,712,116	$494,796,101
Total Benefits	$3,826,215	$495,104,261	$5,292,158	$496,807,952

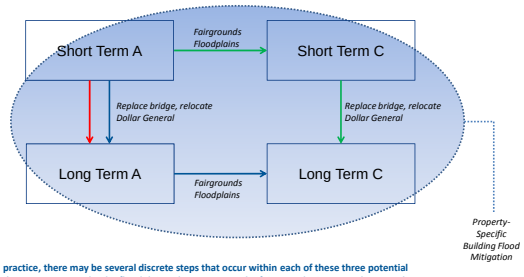
BCA: Comparison of Benefits and Costs

Alternative	Cost Estimates	Total Benefits	BCR > 1?
ST-A: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site	$3.0M	$3.8M	Yes
ST-C: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Create/lower the fairgrounds floodplain	$8.1M	$495.1M	Yes
LT-A: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area	$6.3M	$5.3M	No
LT-C: Lower the floodplain south of Water Street Relocate Breaky Motors and restore site Extend the lowered floodplain through Dollar General Replace bridge with a 380' span and two piers Additional floodplain work related to bridge and connecting through to Water Street area Create/lower the fairgrounds floodplain	$14.9M	$496.8M	Yes

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Implementation

- Three main pathways for implementation of mitigation options



In practice, there may be several discrete steps that occur within each of these three potential pathways. For example, the floodplain enhancement at the fairgrounds site may take several years to implement, with the work paused at times to accommodate funding or logistical issues. It will be important to proceed in a manner that ensures continued cost-effectiveness.

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Implementation

- In general, there are three potential pathways to the long-term outcomes:
  - ✓ ST-A then LT-A: Fairgrounds floodplain enhancement does not occur in this outcome, and total flood mitigation benefits of $5.3 million are possible.
  - ✓ ST-A then LT-A then LT-C: the bridge is replaced and Dollar General is relocated in favor of floodplain work prior to the fairgrounds work, but total flood mitigation benefits of $496.8 million are possible.
  - ✓ ST-A then ST-C then LT-C: the bridge is replaced and Dollar General is relocated in favor of floodplain work subsequent to the fairgrounds work, but total flood mitigation benefits of $496.8 million are possible.
- If Kraft chooses to pursue flood mitigation on its own terms, total flood mitigation benefits of $12.5 million are possible for the LT-C options.

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Summary

- The following flood mitigation recommendations are offered:
  - ✓ Proceed with implementation of the A and C mitigation projects as funding allows.
  - ✓ Pursue floodproofing of commercial buildings along Delaware Street. Floodproofing should include sealing of lower portions of buildings including doors and other openings, and elevation of building utilities. Ensure that floodproofing is viable under a set of potential future conditions (for example, designed according to the higher of future flood elevation based on A or C).
  - ✓ Pursue elevation of homes on a case-by-case basis as property owners approach the Walton Flood Commission and/or the Village about mitigation. Ensure that elevations are conducted in accordance with the effective BFE at the time of the work.
  - ✓ Pursue relocations. These may include critical facilities such as the school bus maintenance facility and key businesses such as the CVS.

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Summary

- The following procedural recommendations are offered:
  - ✓ Continue to gather and file revenue information as provided by businesses. This may help improve future BCA determinations.
  - ✓ During and after future floods, record and compile municipal, county, and state costs related to clean-up and recovery in Walton. This may help improve future BCA determinations.
  - ✓ Identify opportunities to include water quality benefits in future BCA determinations. This may be particularly helpful when costs exceed standard flood mitigation benefits by narrow margins.
  - ✓ Continue to evaluate the cost effectiveness and viability of constructing a flood wall for Kraft as described in the Third Brook Watershed Management Plan.

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Next Steps

- Review draft LFA report
- Provide comments to Walton Flood Commission by 2/27/15
- Walton Flood Commission will adopt LFA report
- Seek funding for projects





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Public Information Meeting
Walton LFA
February 4, 2015
Meeting Minutes

A public meeting was held on February 2, 2015 at 6:30 PM at the Walton High School. Mr. Rick Weidenbach and Mr. Graydon Dutcher provided introductory statements and described the LFA process. Mr. David Murphy, P.E., CFM presented a power point slide show and then turned over the meeting for a general discussion. Discussion points included the following:

- An attendee asked when the tributary streams would be evaluated. Mr. Dutcher explained that the Walton Flood Commission would commence these evaluations in 2015.
- An attendee asked what information had been gathered about the relocations. Specifically, has Dollar General been approached? Will businesses remain in the village? Have contaminants been found in the soil south of Water Street. Mr. Dutcher explained that the Walton Flood Commission would work with businesses to remain in the village and be more resilient to flooding, and that the soil south of Water Street had not been fully evaluated yet.
- Dean Frazier took a moment to explain that a county grant is helping to floodproof businesses on Delaware Street. He also explained that the county and DCSWCD have completed many projects in the town and village already, including the slope failure stabilizations along Third Brook. He went on to say that much work has been done like Terrace Ave, Third Brook, CR-22 at the village line, and the floodplain reclamation behind the country store.
- Attendees asked how the flood mitigation cost estimates were determined. Presenters explained that they were conceptual estimates.
- An attendee asked if people would be allowed to add fill to their properties to be above the flood elevation. Steve Dutcher described the flood damage prevention ordinance and used this opportunity to also describe the Community Rating System (CRS) program that the town and village are entering.
- An attendee asked how much money the taxpayers will need to contribute to flood mitigation projects. Mayor Snow and Supervisor Dolph answered together, explaining that some in-kind services will be provided but that many grants are available for these projects. To date, tax payers have not been paying for the mitigation practices and that model is expected to be followed in the future.

DRAFT

APPENDIX B

INDIVIDUAL BENEFITS LISTED BY PROPERTY

		Existing Conditions Elevations				Long-Term A Water Surface Elevations					Long-Term C Water Surface Elevations					Short-Term A Water Surface Elevations					Short-Term C Water Surface Elevations				
Address	**Description**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**LT-A Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**LT-C Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**ST-A Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**ST-C Benefits**
136 Delaware St	Allie's Attic	1208.55	1210.21	1210.80	1211.98	1208.04	1209.49	1210.04	1211.22	$13,308	1207.39	1208.74	1209.21	1210.19	$23,633	1208.25	1209.80	1210.38	1211.52	$9,252	1207.65	1209.25	1209.84	1211.24	$17,597
109 Delaware St	Another Mans Treasure	1208.87	1210.89	1211.64	1213.36	1208.28	1210.01	1210.63	1212.01	$16,064	1207.66	1209.26	1209.90	1211.23	$23,828	1208.59	1210.54	1211.31	1213.02	$8,375	1208.02	1210.03	1210.86	1212.83	$17,633
119 Delaware St	Antiques - in L Shaped Building	1208.81	1210.68	1211.37	1212.78	1208.30	1209.94	1210.53	1211.84	$6,363	1207.69	1209.23	1209.80	1211.03	$9,784	1208.52	1210.31	1211.00	1212.39	$3,538	1207.96	1209.81	1210.54	1212.20	$6,493
151 Delaware St	Antiques	1207.97	1209.54	1210.11	1211.32	1207.82	1209.31	1209.87	1211.06	$5,170	1207.00	1208.37	1208.86	1209.91	$24,658	1207.77	1209.19	1209.70	1210.78	$7,331	1206.99	1208.30	1208.77	1209.73	$25,508
64 Delaware St	Apartment Building	1211.49	1213.58	1214.26	1215.78	1209.91	1211.75	1212.37	1213.74	$33,174	1209.65	1211.53	1212.17	1213.50	$35,764	1210.12	1212.07	1212.77	1214.35	$29,964	1209.86	1211.87	1212.58	1214.25	$32,845
211A Delaware St	Auto Plus	1207.35	1208.94	1209.53	1210.83	1207.38	1208.95	1209.52	1210.75	-$16,236	1206.17	1207.60	1208.14	1209.28	$468,437	1207.38	1208.95	1209.52	1210.75	-$16,236	1206.20	1207.64	1208.17	1209.32	$463,050
5 Townsend St	Bear Spring Realty	1208.04	1209.62	1210.20	1211.40	1207.76	1209.27	1209.83	1211.02	$403	1206.90	1208.28	1208.78	1209.84	$1,226	1207.65	1209.04	1209.53	1210.60	$603	1206.83	1208.07	1208.51	1209.37	$2,024
24 Griswold St	Bed and Breakfast	1210.64	1212.71	1213.42	1215.00	1209.14	1210.92	1211.53	1212.90	$8,176	1208.75	1210.48	1211.11	1212.43	$8,605	1209.45	1211.42	1212.16	1213.80	$6,403	1209.07	1211.12	1211.88	1213.66	$6,734
204 Delaware St	Big M Supermarket	1207.40	1209.00	1209.59	1210.91	1207.43	1209.00	1209.58	1210.81	$5,632	1206.26	1207.70	1208.23	1209.38	$1,069,253	1207.43	1209.00	1209.58	1210.81	$5,632	1206.29	1207.73	1208.27	1209.42	$1,141,291
180 Delaware St	Black Bull Tattoo	1207.46	1209.06	1209.65	1210.99	1207.48	1209.06	1209.64	1210.88	-$1,285	1206.35	1207.80	1208.33	1209.49	$30,121	1207.48	1209.06	1209.64	1210.88	-$253	1206.38	1207.83	1208.37	1209.53	$32,289
10 Bridge St	Bluestone Billiards, Walton Lanes	1207.99	1209.56	1210.14	1211.35	1207.73	1209.25	1209.81	1211.00	$1,794	1206.85	1208.23	1208.74	1209.80	$5,684	1207.59	1208.97	1209.45	1210.52	$2,747	1206.76	1207.96	1208.38	1209.19	$10,829
99 Delaware St	Brandow's Feed and Seed	1209.19	1211.22	1211.97	1213.68	1208.42	1210.15	1210.76	1212.14	$1,380,242	1207.85	1209.46	1210.10	1211.42	$2,606,371	1208.75	1210.71	1211.47	1213.17	$870,168	1208.22	1210.25	1211.07	1212.99	$1,953,945
11 Bridge St	Breaky's Liquor Store	1208.86	1210.79	1211.49	1212.96	1208.35	1210.05	1210.65	1211.98	$9,495	1207.75	1209.34	1209.93	1211.22	$16,807	1208.58	1210.42	1211.14	1212.59	$5,377	1208.03	1209.93	1210.69	1212.40	$12,178
93 Delaware St	**Breaky Motors**	**1209.69**	**1211.73**	**1212.46**	**1214.13**	**1208.67**	**1210.40**	**1211.01**	**1212.38**	**$548,341**	**1208.19**	**1209.82**	**1210.45**	**1211.76**	**$548,341**	**1209.04**	**1211.02**	**1211.77**	**1213.45**	**$548,341**	**1208.58**	**1210.65**	**1211.45**	**1213.29**	**$548,341**
137 Delaware St	Catskill Dance	1208.53	1210.18	1210.77	1211.95	1208.03	1209.48	1210.03	1211.21	$168,323	1207.37	1208.72	1209.19	1210.17	$276,025	1208.22	1209.76	1210.34	1211.48	$131,804	1207.61	1209.19	1209.78	1211.15	$215,021
162 Delaware St	Combs Realty	1207.91	1209.48	1210.06	1211.28	1207.69	1209.22	1209.78	1210.98	$4,870	1206.77	1208.16	1208.67	1209.75	$18,753	1207.55	1208.95	1209.44	1210.53	$7,235	1206.68	1207.90	1208.33	1209.16	$19,974
124 Delaware St	Community Bank	1208.76	1210.59	1211.26	1212.63	1208.25	1209.86	1210.44	1211.72	$593,416	1207.63	1209.14	1209.69	1210.87	$1,038,033	1208.47	1210.22	1210.89	1212.23	$307,461	1207.91	1209.71	1210.41	1212.03	$823,912
132 Delaware St	County Emporium Laundromat	1208.68	1210.44	1211.07	1212.36	1208.17	1209.70	1210.27	1211.51	$193,100	1207.54	1208.97	1209.49	1210.59	$328,322	1208.39	1210.05	1210.68	1211.94	$102,628	1207.81	1209.53	1210.19	1211.72	$259,810
25 Townsend St	Courtney Funeral Home	1207.62	1209.21	1209.79	1211.10	1207.56	1209.12	1209.69	1210.92	$268	1206.51	1207.93	1208.46	1209.60	$674	1207.51	1209.03	1209.58	1210.77	-$1,006	1206.50	1207.87	1208.37	1209.42	$691
7 Townsend St	Craftiques	1207.97	1209.53	1210.11	1211.32	1207.72	1209.24	1209.80	1210.99	$3,882	1206.83	1208.21	1208.71	1209.79	$16,365	1207.56	1208.93	1209.41	1210.48	$10,485	1206.72	1207.91	1208.32	1209.10	$18,561
215 Delaware St	CVS	1207.33	1208.92	1209.51	1210.80	1207.36	1208.93	1209.50	1210.73	-$10,149	1206.13	1207.57	1208.10	1209.24	$273,463	1207.36	1208.93	1209.50	1210.73	-$10,149	1206.17	1207.61	1208.14	1209.29	$269,794
210 Delaware St	Delaware Dental Office	1207.37	1208.96	1209.55	1210.87	1207.40	1208.97	1209.54	1210.78	-$2,182	1206.21	1207.64	1208.18	1209.33	$23,708	1207.40	1208.97	1209.54	1210.78	-$2,182	1206.24	1207.68	1208.22	1209.37	$23,351
144-146 Delaware St	Distillery (see Webb Clothing)	1208.40	1210.03	1210.61	1211.80	1207.96	1209.42	1209.97	1211.16		1207.24	1208.60	1209.08	1210.08		1208.07	1209.57	1210.12	1211.24		1207.40	1208.89	1209.43	1210.67	
14 Bridge St	**Dollar General**	**1207.95**	**1209.52**	**1210.09**	**1211.31**	**1207.71**	**1209.23**	**1209.79**	**1210.99**	**$26,398**	**1206.81**	**1208.19**	**1208.70**	**1209.78**	**$26,398**	**1207.56**	**1208.94**	**1209.42**	**1210.49**	**$15,943**	**1206.71**	**1207.90**	**1208.32**	**1209.12**	**$25,020**
138 Delaware St	Eggleton Insurance	1208.51	1210.15	1210.74	1211.92	1208.02	1209.47	1210.02	1211.20	$7,397	1207.34	1208.70	1209.17	1210.16	$15,030	1208.19	1209.73	1210.30	1211.43	$5,236	1207.57	1209.14	1209.71	1211.07	$11,194
207 Delaware St	Elizabeth Hair Designs	1207.39	1208.98	1209.57	1210.89	1207.41	1208.99	1209.56	1210.80	-$902	1206.23	1207.67	1208.21	1209.36	$29,104	1207.41	1208.99	1209.56	1210.80	-$902	1206.27	1207.71	1208.25	1209.40	$28,670
183 Delaware St	Family Dollar	1207.45	1209.05	1209.64	1210.99	1207.48	1209.06	1209.63	1210.87	$543	1206.35	1207.79	1208.33	1209.49	$35,161	1207.48	1209.06	1209.63	1210.87	$543	1206.38	1207.82	1208.36	1209.52	$34,689
164 Delaware St	Full Circle Antiques	1207.83	1209.41	1209.99	1211.24	1207.66	1209.19	1209.76	1210.97	$4,823	1206.71	1208.10	1208.62	1209.71	$34,325	1207.54	1208.97	1209.48	1210.59	$10,351	1206.63	1207.89	1208.34	1209.22	$28,570
192 Delaware St	Gramma D's	1207.43	1209.02	1209.61	1210.95	1207.45	1209.03	1209.60	1210.84	-$3,591	1206.30	1207.74	1208.28	1209.43	$49,202	1207.45	1209.03	1209.60	1210.84	-$3,410	1206.33	1207.77	1208.31	1209.47	$48,517
142 Delaware St	H&R Block	1208.46	1210.09	1210.68	1211.87	1207.99	1209.45	1210.00	1211.18	$8,931	1207.30	1208.65	1209.13	1210.12	$13,973	1208.14	1209.65	1210.22	1211.35	$4,855	1207.50	1209.03	1209.59	1210.89	$14,622
150 Delaware St	Hartz Plumbing	1208.11	1209.70	1210.27	1211.47	1207.80	1209.30	1209.85	1211.05	$22,704	1206.96	1208.34	1208.83	1209.88	$57,823	1207.73	1209.14	1209.64	1210.72	$27,184	1206.94	1208.23	1208.68	1209.61	$59,188
Water St	**Highway Department**	**1207.85**	**1209.43**	**1210.00**	**1211.25**	**1207.67**	**1209.20**	**1209.76**	**1210.97**	**$34,196**	**1206.72**	**1208.12**	**1208.63**	**1209.72**	**$34,196**	**1207.55**	**1208.97**	**1209.47**	**1210.57**	**$34,196**	**1206.64**	**1207.89**	**1208.34**	**1209.21**	**$34,196**
Bridge St	Historic building used by realtor	1208.86	1210.78	1211.48	1212.94	1208.35	1210.04	1210.64	1211.97	$1,016	1207.75	1209.32	1209.92	1211.20	$1,503	1208.57	1210.41	1211.12	1212.57	$544	1208.02	1209.92	1210.68	1212.38	$1,020
8 Griswold St	House	1210.85	1212.93	1213.63	1215.19	1209.66	1211.48	1212.10	1213.47	$28,635	1209.36	1211.19	1211.83	1213.15	$32,897	1209.91	1211.86	1212.57	1214.17	$23,837	1209.60	1211.63	1212.36	1214.06	$28,549
10 Griswold St	House	1210.85	1212.93	1213.63	1215.19	1209.63	1211.45	1212.07	1213.44	$29,420	1209.33	1211.16	1211.79	1213.12	$33,646	1209.88	1211.84	1212.55	1214.15	$24,577	1209.58	1211.61	1212.33	1214.04	$29,156
12 Griswold St	House	1211.18	1213.25	1213.95	1215.49	1209.60	1211.41	1212.03	1213.40	$27,322	1209.29	1211.11	1211.74	1213.07	$26,547	1209.85	1211.81	1212.52	1214.13	$23,795	1209.54	1211.57	1212.30	1214.01	$26,092
14 Griswold St	House	1211.18	1213.25	1213.95	1215.49	1209.55	1211.36	1211.98	1213.35	$29,715	1209.23	1211.04	1211.67	1213.00	$32,013	1209.81	1211.76	1212.48	1214.09	$25,966	1209.49	1211.52	1212.25	1213.97	$28,382
16 Griswold St	House	1210.94	1213.02	1213.72	1215.28	1209.45	1211.25	1211.87	1213.23	$9,959	1209.11	1210.90	1211.53	1212.85	$11,035	1209.72	1211.68	1212.40	1214.01	$6,721	1209.38	1211.42	1212.16	1213.89	$7,702
20 Griswold St	House	1210.64	1212.71	1213.42	1215.00	1209.29	1211.07	1211.69	1213.06	$8,417	1208.92	1210.68	1211.31	1212.63	$8,908	1209.58	1211.54	1212.27	1213.90	$6,464	1209.22	1211.26	1212.01	1213.77	$6,838
22 Griswold St	House	1210.64	1212.71	1213.42	1215.00	1209.21	1210.99	1211.61	1212.97	$9,783	1208.83	1210.57	1211.20	1212.52	$10,329	1209.51	1211.48	1212.21	1213.84	$7,608	1209.14	1211.19	1211.94	1213.71	$8,008
9 Griswold St	House	1210.85	1212.93	1213.63	1215.19	1209.23	1211.01	1211.63	1212.99	$34,156	1208.85	1210.60	1211.23	1212.55	$37,959	1209.53	1211.49	1212.22	1213.86	$29,315	1209.16	1211.21	1211.96	1213.72	$33,236
13 Griswold St	House	1210.66	1212.72	1213.43	1215.01	1209.12	1210.89	1211.51	1212.88	$6,231	1208.73	1210.45	1211.08	1212.40	$6,554	1209.43	1211.40	1212.14	1213.78	$4,916	1209.05	1211.10	1211.86	1213.64	$5,159
15 Griswold St	House	1210.66	1212.72	1213.43	1215.01	1209.08	1210.85	1211.47	1212.83	$30,527	1208.68	1210.40	1211.03	1212.35	$34,141	1209.40	1211.37	1212.11	1213.75	$25,584	1209.01	1211.06	1211.83	1213.61	$29,366
17 Griswold St	House	1210.41	1212.47	1213.18	1214.79	1208.99	1210.75	1211.36	1212.73	$11,957	1208.57	1210.26	1210.90	1212.21	$14,303	1209.32	1211.29	1212.03	1213.68	$8,719	1208.91	1210.97	1211.74	1213.54	$9,963
21 Griswold St	House	1210.41	1212.47	1213.18	1214.79	1208.88	1210.63	1211.25	1212.61	$4,476	1208.45	1210.12	1210.75	1212.06	$4,946	1209.22	1211.20	1211.94	1213.61	$2,571	1208.80	1210.86	1211.64	1213.46	$2,919
23 Griswold St	House	1210.11	1212.16	1212.88	1214.51	1208.76	1210.50	1211.11	1212.48	$6,168	1208.30	1209.95	1210.58	1211.89	$6,780	1209.12	1211.10	1211.85	1213.52	$3,817	1208.68	1210.74	1211.53	1213.36	$4,425
25 Griswold St	House	1210.11	1212.16	1212.88	1214.51	1208.68	1210.41	1211.02	1212.38	$10,146	1208.20	1209.83	1210.46	1211.77	$11,059	1209.04	1211.03	1211.78	1213.46	$6,478	1208.59	1210.66	1211.45	1213.30	$7,392
29 Griswold St	House	1210.38	1212.44	1213.15	1214.76	1208.65	1210.38	1210.99	1212.36	$5,918	1208.16	1209.79	1210.42	1211.73	$6,165	1209.01	1210.99	1211.74	1213.43	$4,675	1208.55	1210.62	1211.41	1213.26	$4,865
24 Benton Ave	House	1210.16	1212.22	1212.94	1214.56	1208.63	1210.36	1210.97	1212.34	$2,191	1208.14	1209.76	1210.39	1211.71	$2,277	1208.99	1210.97	1211.72	1213.40	$1,617	1208.52	1210.58	1211.38	1213.24	$1,647
22 Benton Ave	House	1209.88	1211.93	1212.66	1214.31	1208.58	1210.31	1210.93	1212.29	$6,605	1208.07	1209.70	1210.33	1211.64	$7,239	1208.93	1210.91	1211.67	1213.35	$4,209	1208.45	1210.51	1211.31	1213.18	$4,830
20 Benton Ave	House	1209.88	1211.93	1212.66	1214.31	1208.54	1210.27	1210.88	1212.25	$5,587	1208.01	1209.63	1210.26	1211.58	$6,104	1208.88	1210.85	1211.61	1213.30	$3,679	1208.39	1210.44	1211.24	1213.13	$4,172
18 Benton Ave	House	1209.60	1211.64	1212.38	1214.05	1208.51	1210.24	1210.85	1212.22	$5,007	1207.97	1209.59	1210.22	1211.54	$5,530	1208.85	1210.82	1211.58	1213.27	$3,091	1208.35	1210.39	1211.20	1213.10	$3,590
16 Benton Ave	House	1209.60	1211.64	1212.38	1214.05	1208.48	1210.21	1210.82	1212.20	$5,019	1207.93	1209.55	1210.18	1211.50	$5,538	1208.82	1210.78	1211.54	1213.24	$3,181	1208.31	1210.35	1211.16	1213.06	$3,664
14 Benton Ave	House	1209.11	1211.14	1211.89	1213.60	1208.41	1210.14	1210.75	1212.13	$3,299	1207.83	1209.44	1210.08	1211.40	$3,831	1208.73	1210.69	1211.46	1213.16	$1,460	1208.20	1210.23	1211.04	1212.98	$1,961
8 Benton Ave	House	1209.11	1211.14	1211.89	1213.60	1208.33	1210.06	1210.67	1212.05	$3,374	1207.72	1209.33	1209.96	1211.30	$3,871	1208.64	1210.59	1211.36	1213.07	$1,700	1208.09	1210.10	1210.92	1212.88	$2,168
6 Benton Ave	House	1208.87	1210.89	1211.64	1213.35	1208.28	1210.01	1210.63	1212.01	$3,175	1207.66	1209.26	1209.90	1211.23	$3,793	1208.59	1210.54	1211.31	1213.02	$1,172	1208.03	1210.03	1210.86	1212.83	$1,735
40 North St-15	House	1208.88	1210.86	1211.59	1213.17	1208.33	1210.05	1210.66	1212.03	$179	1207.72	1209.32	1209.94	1211.27	$196	1208.59	1210.49	1211.23	1212.80	$81	1208.03	1209.99	1210.79	1212.62	$68
38 North St	House	1208.88	1210.86	1211.60	1213.21	1208.32	1210.04	1210.65	1212.02	$556	1207.71	1209.31	1209.93	1211.26	$624	1208.58	1210.49	1211.24	1212.84	$240	1208.03	1209.99	1210.80	1212.66	$253
7 Benton Ave	House	1208.89	1210.92	1211.67	1213.41	1208.27	1210.00	1210.62	1212.00	$2,541	1207.65	1209.25	1209.89	1211.22	$3,000	1208.58	1210.52	1211.30	1213.01	$1,059	1208.01	1210.01	1210.84	1212.82	$1,473
11 Benton Ave	House	1209.11	1211.14	1211.89	1213.60	1208.34	1210.07	1210.69	1212.07	$3,253	1207.74	1209.35	1209.98	1211.31	$3,754	1208.66	1210.61	1211.38	1213.09	$1,603	1208.11	1210.12	1210.94	1212.90	$2,069
13 Benton Ave	House	1209.39	1211.42	1212.17	1213.86	1208.38	1210.10	1210.72	1212.10	$1,758	1207.79	1209.40	1210.03	1211.36	$1,043	1208.70	1210.65	1211.42	1213.12	$1,046	1208.16	1210.18	1211.00	1212.94	$1,156
76 Delaware St	House	1210.71	1212.78	1213.48	1215.06	1209.27	1211.06	1211.67	1213.04	$60,791	1208.90	1210.66	1211.29	1212.61	$73,696	1209.57	1211.53	1212.26	1213.89	$54,155	1209.20	1211.25	1212.00	1213.76	$68,388
80 Delaware St	House	1210.21	1212.27	1212.99	1214.61	1208.97	1210.73	1211.35	1212.71	$73,758	1208.55	1210.24	1210.88	1212.19	$94,469	1209.30	1211.28	1212.02	1213.67	$61,479	1208.90	1210.95	1211.73	1213.53	$83,062
86 Delaware St	House	1209.89	1211.94	1212.66	1214.31	1208.65	1210.39	1211.00	1212.36	$50,126	1208.17	1209.80	1210.43	1211.74	$65,260	1209.02	1211.00	1211.75	1213.43	$39,732	1208.56	1210.63	1211.42	1213.27	$55,197
12 North St	House	1209.22	1211.25	1212.00	1213.70	1208.39	1210.12	1210.73	1212.11	$35,865	1207.80	1209.41	1210.05	1211.38	$56,313	1208.71	1210.66	1211.43	1213.14	$24,782	1208.17	1210.19	1211.01	1212.95	$44,447
16 North St	House	1209.22	1211.25	1212.00	1213.70	1208.37	1210.10	1210.72	1212.10	$17,605	1207.78	1209.39	1210.03	1211.36	$27,070	1208.69	1210.65	1211.42	1213.12	$10,426	1208.15	1210.17	1210.99	1212.94	$15,939
20 North St	House	1209.29	1211.32	1212.07	1213.77	1208.35	1210.08	1210.69	1212.07	$14,775	1207.75	1209.36	1209.99	1211.33	$22,000	1208.67	1210.62	1211.39	1213.10	$9,413	1208.12	1210.14	1210.96	1212.91	$13,540

		Existing Conditions Elevations				Long-Term A Water Surface Elevations					Long-Term C Water Surface Elevations					Short-Term A Water Surface Elevations					Short-Term C Water Surface Elevations				
Address	**Description**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**LT-A Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**LT-C Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**ST-A Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**ST-C Benefits**
20 1/2 North St	House	1209.59	1211.63	1212.37	1214.04	1208.41	1210.13	1210.75	1212.13	$17,623	1207.83	1209.44	1210.07	1211.40	$9,449	1208.73	1210.69	1211.45	1213.16	$13,323	1208.20	1210.23	1211.04	1212.97	$17,976
28-30 North St	House	1208.87	1210.89	1211.64	1213.37	1208.27	1210.00	1210.61	1212.00	$3,341	1207.64	1209.24	1209.88	1211.22	$3,966	1208.57	1210.51	1211.29	1212.99	$1,345	1208.00	1210.00	1210.83	1212.80	$1,904
19 North St	House	1208.87	1210.87	1211.61	1213.27	1208.30	1210.03	1210.64	1212.01	$7,759	1207.68	1209.29	1209.91	1211.24	$14,620	1208.58	1210.50	1211.26	1212.89	$3,601	1208.02	1210.00	1210.81	1212.71	$7,151
17 North St	House	1208.87	1210.88	1211.63	1213.33	1208.28	1210.01	1210.62	1212.00	$5,676	1207.66	1209.26	1209.89	1211.23	$10,504	1208.57	1210.51	1211.28	1212.96	$2,563	1208.01	1210.00	1210.82	1212.76	$5,108
15 North St	House	1208.87	1210.89	1211.64	1213.36	1208.27	1210.00	1210.62	1212.00	$5,308	1207.64	1209.25	1209.88	1211.22	$9,770	1208.57	1210.51	1211.28	1212.99	$2,393	1208.00	1210.00	1210.83	1212.79	$4,742
22 Gardiner Pl	House	1208.88	1210.81	1211.52	1212.99	1208.36	1210.07	1210.67	1212.01	$17,682	1207.77	1209.36	1209.96	1211.26	$29,946	1208.59	1210.44	1211.17	1212.62	$9,817	1208.04	1209.95	1210.72	1212.44	$21,542
37 Gardiner Pl	House	1208.62	1210.33	1210.94	1212.17	1208.11	1209.59	1210.15	1211.36	$1,000	1207.47	1208.86	1209.35	1210.39	$1,302	1208.33	1209.93	1210.54	1211.74	$638	1207.74	1209.40	1210.03	1211.50	$804
35 Gardiner Pl	House	1208.62	1210.32	1210.93	1212.15	1208.10	1209.59	1210.14	1211.35	$1,001	1207.46	1208.85	1209.34	1210.37	$1,313	1208.32	1209.92	1210.52	1211.72	$647	1207.73	1209.39	1210.02	1211.49	$801
31-33 Gardiner Pl	House	1208.64	1210.36	1210.97	1212.22	1208.12	1209.63	1210.19	1211.40	$1,165	1207.49	1208.89	1209.39	1210.44	$1,528	1208.34	1209.96	1210.58	1211.79	$730	1207.76	1209.44	1210.07	1211.56	$927
29 Gardiner Pl	House	1208.65	1210.38	1211.00	1212.26	1208.14	1209.65	1210.21	1211.44	$4,623	1207.50	1208.92	1209.42	1210.48	$6,358	1208.36	1209.99	1210.61	1211.84	$2,836	1207.77	1209.47	1210.11	1211.61	$4,000
6 Townsend St	House	1208.31	1209.92	1210.50	1211.70	1207.91	1209.38	1209.94	1211.12	$15,647	1207.15	1208.51	1209.00	1210.02	$34,468	1207.96	1209.43	1209.97	1211.08	$13,736	1207.25	1208.68	1209.19	1210.33	$32,007
10 Townsend St	House	1208.27	1209.88	1210.46	1211.65	1207.88	1209.37	1209.92	1211.11	$7,503	1207.11	1208.48	1208.97	1209.99	$20,154	1207.91	1209.37	1209.90	1211.00	$7,579	1207.19	1208.59	1209.09	1210.19	$18,921
12 Townsend St	House	1208.26	1209.87	1210.46	1211.65	1207.88	1209.37	1209.92	1211.11	$3,810	1207.11	1208.48	1208.97	1209.99	$10,381	1207.91	1209.37	1209.90	1211.00	$3,850	1207.19	1208.58	1209.09	1210.18	$9,772
14 Townsend St	House	1208.24	1209.85	1210.43	1211.62	1207.87	1209.35	1209.91	1211.10	$4,810	1207.09	1208.46	1208.95	1209.97	$13,388	1207.88	1209.33	1209.86	1210.96	$5,368	1207.15	1208.53	1209.02	1210.10	$12,891
14 1/2 Townsend St	House	1208.19	1209.79	1210.37	1211.56	1207.84	1209.33	1209.89	1211.08	$2,738	1207.04	1208.41	1208.90	1209.94	$5,222	1207.82	1209.25	1209.77	1210.87	$3,433	1207.07	1208.41	1208.89	1209.90	$5,271
16 Townsend St	House	1208.18	1209.78	1210.36	1211.55	1207.84	1209.33	1209.88	1211.07	$3,586	1207.03	1208.40	1208.89	1209.93	$6,849	1207.81	1209.24	1209.76	1210.85	$4,530	1207.05	1208.39	1208.86	1209.87	$6,942
20 Townsend St	House	1208.09	1209.68	1210.26	1211.46	1207.79	1209.29	1209.85	1211.04	$3,743	1206.95	1208.32	1208.82	1209.87	$7,883	1207.71	1209.12	1209.62	1210.70	$5,567	1206.92	1208.19	1208.64	1209.56	$8,323
24 Townsend St	House	1208.02	1209.59	1210.17	1211.37	1207.75	1209.26	1209.82	1211.01	$262	1206.88	1208.25	1208.76	1209.82	$543	1207.62	1209.01	1209.49	1210.56	$464	1206.80	1208.02	1208.45	1209.28	$570
32 Townsend St	House	1207.87	1209.44	1210.02	1211.26	1207.67	1209.21	1209.77	1210.97	$187	1206.74	1208.13	1208.64	1209.73	$18	1207.55	1208.96	1209.46	1210.56	$16	1206.65	1207.90	1208.33	1209.19	$18
36 Townsend St	House	1207.82	1209.39	1209.97	1211.22	1207.65	1209.19	1209.75	1210.96	$14	1206.69	1208.09	1208.60	1209.70	$31	1207.54	1208.98	1209.49	1210.60	$79	1206.62	1207.89	1208.34	1209.24	$32
38 Townsend St	House	1207.69	1209.28	1209.86	1211.15	1207.59	1209.15	1209.71	1210.94	$1	1206.58	1207.99	1208.52	1209.64	$1	1207.52	1209.01	1209.54	1210.71	$1	1206.54	1207.88	1208.36	1209.35	$1
35 Townsend St	House	1207.47	1209.07	1209.66	1211.01	1207.49	1209.07	1209.64	1210.89	$5	1206.37	1207.81	1208.35	1209.51	$14	1207.49	1209.07	1209.64	1210.89	$4	1206.40	1207.84	1208.38	1209.55	$14
33 Townsend St	House	1207.47	1209.07	1209.66	1211.01	1207.49	1209.07	1209.65	1210.89	$11	1206.37	1207.82	1208.36	1209.51	$41	1207.49	1209.07	1209.65	1210.89	$11	1206.40	1207.85	1208.39	1209.55	$41
21 Townsend St	House	1207.76	1209.34	1209.92	1211.19	1207.62	1209.17	1209.73	1210.95	$1,661	1206.64	1208.04	1208.56	1209.67	$5,790	1207.53	1208.99	1209.51	1210.65	$3,289	1206.58	1207.88	1208.35	1209.29	$6,195
17 Townsend St	House	1207.77	1209.35	1209.93	1211.19	1207.63	1209.17	1209.74	1210.95	$1,550	1206.64	1208.05	1208.57	1209.68	$5,359	1207.53	1208.99	1209.51	1210.65	$3,063	1206.59	1207.88	1208.35	1209.29	$5,767
11 Townsend St	House	1207.84	1209.41	1209.99	1211.24	1207.66	1209.20	1209.76	1210.97	$1,800	1206.71	1208.11	1208.62	1209.72	$5,586	1207.54	1208.97	1209.47	1210.58	$3,671	1206.63	1207.89	1208.34	1209.22	$6,073
4 Liberty St	House	1207.49	1209.09	1209.68	1211.03	1207.50	1209.08	1209.66	1210.90	-$3,307	1206.39	1207.83	1208.37	1209.53	$43,817	1207.49	1209.07	1209.64	1210.87	-$3,206	1206.42	1207.85	1208.39	1209.53	$42,739
6 Liberty St	House (aka 8-10 Liberty St)	1207.47	1209.07	1209.65	1211.01	1207.49	1209.07	1209.64	1210.89	-$4,378	1206.36	1207.81	1208.35	1209.50	$49,925	1207.49	1209.07	1209.64	1210.89	-$4,378	1206.39	1207.84	1208.38	1209.54	$48,821
12 Liberty St	House	1207.46	1209.06	1209.65	1211.00	1207.48	1209.07	1209.64	1210.88	-$1,955	1206.36	1207.80	1208.34	1209.50	$33,186	1207.48	1209.07	1209.64	1210.88	-$1,767	1206.39	1207.84	1208.38	1209.54	$32,540
16 Liberty St	House	1207.46	1209.06	1209.65	1211.00	1207.48	1209.06	1209.64	1210.88	-$223	1206.36	1207.80	1208.34	1209.50	$16,069	1207.48	1209.06	1209.64	1210.88	-$223	1206.39	1207.83	1208.37	1209.53	$15,883
18 Liberty St	House	1207.45	1209.05	1209.64	1210.99	1207.47	1209.06	1209.63	1210.87	-$213	1206.34	1207.79	1208.33	1209.48	$12,956	1207.47	1209.06	1209.63	1210.87	-$213	1206.37	1207.82	1208.36	1209.52	$12,704
20 Liberty St	House	1207.45	1209.05	1209.64	1210.98	1207.47	1209.05	1209.63	1210.87	$366	1206.34	1207.78	1208.32	1209.48	$3,311	1207.47	1209.05	1209.63	1210.87	$366	1206.37	1207.81	1208.36	1209.51	$3,286
26 Liberty St	House	1207.45	1209.04	1209.63	1210.98	1207.47	1209.05	1209.62	1210.86	$157	1206.33	1207.77	1208.31	1209.47	$957	1207.47	1209.05	1209.62	1210.86	$157	1206.36	1207.81	1208.35	1209.51	$950
31 Mead St	House	1207.43	1209.02	1209.61	1210.95	1207.45	1209.03	1209.60	1210.84	$59	1206.30	1207.74	1208.28	1209.43	$288	1207.45	1209.03	1209.60	1210.84	$59	1206.33	1207.77	1208.31	1209.47	$287
37 Liberty St	House	1207.41	1209.00	1209.59	1210.91	1207.43	1209.00	1209.58	1210.81	$32	1206.26	1207.70	1208.24	1209.39	$165	1207.43	1209.00	1209.58	1210.81	$32	1206.29	1207.73	1208.27	1209.43	$165
35 Liberty St	House	1207.41	1209.00	1209.59	1210.92	1207.43	1209.01	1209.58	1210.82	$27	1206.27	1207.71	1208.24	1209.40	$141	1207.43	1209.01	1209.58	1210.82	$27	1206.30	1207.74	1208.28	1209.44	$140
33 Liberty St	House	1207.41	1209.01	1209.60	1210.92	1207.43	1209.01	1209.59	1210.82	$31	1206.27	1207.71	1208.25	1209.40	$161	1207.43	1209.01	1209.59	1210.82	$31	1206.30	1207.75	1208.28	1209.44	$160
31 Liberty St	House	1207.42	1209.01	1209.60	1210.93	1207.44	1209.02	1209.59	1210.83	$84	1206.28	1207.72	1208.26	1209.41	$591	1207.44	1209.02	1209.59	1210.83	$84	1206.31	1207.75	1208.29	1209.45	$587
29 Liberty St	House	1207.42	1209.01	1209.60	1210.94	1207.44	1209.02	1209.59	1210.83	$224	1206.28	1207.72	1208.26	1209.41	$2,055	1207.44	1209.02	1209.59	1210.83	$224	1206.31	1207.76	1208.30	1209.45	$2,019
27 Liberty St	House	1207.42	1209.01	1209.60	1210.93	1207.44	1209.02	1209.59	1210.83	$251	1206.28	1207.72	1208.26	1209.41	$2,500	1207.44	1209.02	1209.59	1210.83	$251	1206.31	1207.76	1208.30	1209.45	$2,475
21 Liberty St	House	1207.43	1209.03	1209.62	1210.95	1207.45	1209.03	1209.61	1210.85	$598	1206.31	1207.75	1208.29	1209.44	$9,794	1207.45	1209.03	1209.61	1210.85	$598	1206.34	1207.78	1208.32	1209.48	$9,701
19 Liberty St	House	1207.43	1209.03	1209.62	1210.96	1207.46	1209.03	1209.61	1210.85	$491	1206.31	1207.75	1208.29	1209.44	$7,421	1207.46	1209.03	1209.61	1210.85	$491	1206.34	1207.79	1208.33	1209.48	$7,339
17 Liberty St	House	1207.44	1209.03	1209.62	1210.96	1207.46	1209.04	1209.61	1210.85	-$238	1206.31	1207.76	1208.29	1209.45	$15,093	1207.46	1209.04	1209.61	1210.85	-$238	1206.34	1207.79	1208.33	1209.49	$14,784
13 Liberty St	House	1207.44	1209.04	1209.63	1210.97	1207.46	1209.04	1209.62	1210.86	-$136	1206.32	1207.77	1208.30	1209.46	$10,573	1207.46	1209.04	1209.62	1210.86	-$136	1206.35	1207.80	1208.34	1209.50	$10,354
11 Liberty St	House	1207.44	1209.04	1209.63	1210.97	1207.46	1209.04	1209.62	1210.86	-$185	1206.32	1207.77	1208.30	1209.46	$14,424	1207.46	1209.04	1209.62	1210.86	$222	1206.35	1207.80	1208.34	1209.50	$14,124
9 Liberty St	House	1207.44	1209.04	1209.63	1210.96	1207.46	1209.04	1209.61	1210.85	-$149	1206.32	1207.76	1208.30	1209.45	$13,581	1207.46	1209.04	1209.61	1210.85	-$149	1206.35	1207.79	1208.33	1209.49	$13,326
7 Griswold St	House	1210.53	1212.60	1213.31	1214.90	1209.28	1211.07	1211.69	1213.05	$22,544	1208.92	1210.67	1211.30	1212.62	$26,179	1209.58	1211.54	1212.27	1213.90	$17,927	1209.21	1211.26	1212.01	1213.77	$21,762
3 Griswold St	House with commercial space	1210.71	1212.78	1213.48	1215.06	1209.39	1211.18	1211.80	1213.17	$66,425	1209.04	1210.82	1211.45	1212.77	$84,960	1209.67	1211.63	1212.35	1213.97	$68,195	1209.32	1211.36	1212.11	1213.85	$84,571
9 Benton Ave	House	1208.89	1210.92	1211.67	1213.41	1208.31	1210.04	1210.66	1212.04	$2,658	1207.70	1209.30	1209.94	1211.27	$3,162	1208.62	1210.57	1211.34	1213.05	$1,025	1208.07	1210.07	1210.90	1212.86	$1,486
39 Gardiner Pl	House	1208.62	1210.32	1210.93	1212.15	1208.10	1209.59	1210.14	1211.35	$82	1207.46	1208.85	1209.34	1210.37	$98	1208.32	1209.92	1210.52	1211.72	$56	1207.73	1209.39	1210.01	1211.48	$55
47 Gardiner Pl	House	1208.72	1210.51	1211.16	1212.48	1208.20	1209.78	1210.35	1211.61	$136	1207.58	1209.05	1209.59	1210.72	$161	1208.43	1210.13	1210.78	1212.08	$81	1207.85	1209.61	1210.29	1211.86	$81
43 North St	House	1208.80	1210.65	1211.33	1212.73	1208.28	1209.92	1210.50	1211.80	$433	1207.67	1209.20	1209.77	1210.98	$510	1208.50	1210.28	1210.96	1212.34	$231	1207.94	1209.78	1210.50	1212.14	$232
6 Griswold St	Vacant lot	1211.03	1213.11	1213.80	1215.35	1209.67	1211.49	1212.11	1213.48		1209.37	1211.21	1211.84	1213.17		1209.92	1211.87	1212.58	1214.18		1209.61	1211.64	1212.36	1214.07	
15 Liberty St	House	1207.44	1209.04	1209.63	1210.97	1207.46	1209.04	1209.62	1210.86	-$124	1206.32	1207.76	1208.30	1209.45	$9,786	1207.46	1209.04	1209.62	1210.86	-$124	1206.35	1207.80	1208.34	1209.49	$9,518
10 Benton Ave	House	1209.11	1211.14	1211.89	1213.60	1208.37	1210.09	1210.71	1212.09	$3,893	1207.77	1209.38	1210.02	1211.35	$4,489	1208.68	1210.64	1211.41	1213.11	$1,850	1208.14	1210.16	1210.98	1212.93	$2,408
34-36 North St	House (aka 2 Benton Ave)	1208.87	1210.87	1211.62	1213.29	1208.30	1210.02	1210.63	1212.01	$3,769	1207.68	1209.28	1209.91	1211.24	$4,537	1208.58	1210.50	1211.26	1212.91	$1,589	1208.02	1210.00	1210.81	1212.72	$2,215
41 Gardiner Pl	House and Church	1208.57	1210.23	1210.82	1211.99	1208.05	1209.50	1210.05	1211.23	$244	1207.41	1208.76	1209.23	1210.20	$294	1208.27	1209.82	1210.40	1211.55	$179	1207.68	1209.29	1209.88	1211.31	$172
74 Delaware St	House and vacant store	1210.71	1212.78	1213.48	1215.06	1209.41	1211.21	1211.82	1213.19	$97,101	1209.06	1210.85	1211.48	1212.80	$128,088	1209.69	1211.65	1212.37	1213.99	$29,514	1209.34	1211.38	1212.13	1213.86	$131,863
84 Delaware St	House; McAdams Lawnmowers	1210.21	1212.27	1212.99	1214.61	1208.76	1210.50	1211.12	1212.48	$114,732	1208.31	1209.96	1210.59	1211.90	$142,719	1209.12	1211.10	1211.85	1213.52	$97,381	1208.68	1210.75	1211.54	1213.36	$125,635
106 Delaware St	Jewelry and Frame Shop	1208.88	1210.85	1211.57	1213.13	1208.29	1210.02	1210.63	1212.01	$24,421	1207.67	1209.27	1209.90	1211.23	$26,827	1208.58	1210.51	1211.27	1212.93	$6,844	1208.01	1210.00	1210.82	1212.74	$40,932
Liberty St/Townsend I	Liberty Street apartment bldg	1207.44	1209.04	1209.63	1210.97	1207.46	1209.04	1209.62	1210.86	$1,448	1206.32	1207.76	1208.30	1209.46	$11,087	1207.46	1209.04	1209.62	1210.86	$1,448	1206.35	1207.80	1208.34	1209.49	$11,011
42 Gardiner Pl	Library	1208.82	1210.70	1211.38	1212.80	1208.30	1209.96	1210.55	1211.86	$2,593	1207.70	1209.24	1209.82	1211.06	$3,028	1208.53	1210.32	1211.02	1212.42	$1,356	1207.97	1209.83	1210.56	1212.22	$1,340
134 Delaware St	Liquor Emporium	1208.63	1210.33	1210.94	1212.17	1208.11	1209.60	1210.16	1211.37	$42,947	1207.47	1208.86	1209.36	1210.39	$169,319	1208.33	1209.93	1210.54	1211.74	$53,323	1207.74	1209.41	1210.03	1211.51	$57,604
205 Delaware St	McDonald's	1207.42	1209.02	1209.60	1210.94	1207.44	1209.02	1209.59	1210.83	-$78,150	1206.29	1207.73	1208.26	1209.41	$1,237,796	1207.44	1209.02	1209.59	1210.83	-$78,150	1206.32	1207.76	1208.30	1209.45	$1,224,611
190 Delaware St	Mostly vacant commercial	1207.44	1209.04	1209.63	1210.97	1207.46	1209.04	1209.62	1210.86	-$662	1206.32	1207.77	1208.30	1209.46	$16,869	1207.46	1209.04	1209.62	1210.86	-$791	1206.35	1207.80	1208.34	1209.50	$16,585
187 Delaware St	Muffler Masters	1207.45	1209.05	1209.64	1210.98	1207.47	1209.05	1209.63	1210.87	-$18,757	1206.34	1207.78	1208.32	1209.48	$214,020	1207.47	1209.05	1209.63	1210.87	-$18,757	1206.37	1207.82	1208.36	1209.52	$202,724
90 Delaware St	Napa Auto	1209.72	1211.76	1212.49	1214.16	1208.56	1210.29	1210.90	1212.27	$89,711	1208.04	1209.66	1210.29	1211.61	$93,669	1208.91	1210.88	1211.64	1213.33	$58,995	1208.42	1210.47	1211.28	1213.16	$71,694

		Existing Conditions Elevations				Long-Term A Water Surface Elevations					Long-Term C Water Surface Elevations					Short-Term A Water Surface Elevations					Short-Term C Water Surface Elevations				
Address	**Description**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**LT-A Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**LT-C Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**ST-A Benefits**	**10-Year**	**50-Year**	**100-Year**	**500-Year**	**ST-C Benefits**
139 Delaware St	National Bank of DC	1208.63	1210.34	1210.95	1212.19	1208.11	1209.61	1210.17	1211.38	$51,822	1207.48	1208.87	1209.37	1210.41	$81,126	1208.33	1209.94	1210.55	1211.76	$31,304	1207.75	1209.42	1210.05	1211.53	$56,264
133 Delaware St	National Bank of Delaware Cty	1208.53	1210.17	1210.76	1211.94	1208.03	1209.48	1210.03	1211.21	$114,689	1207.36	1208.71	1209.19	1210.17	$307,460	1208.22	1209.75	1210.33	1211.47	$81,139	1207.60	1209.18	1209.76	1211.14	$164,218
18 Gardiner Pl	Netty's Flowers	1208.89	1210.83	1211.55	1213.04	1208.38	1210.09	1210.69	1212.04	$10,712	1207.78	1209.38	1209.99	1211.30	$21,083	1208.60	1210.47	1211.20	1212.67	$5,710	1208.05	1209.98	1210.76	1212.50	$16,529
121 Delaware St	Nichols Pond Insurance	1208.88	1210.84	1211.57	1213.11	1208.35	1210.07	1210.68	1212.03	$27,741	1207.75	1209.35	1209.97	1211.28	$62,693	1208.59	1210.48	1211.22	1212.74	$19,225	1208.04	1209.99	1210.77	1212.56	$54,738
157 Delaware St	Old Frontier Cable (vacant)	1208.07	1209.65	1210.23	1211.43	1207.78	1209.28	1209.84	1211.03	$21,187	1206.93	1208.30	1208.80	1209.86	$62,837	1207.68	1209.08	1209.58	1210.66	$30,827	1206.88	1208.14	1208.58	1209.48	$67,757
209 Delaware St	Papas Diner	1207.37	1208.96	1209.55	1210.87	1207.40	1208.97	1209.54	1210.78	$270	1206.20	1207.64	1208.18	1209.32	$8,843	1207.40	1208.97	1209.54	1210.78	$270	1206.24	1207.68	1208.22	1209.37	$8,776
110 Delaware St	Parking lot	1208.88	1210.86	1211.60	1213.22	1208.32	1210.04	1210.65	1212.02		1207.70	1209.31	1209.93	1211.25		1208.58	1210.49	1211.25	1212.85		1208.03	1209.99	1210.80	1212.66	
Gardiner Pl	Parking lot	1208.68	1210.44	1211.07	1212.36	1208.17	1209.70	1210.27	1211.51		1207.54	1208.97	1209.49	1210.59		1208.39	1210.05	1210.68	1211.94		1207.81	1209.53	1210.19	1211.72	
87 Delaware St	Parking lot for Breaky Motors	1209.54	1211.58	1212.32	1213.99	1208.58	1210.31	1210.92	1212.29		1208.07	1209.69	1210.32	1211.64		1208.93	1210.91	1211.66	1213.35		1208.45	1210.50	1211.31	1213.18	
34 Gardiner Pl	Post Office	1208.85	1210.76	1211.46	1212.91	1208.34	1210.02	1210.62	1211.95	$1,090	1207.74	1209.31	1209.90	1211.18	$1,266	1208.56	1210.39	1211.10	1212.54	$541	1208.01	1209.90	1210.65	1212.35	$544
22 North St	Reflection, Yarn Over	1208.84	1210.86	1211.61	1213.35	1208.30	1210.03	1210.64	1212.03	$4,693	1207.68	1209.29	1209.92	1211.26	$6,787	1208.61	1210.56	1211.33	1213.04	$1,839	1208.05	1210.05	1210.88	1212.85	$3,688
181 Delaware St	**Reporter Building**	**1207.57**	**1209.16**	**1209.75**	**1211.07**	**1207.54**	**1209.11**	**1209.68**	**1210.91**	**$214,577**	**1206.46**	**1207.89**	**1208.43**	**1209.57**	**$214,577**	**1207.51**	**1209.05**	**1209.60**	**1210.81**	**$214,577**	**1206.47**	**1207.86**	**1208.38**	**1209.46**	**$214,577**
14 Gardiner Pl	Restaurant	1208.88	1210.85	1211.57	1213.12	1208.35	1210.07	1210.67	1212.03	$286,737	1207.74	1209.35	1209.96	1211.28	$42,517	1208.59	1210.48	1211.22	1212.75	$124,878	1208.04	1209.99	1210.77	1212.57	$308,470
5 Bridge St	Restaurant	1208.86	1210.77	1211.48	1212.93	1208.35	1210.03	1210.63	1211.96	$17,196	1207.74	1209.32	1209.92	1211.20	$395,639	1208.57	1210.41	1211.12	1212.56	$8,937	1208.02	1209.91	1210.67	1212.37	$15,054
North St	School	1208.88	1210.86	1211.59	1213.20	1208.33	1210.05	1210.66	1212.02	$3,627	1207.71	1209.31	1209.94	1211.26	$3,946	1208.59	1210.49	1211.24	1212.82	$1,643	1208.03	1209.99	1210.79	1212.64	$1,407
3 Liberty St	Sidney Federal Credit Union	1207.44	1209.03	1209.62	1210.96	1207.46	1209.04	1209.61	1210.85	$800	1206.31	1207.75	1208.29	1209.45	$25,079	1207.46	1209.04	1209.61	1210.85	$800	1206.34	1207.79	1208.33	1209.49	$22,345
169 Delaware St	Smokers Choice Superstore	1207.74	1209.32	1209.90	1211.18	1207.62	1209.16	1209.73	1210.95	$3,653	1206.62	1208.03	1208.55	1209.66	$28,892	1207.53	1209.00	1209.52	1210.67	$6,773	1206.57	1207.88	1208.35	1209.31	$30,588
21 Benton Ave	St. John Office	1209.95	1212.00	1212.72	1214.37	1208.56	1210.29	1210.91	1212.27	$13	1208.04	1209.67	1210.30	1211.62	$14	1208.91	1210.89	1211.64	1213.33	$2	1208.43	1210.48	1211.28	1213.16	$9
21 Benton Ave	St. John Rectory	1209.39	1211.42	1212.17	1213.86	1208.44	1210.17	1210.78	1212.16	$0	1207.87	1209.49	1210.12	1211.45	$0	1208.77	1210.73	1211.49	1213.19	$0	1208.25	1210.28	1211.09	1213.01	$0
21 Benton Ave	St. John the Baptist Church	1209.67	1211.71	1212.44	1214.11	1208.50	1210.23	1210.85	1212.22	$0	1207.96	1209.58	1210.21	1211.53	$0	1208.84	1210.81	1211.57	1213.26	$0	1208.34	1210.38	1211.19	1213.09	$0
150 Delaware St	Tannare Ink	1208.05	1209.63	1210.20	1211.41	1207.76	1209.27	1209.83	1211.02	$15,223	1206.91	1208.28	1208.78	1209.84	$38,499	1207.66	1209.05	1209.54	1210.62	$15,114	1206.84	1208.09	1208.52	1209.39	$40,280
145 Delware St	The Old Bakery	1208.30	1209.92	1210.50	1211.69	1207.90	1209.38	1209.93	1211.12	$8,047	1207.15	1208.51	1209.00	1210.02	$22,977	1207.95	1209.42	1209.96	1211.07	$11,853	1207.25	1208.67	1209.18	1210.32	$21,278
2 Liberty St	Tom's Tire Barn	1207.53	1209.13	1209.71	1211.05	1207.52	1209.09	1209.67	1210.90	-$257	1206.43	1207.86	1208.40	1209.55	$44,054	1207.50	1209.06	1209.62	1210.84	$450	1206.44	1207.86	1208.38	1209.50	$42,778
163 Delaware St	Tony's Shoe Store	1207.99	1209.56	1210.14	1211.34	1207.73	1209.25	1209.81	1211.00	$36,964	1206.85	1208.23	1208.74	1209.80	$117,762	1207.59	1208.97	1209.45	1210.52	$58,395	1206.75	1207.96	1208.38	1209.19	$125,898
2 North St	Top Dogs	1208.73	1210.71	1211.47	1213.22	1208.44	1210.17	1210.79	1212.16	$33,839	1207.88	1209.49	1210.13	1211.45	$86,565	1208.77	1210.74	1211.50	1213.20	-$3,718	1208.25	1210.29	1211.10	1213.02	$44,514
Townsend St	Townsend Garden Apts	1207.49	1209.09	1209.68	1211.03	1207.50	1209.08	1209.66	1210.90	$1,878	1206.39	1207.83	1208.37	1209.53	$12,434	1207.49	1209.07	1209.64	1210.87	$2,335	1206.42	1207.85	1208.39	1209.53	$12,459
28 Townsend St	Townsend Professional Building	1207.97	1209.54	1210.12	1211.32	1207.72	1209.24	1209.80	1211.00	$42	1206.84	1208.21	1208.72	1209.79	$87	1207.57	1208.94	1209.42	1210.49	$81	1206.73	1207.92	1208.33	1209.12	$90
37 Townsend St	Vacant	1207.46	1209.06	1209.65	1211.00	1207.48	1209.07	1209.64	1210.88		1206.36	1207.81	1208.35	1209.50		1207.48	1209.07	1209.64	1210.88		1206.39	1207.84	1208.38	1209.54	
Delaware St	Vacant commercial	1208.88	1210.86	1211.59	1213.20	1208.32	1210.05	1210.66	1212.02		1207.71	1209.31	1209.94	1211.26		1208.59	1210.49	1211.24	1212.83		1208.03	1209.99	1210.79	1212.64	
North St	Vacant lot	1208.87	1210.89	1211.65	1213.38	1208.27	1210.00	1210.61	1212.00		1207.64	1209.24	1209.88	1211.21		1208.57	1210.52	1211.29	1213.00		1208.00	1210.00	1210.83	1212.81	
104 Delaware St	Vacant lot	1208.89	1210.92	1211.67	1213.41	1208.29	1210.02	1210.63	1212.01		1207.66	1209.27	1209.90	1211.24		1208.59	1210.54	1211.31	1213.03		1208.03	1210.03	1210.86	1212.83	
174 Delaware St	Vacant lot	1207.54	1209.13	1209.72	1211.05	1207.52	1209.10	1209.67	1210.91		1206.44	1207.87	1208.41	1209.55		1207.50	1209.05	1209.62	1210.84		1206.45	1207.86	1208.38	1209.49	
168 Delaware St	Vacant lot	1207.64	1209.23	1209.82	1211.12	1207.57	1209.13	1209.70	1210.93		1206.53	1207.95	1208.48	1209.61		1207.52	1209.02	1209.57	1210.75		1206.51	1207.87	1208.37	1209.40	
166 Delaware St	Vacant lot	1207.73	1209.32	1209.90	1211.17	1207.61	1209.16	1209.73	1210.95		1206.62	1208.02	1208.55	1209.66		1207.53	1209.00	1209.52	1210.67		1206.57	1207.88	1208.35	1209.31	
141 Delaware St	Vacant lot	1208.39	1210.02	1210.61	1211.80	1207.95	1209.42	1209.97	1211.16		1207.24	1208.59	1209.08	1210.08		1208.06	1209.56	1210.11	1211.23		1207.39	1208.88	1209.42	1210.66	
5 Griswold St	Vacant lot	1210.08	1212.09	1212.81	1214.44	1209.37	1211.16	1211.78	1213.15		1209.02	1210.79	1211.42	1212.74		1209.65	1211.61	1212.34	1213.96		1209.30	1211.34	1212.09	1213.83	
102 Delaware St	Vacant commercial	1209.04	1211.07	1211.82	1213.54	1208.33	1210.06	1210.67	1212.05	$18,996	1207.72	1209.33	1209.96	1211.30	$32,718	1208.64	1210.59	1211.36	1213.07	$9,829	1208.09	1210.10	1210.93	1212.88	$24,422
23 Liberty St	Vacant lot owned by the county	1207.42	1209.02	1209.61	1210.94	1207.45	1209.02	1209.60	1210.84		1206.29	1207.73	1208.27	1209.42		1207.45	1209.02	1209.60	1210.84		1206.32	1207.77	1208.31	1209.46	
158-160 Delaware St	Vacant stores (bldgs separate in BC/	1207.99	1209.56	1210.14	1211.34	1207.73	1209.25	1209.80	1211.00	$28,541	1206.85	1208.23	1208.73	1209.80	$97,581	1207.59	1208.96	1209.45	1210.51	$47,236	1206.75	1207.96	1208.37	1209.18	$84,068
Gardiner Pl	Village Hall	1208.88	1210.84	1211.56	1213.10	1208.36	1210.08	1210.68	1212.04	$3,839	1207.76	1209.36	1209.97	1211.29	$26,370	1208.59	1210.48	1211.21	1212.73	$2,555	1208.04	1209.98	1210.77	1212.55	$3,521
167 Delaware St	Village Laundromat	1207.87	1209.45	1210.02	1211.26	1207.68	1209.21	1209.77	1210.97	$6,721	1206.74	1208.13	1208.65	1209.73	$48,517	1207.55	1208.96	1209.46	1210.56	$11,452	1206.66	1207.90	1208.33	1209.19	$50,060
Delaware St	Walton Central School Garage	1207.35	1208.94	1209.53	1210.83	1207.38	1208.95	1209.52	1210.75	-$229	1206.16	1207.60	1208.14	1209.28	$32,444	1207.38	1208.95	1209.52	1210.75	-$229	1206.20	1207.64	1208.17	1209.32	$32,032
15 Townsend St	Walton Chiropractic	1207.80	1209.38	1209.96	1211.22	1207.64	1209.18	1209.75	1210.96	$480	1206.68	1208.08	1208.60	1209.70	$1,347	1207.54	1208.98	1209.49	1210.61	$967	1206.61	1207.89	1208.34	1209.25	$1,428
70 Delaware St	Walton Deli	1211.03	1213.11	1213.80	1215.35	1209.67	1211.49	1212.11	1213.48	$265,937	1209.37	1211.20	1211.84	1213.16	$287,739	1209.91	1211.86	1212.58	1214.17	$237,899	1209.61	1211.64	1212.36	1214.06	$254,872
194 Delaware St	Walton Fitness, Walton Car Wash	1207.42	1209.01	1209.60	1210.93	1207.44	1209.02	1209.59	1210.83	-$643	1206.28	1207.72	1208.26	1209.41	$22,234	1207.44	1209.02	1209.59	1210.83	-$643	1206.31	1207.75	1208.29	1209.45	$22,013
9 Townsend St	Walton Historical Society	1207.88	1209.46	1210.03	1211.27	1207.68	1209.21	1209.77	1210.98	$486	1206.75	1208.14	1208.65	1209.74	$1,244	1207.55	1208.96	1209.45	1210.55	$980	1206.66	1207.90	1208.33	1209.18	$1,321
144-146 Delaware St	Webb's Clothing Store	1208.31	1209.92	1210.51	1211.70	1207.91	1209.38	1209.94	1211.12	$7,779	1207.15	1208.52	1209.00	1210.02	$26,251	1207.96	1209.43	1209.97	1211.08	$8,763	1207.26	1208.68	1209.20	1210.34	$13,665
60 Delaware St	West Branch Collision & Classics	1211.51	1213.59	1214.28	1215.79	1210.05	1211.90	1212.53	1213.90	$12,741	1209.82	1211.72	1212.35	1213.68	$13,166	1210.25	1212.19	1212.89	1214.45	$11,869	1210.01	1212.01	1212.71	1214.36	$12,104
261 Delaware	Kraft Factory	1206.41	1207.84	1208.35	1209.43	1206.41	1207.84	1208.35	1209.43	$0	1204.680	1205.870	1206.310	1207.240	$484,256,579	1206.41	1207.84	1208.35	1209.43	$0	1204.68	1205.87	1206.31	1207.24	$484,255,671

Residential WSE reduction benefits	$752,152	$1,238,264	$604,784	$1,073,916
Non-residential WSE reduction benefits	$3,714,991	$494,796,101	$2,419,939	$493,282,052
Acquisition/relocation benefits	$823,512	$823,512	$797,114	$797,114
Total Benefits	**$5,290,655**	**$496,857,877**	**$3,821,837**	**$495,153,082**

Note:
All water surface elevations are generated from GeoRAS. A property located between two HEC-RAS cross sections will have water surface elevations that are intermediate between the two cross sections.

APPENDIX C

COST ESTIMATES

Engineering, Planning,
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and Environmental Science

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JOB Walton BCA - Breaky Motors
SHEET NO. 1 OF 1
CALCULATED BY JCS DATE 7/30/14
CHECKED BY DATE
SCALE

Project Cost 87 & 93 Delaware Street

- Purchasing the property - sum of prop. value for two parcels
  - ★ Auto Dealer $367,647.00 ✓
  - ★ Parking Lot $9,125.00 ✓
  - $376,772.00

- Building demolition, utility disconnections, building related expenses

  $100,000

- Floodplain creation:
  excavate 2.5 ft over red hatch, A = 42,952 ft²
  10 ft over black hatch, A = 15,451 ft²

  excavated volume = 42,952 × 2.5 + 15,451 × 10 = 261,888 ft³

  Assume fill will be exported $4/cy to excavate
  $20/cy to export

  $$261{,}888\ ft^3 \times \frac{1\ yd^3}{27\ ft^3} \times \$24/yd^3 = \$232{,}789$$

- Restoration
  - ★ Assumed 0.5 ft topsoil: $0.5\ ft \times 42{,}952\ ft^2 \times \frac{1}{27} \times \$25/yd^3 = \$19{,}885$
  - Seed mix: $42{,}952\ ft^2 \times \$0.75/ft^2 = \$32{,}214$
  - Willow: $60 \times \$30\ ea = \$1800$

- Sheet Piling Removal, assume 1 ft width

  ~125 ft of sheet piling × 1 ft = $125\ ft^2$

  $125\ ft^2 \times \$40/ft^2 = \$5{,}000$

TOTAL: $768,460

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Landscape Architecture
and Environmental Science

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JOB Walton BCA - Short Term A
SHEET NO. | OF |
CALCULATED BY JCS DATE 8/20/14
CHECKED BY DATE
SCALE

★ Remove Fill south of Water Street
★ Relocate & Restore Breaky Motors

Breaky Motors

- Same cost as Acquisition Calcs

$ 768,460

South of Water Street

- Building Demolition: 3 buildings at ~$20,000 each
  = $60,000

- Floodplain Creation:
  Using XS Area of cut from Hec-Ras + 0.5 ft ex. for topsoil
  $A_1 = 837\ ft^2$ $A_2 = 2218\ ft^2$ $A_3 = 2644\ ft^2$

  $V = \frac{837 + 2218 + 2644}{3} \times 1{,}036\ ft = 1{,}968{,}055\ ft^3$

  Assume fill will be exported

  $1{,}968{,}055\ ft^3 \times \frac{1\ yd^3}{27\ ft^3} \times \$24/yd^3 = \$1{,}749{,}382$

- Restoration
  Assume 0.5 ft topsoil over 395 648 ft^2
  $0.5\ ft \times 395{,}648\ ft^2 \times \frac{1}{27} \times \$25/yd^3 = \$183{,}170$
  Seedmix: $395{,}648\ ft^2 \times \$0.75/ft^2 = \$296{,}736$

South of Water Street Total: $2,289,288

Short Term A Total: $3,057,748

~$3,058,000

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JOB Walton BCA - Short Term C
SHEET NO. 1 OF 1
CALCULATED BY JCS DATE 8/20/14
CHECKED BY _____ DATE _____
SCALE _____

* Remove fill south of Water Street
* Remove & restore Breaky Motors
* Regrade Fairgrounds

Breaky Motors

$768,460

South of Water Street

$2,289,288

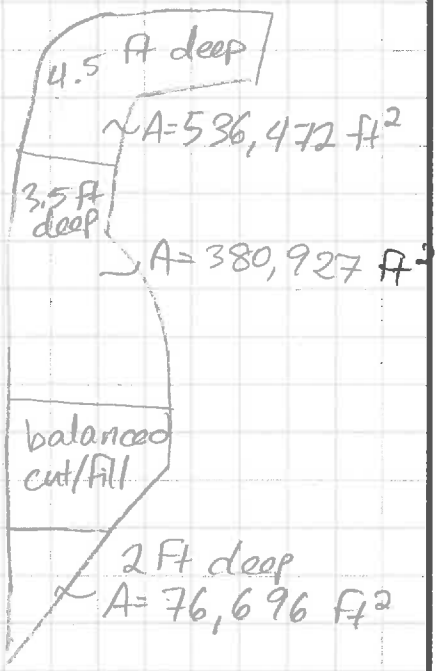
Fairgrounds - ignore building demolition

- Floodplain Creation
  including extra 0.5 ft for topsoil

$V = 4.5(536,472\ ft^2) + 3.5(380,927\ ft^2) + 2(76,696\ ft^2)$
$= 3,900,761\ ft^3$

$3,900,761\ ft^3 \times \frac{1\ yd^3}{27\ ft^3} \times \$24/yd^3$

$= \$3,467,343$



- Restoration
  Assume 0.5 ft topsoil over 1,352,532 ft²

$0.5 \times 1,352,532\ ft^2 \times \frac{1}{27} \times \$25/yd^3$
$= \$626,172$

Seedmix: $1,352,532\ ft^2 \times \$0.75/ft^2 = \$1,014,399$

Fairgrounds total: $5,107,914

Short Term C Total: $8,165,662
~$8,166,000

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JOB Walton BCA - Long Term A
SHEET NO. 1 OF 2
CALCULATED BY JCS DATE 8/20/14
CHECKED BY DATE
SCALE

Breaky Motors: $ 768,460

South of Water Street: $ 2,289,288

Replace Bridge: $ 5,000,000

Bridge Floodplain Work:

- Floodplain Creation: (including 0.5 ft extra for topsoil)

Northern Bank
XS 220136 A = 286 ft² } 72 ft
XS 220051 A = 413 ft² } 199 ft
XS 219830 A = 463 ft² } 221 ft
181 ft

$$V = 181(286) + \frac{286+413}{2}(72) + \frac{413+463}{2}(199) + 463(221)$$

$$= 266,415 \text{ ft}^3$$

Southern Bank
XS 219830 A = 407 ft² } 230 ft
XS 219591 A = 869 ft² } 214 ft
190 ft

$$V = 190(407) + \frac{407+869}{2}(230) + 869(214)$$

$$= 410,036 \text{ ft}^3$$

$$(266,415 + 410,036) \times \frac{1}{27} \times \$24/\text{yd}^3 = \$601,290$$

- Restoration:

$$A = 52,239 \text{ ft}^2 + 35,844 \text{ ft}^2 = 88,083 \text{ ft}^2$$

Topsoil: $0.5 \text{ ft} \times (88,083 \text{ ft}^2) \times 1/27 \times \$25/\text{yd}^3$
$= \$40,779$

Seed Mix: $88,083 \text{ ft}^2 \times \$0.75/\text{ft}^2 = \$66,062$

- Bridge Grading/Restoration Total: $ 708,131

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JOB Walton BCA - Long Term A
SHEET NO. 2 OF 2
CALCULATED BY JCS DATE 8/20/14
CHECKED BY _____ DATE _____
SCALE _____

Dollar General Building

Demolition : $ 100,000

Property Acquisition: $ 602,941

Floodplain Creation:
$V = 40,746\ ft^2 \times 9.5\ ft = 387,087\ ft^3$
$387,087\ ft^3 \times \frac{1}{27} \times \$24/yd^3 = \$344,077$

Restoration:
$A = 40,746\ ft^2$
Topsoil: $0.5\ ft(40,746\ ft^2) \times 1/27 \times \$25/yd^3$
$= \$18,864$
Seed Mix: $40,746\ ft^2 \times \$0.75/ft^2 = \$30,560$

- Dollar General Total: $ 1,096,442

Long Term A Total: $ 9,862,321

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JOB Walton BCA - Long Term C
SHEET NO. 1 OF 1
CALCULATED BY JCS DATE 8/20/14
CHECKED BY _____ DATE _____
SCALE _____

Same as Long Term A + Fairgrounds

= $9,862,321 + $5,107,914

= $14,970,235

Long Term C : $14,970,235

Engineering,
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and Environmental Science

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JOB Walton BCA
SHEET NO. 1 OF 2
CALCULATED BY JCS DATE 1/5/15
CHECKED BY DATE
SCALE

Acquisitions

* Areas from CAD survey *

& FFE

Reporter, 181 Delaware St
2 stories
FFE = 1205.94
A = 15487 SF
Streambed El. = 1191.2 XS 21901
Diagram 1A

Flows

10	50	100	500
17793	25031	28137	35526

$ 281,111 / 15,487 ft^2 = 18.15 $/SF

engineered

Benefits: $214,577.45

Dollar General

FFE: 1211.07
A = 9,310 SF
Streambed El. = 1193.71 XS 21959
Diagram 1A

$570,370/9310 = 61.3 $/SF

Engineered
Convenience Store
Benefits: $26,398.00

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JOB Walton BCA
SHEET NO. 2 OF 2
CALCULATED BY JCS DATE 1/5/15
CHECKED BY DATE
SCALE

Highway Dept. Big

FFE = 1208.60
A = 2467 SF
Streambed El. = 1193.71 XS 21959
Diagram 1A

engineered
$111,111 / 2,467 SF = $45.0

Warehouse - Non-Refrig.

Benefits: $13,129

Highway Dept. Little

FFE = 1206.63 ~$25,000 value
A = 693 SF
Streambed El. = 1191.2 XS 21901
Diagram 1A

$25,000 / 693 SF = 36.08

pre-engineered

Warehouse - Non refrig.

Benefits $21,067

APPENDIX D

INCORPORATING WATER QUALITY BENEFITS INTO BENEFIT COST ANALYSIS

A DISCUSSION OF APPROACHES THAT CAN BE USED BY THE WALTON FLOOD COMMISSION

Incorporating Water Quality Benefits into Benefit Cost Analysis (BCA)

A discussion of approaches that can be used by the Walton Flood Commission

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Standard FEMA BCA relies on the reduction of flood inundation to calculate benefits (in units of dollars) from avoided losses and damages. Over the years, FEMA's BCA program has been modified to include other factors that can be quantified and summed with flood inundation benefits, such as open space and riparian benefits, mental health, and volunteer costs. As of 2015, calculation of water quality benefits has not been added to the BCA program. Nevertheless, flooding is known to cause impaired water quality. Therefore, reduction of flooding is believed to proportionally reduce water quality impairment by reducing the area of land and buildings exposed to floodwaters and by reducing the depth and velocity of floodwaters that mobilize pollutants. Two approaches to including water quality benefits are discussed in this memorandum.

Approach Number 1

When the Local Flood Hazard Mitigation Analysis (LFHMA) [now LFA] program was being discussed in 2012, discussions about incorporating water quality benefits focused on developing appropriate "scores" that would correspond to "multipliers" that would then be applied to the benefit cost ratio (BCR) when proposed flood mitigation projects would result in reduced water quality impairment if implemented. Discussions centered on a set of scores for "chemical release prevention" ranging from zero (no water quality benefits) to 2.0 ("will protect at least one but less than six contaminant sources") to 4.0 ("will protect more than six potential contaminant sources"). Separate scores were developed for sediment transport from properties (as opposed to sediment transport from stream banks) and wetland preservation.

During these early discussions, stakeholders understood that low BCRs such as 0.3 would have a low likelihood of increasing above 1.0 when multipliers corresponding to moderate benefit were applied (0.3 x 2.0 = 0.6) but would have a higher likelihood of increasing above 1.0 when multipliers corresponding to significant benefit were applied (0.3 x 4 = 1.2). For this reason, the multipliers were set as follows:

- If total score is less than 4, multiplier = 1.0
- If total score is between 4 and 7, multiplier = 1.1
- If total score is greater than 7, multiplier = 1.2

Although this approach gained modest traction, it was not incorporated into the final LFHMA rules.

Since 2012, the additional factors incorporated into the BCA tool (open space and riparian benefits, mental health, and volunteer costs) were programmed to become available only when flood inundation benefits alone were sufficient to generate a BCR of 0.75 or greater[1]. In other words, these benefits can help make a "nearly cost effective" project into a cost effective project. This has set a reasonable precedent and a benchmark for considering water quality benefits in the BCA completed for LFAs.

[1] According to FEMA (2013), "green open space and riparian area benefits can now be included in the project benefit cost ratio (BCR) once the project BCR reaches 0.75 or greater."

With reference to the BCA discussion in the Walton LFA report, alternative LT-A provides a good example of how water quality benefits could be applied using multipliers[2]. LT-A has a BCR of 0.5 ($5.3M/$9.8M) when the full cost of a new bridge is included in the computation and a BCR of 0.8 ($5.3M/$6.3M) when the incremental cost for a longer and higher bridge is used in the computation. Consider the following:

- If, similar to the FEMA "rule" for auxiliary benefits is applied (i.e. the BCR must be 0.75 or greater to allow water quality benefits), only the second BCR would be feasible.
- If a multiplier of 1.2 was applied to the BCR of 0.8, it would push the BCR to approximately just under 1.0 at 0.96.

In the last 12 months, the rollout of the LFA program has reflected a wide range in the number of buildings contributing to BCA for a particular community, from 20 or 30 (for Lexington Hamlet) to more than 180 (for the Village of Walton). Some of the properties are residential and therefore would be expected to contribute to water quality impairment from heating fuels, vehicles, and sanitary wastewater. Other properties are nonresidential and would be expected to contribute to water quality impairment from heating fuels, vehicles, sanitary wastewater, and pollutants that are associated with the land use such as gasoline, oils, chemicals, food products, fertilizers, herbicides, pesticides, etc. In light of the differences from community to community, the approach discussed in 2012 (a set of scores for chemical release prevention ranging from zero to 2.0 [will protect at least one but less than six contaminant sources] to 4.0 [will protect more than six potential contaminant sources]) seems somewhat arbitrary. A community like Walton will easily have more than six potential contaminant sources whereas a community like Lexington Hamlet may not.

For this reason, it may be more appropriate to apply multipliers to the *individual* benefits associated with each property rather than apply multipliers to the sum of all benefits associated with a mitigation project. A new scoring system could be developed, with new multipliers associated with each sum of scores. Scores would be higher for commercial and industrial properties than they would be for residential properties, and the multipliers would therefore be greater for commercial and industrial properties than they would be for residential properties.

Approach Number 2

In a review of the literature, direct studies that provide an impact value to reduced water quality are limited. Turbidity and sediment loading are the issues most frequently studied in relation to water quality benefits in watersheds. Most studies use indirect methods, such as impact to tourism or "willingness to pay" surveys to compute the perceived value of water quality.

Three studies were reviewed to estimate a dollar figure ($) of water quality benefits per acre per year that could be utilized within the context of a BCA for LFAs.

- A study conducted by the State of New Hampshire focused on the potential impact to tourism from a perceived water quality reduction. The study predicted that the statewide impact would be $69 million per year, equivalent to a water quality value of $11.5/acre/year.

[2] Alternatives ST-A, ST-C, and LT-C already present BCRs greater than 1.0 and therefore water quality benefits are not necessary.

- A USDA study of New York State found that the societal benefits of reducing erosion are greater than $9/ton/year for all counties in the state. In other words, a one-ton reduction in soil erosion can increase societal benefits by $9/year. In an effort to apply this value to the West-of-Hudson region, the Upper Esopus Creek Management Plan was consulted. Using the long-term average sediment yield from Appendix III and applying the figure on an area basis, the societal benefits of reducing erosion in that watershed were $10.8/acre/year, reasonably close to the New Hampshire figure.

- Several "willingness to pay" studies were also reviewed. One of the studies summarized a significant amount of previous work nationwide. This study found an overall "willingness to pay" for improved water quality to range from $90 to $112 per person per year. In an effort to relate this value to the West-of-Hudson region, this data was applied to the Upper Esopus Creek Management Plan, resulting in a "willingness to pay" figure for water quality of $10.8/acre/year, in line with the USDA study.

The average of these three methods is approximately $11/acre/year. The range of figures is narrow and although this may be somewhat coincidental, it suggests that the average may be defensible in the West-of-Hudson region.

If per-acre figures were to be used to quantify water quality benefits, the calculation could be conducted on a parcel-by-parcel basis. As an alternative, it could be applied to the entire flooded area. Two additional choices are available: the per-acre figure could be allowed as a benefit on a "pass/fail" basis (either the land floods or it will not flood because a mitigation project has been completed in the future); or the per-acre figure could be used to generate a "depth-impact" function similar to the depth-damage curves currently used by the BCA. These depth-impact functions would then be combined with reductions in flood elevations to generate water quality benefits that vary from a minimum to a maximum according to depth of flooding avoided or reduced. Borrowing from approach #1 above, multipliers could still be applied to these calculations based on the type of parcel. For example, an industrial parcel should have the potential to have a greater impact on water quality than a residential parcel.

Ultimately, approach #2 may not generate sufficient benefits for use in LFAs. This is likely because per-acre benefits are typically estimated from watershed-scale studies or greater, including the three described above. In contrast to a watershed, the SFHA within any given watershed is only a fraction of the total area. If $11/acre/year were multiplied by the total acreage of downtown Walton in the SFHA (perhaps 300 acres), the result is only $3,300 per year. Projected over 50 years (the projection used by the BCA program for flood mitigation projects) without considering flood recurrence intervals, the benefit would be only $165,000. This is a nominal figure when compared to the benefits generated by the BCA program from flood reductions in Walton.

Summary

Approach #1 appears to offer the most significant potential for quantifying water quality benefits, and it is most consistent with the approach discussed when the LFHMA rules were initially developed. Two recommendations are offered if this approach is used to generate water quality benefits:

- The BCR must be 0.75 or greater to allow water quality benefits.
- Multipliers should be applied to the individual benefits generated for each property, and should differ for residential vs. nonresidential properties.