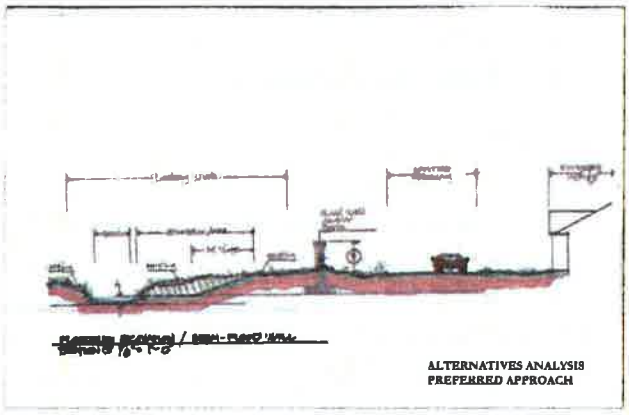
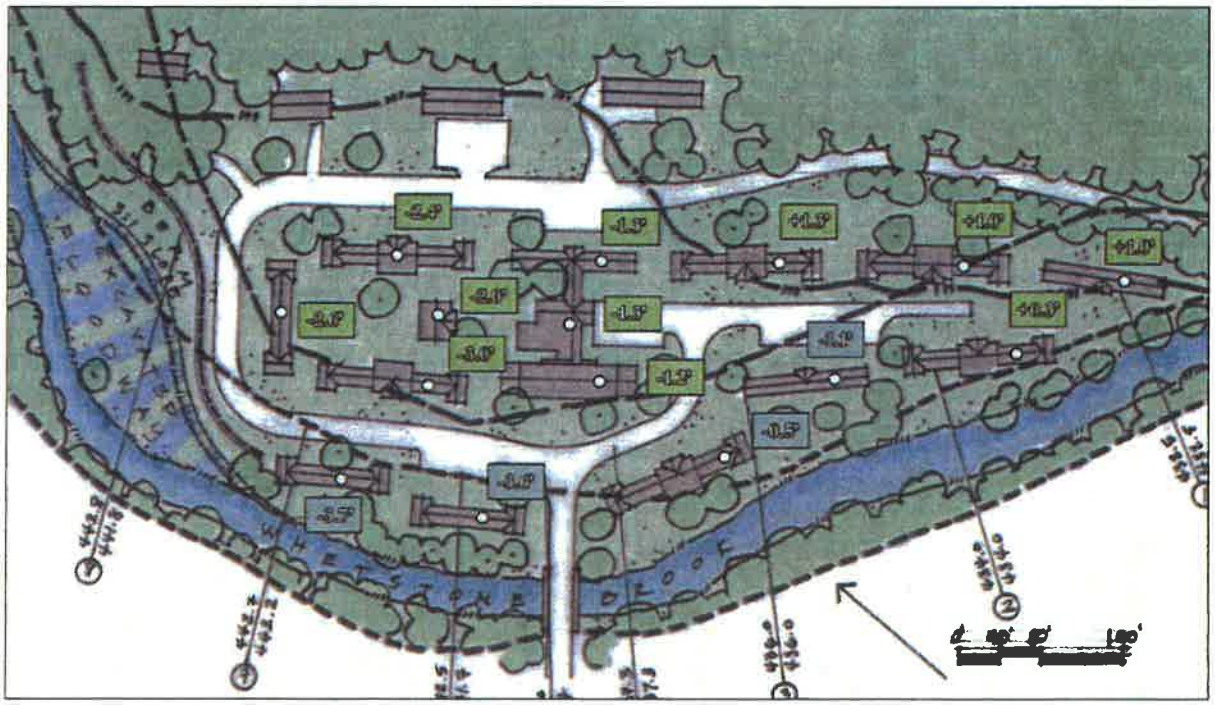
Melrose Terrace Brook Capacity Study

Floodway Restoration and Redevelopment Plan | *Brattleboro, VT*





Prepared for:

Brattleboro Housing Authority

224 Melrose Terrace, Brattleboro, VT 05301

July 2014

STEVENS & ASSOCIATES, P.C.
SMART DESIGN FOR LIVABLE COMMUNITIES
ARCHITECTS | ENGINEERS | LANDSCAPE ARCHITECTS | PLANNERS
95 MAIN ST | P.O. BOX 1586 | BRATTLEBORO, VT 05302

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

This report is the first step in determining a plan for the future use of Melrose Terrace. The Brattleboro Housing Authority (BHA) retained Stevens & Associates to assist with the identification and analysis of viable, potential uses of the property. The goal of the report is to provide stakeholders with objective information for use in final decision making.

The study assesses the options for the retention, modification, or dispensation of the property. In addition to providing technical infrastructure assessments, the study also aims to consider the implication of recent changes to Chapter 24 of Code of Federal Regulation (CFR), parts 50, 55, and 58. These changes affect the Department of Housing and Urban Development (HUD) investment of federal resources with respect to floodplain management and protection of wetlands. The change to the CFR codifies and replaces Executive Orders 11990 Protection of Wetlands & 11988 Floodplain Management.

There are also important changes to floodplain regulation in the recently adopted Biggerts Waters Flood Insurance Reform Act of 2012. These changes intend to raise the premiums of federally subsidized flood insurance rates until they reflect full risk rates.

At one end of the spectrum is the sale of the property and all of the housing, in its current state. At the other end of the spectrum is the demolition of all of the existing housing for the creation of open space.

In between these options are three basic approaches that require different levels of effort, cost, regulation and time. These intermediate options would maintain and protect a range of buildings/homes through the construction of flood walls, excavation of floodways, and/or replacing the bridge.

The goal of the report is to analyze the scenarios in terms of costs, technical feasibility and effect on housing stock, while keeping an eye toward the impact on stakeholders. The stakeholders include the BHA, federal, state and local authorities and technical experts in finance, insurance and engineering.

The analysis includes assessing the viability of protecting the property from future flooding by expanding the capacity of the Whetstone Brook floodway and protecting remaining housing stock, excavating material to increase flood storage volumes, constructing a floodwall and expanding the George Miller Drive bridge span.

<u>Next Steps</u>
1) Solicit creative thinking input from public
2) Establish a planning committee of representatives with technical, regulatory, financial (TRF) and governmental expertise.
3) Identify necessary, additional, technical studies or research
4) TRF participants meet to narrow input from public
5) establish 3-4 solid and realistic alternatives
6) public meeting for review and response to alternatives

II. INTRODUCTION

Melrose Terrace consists of 80 units of elderly and non-elderly disabled, low income housing. The offices of the Brattleboro Housing Authority (BHA) are also located within the complex. The housing units, offices and maintenance building are located in 18 buildings, all of which, are located in the Special Flood Hazard Area (SFHA). 6 of the buildings, containing 30 housing units, are located in the floodway.

The property is prone to flooding and requires regular evacuations during flood events. In the past ten years emergency services personnel responded to 6 flood events and evacuated the property twice.

In August of 2011 Tropical Storm Irene spread intense rain and flooding throughout Vermont. In Brattleboro the effects were devastating; the Whetstone Brook overtopped its banks along the entire stream corridor. At Melrose Terrace the floodwaters tore through the entire site and severely damaged the majority of residences. The financial costs topped $1,000,000. Elderly and disabled residents were displaced for an extended period of time. Countless volunteer and staff hours were dedicated to cleaning and rebuilding.

In 2012 the BHA conducted a Site Alternatives Study as part of an effort to identify locations that could provide safe, accessible and attractive housing for seniors, non-elderly disabled, low income residents. In the course of the study, the Melrose Terrace property was identified as a desired location for housing, provided that it is safe, financially feasible and supported by the community.

In an effort to determine the viability of the property for family housing, an alternatives analysis and development feasibility study was prepared for the BHA. In the study, three different, broad scenarios were investigated and compared; The 'As Is Alternative', the 'Floodway Restoration and Flood Hazard Mitigation Alternative' and 'Demolition and Redevelopment' Alternative. Each alternative was then analyzed and assessed for its merit in meeting the needs of the BHA as an organization, the future residents of Melrose Terrace, and the broader community.

Through the course of the study it was determined that there were three sub-alternatives to the Floodway Restoration and Flood Hazard Mitigation alternative. Each sub alternative relates to a different number of buildings removed and varying volumes of restored floodway.

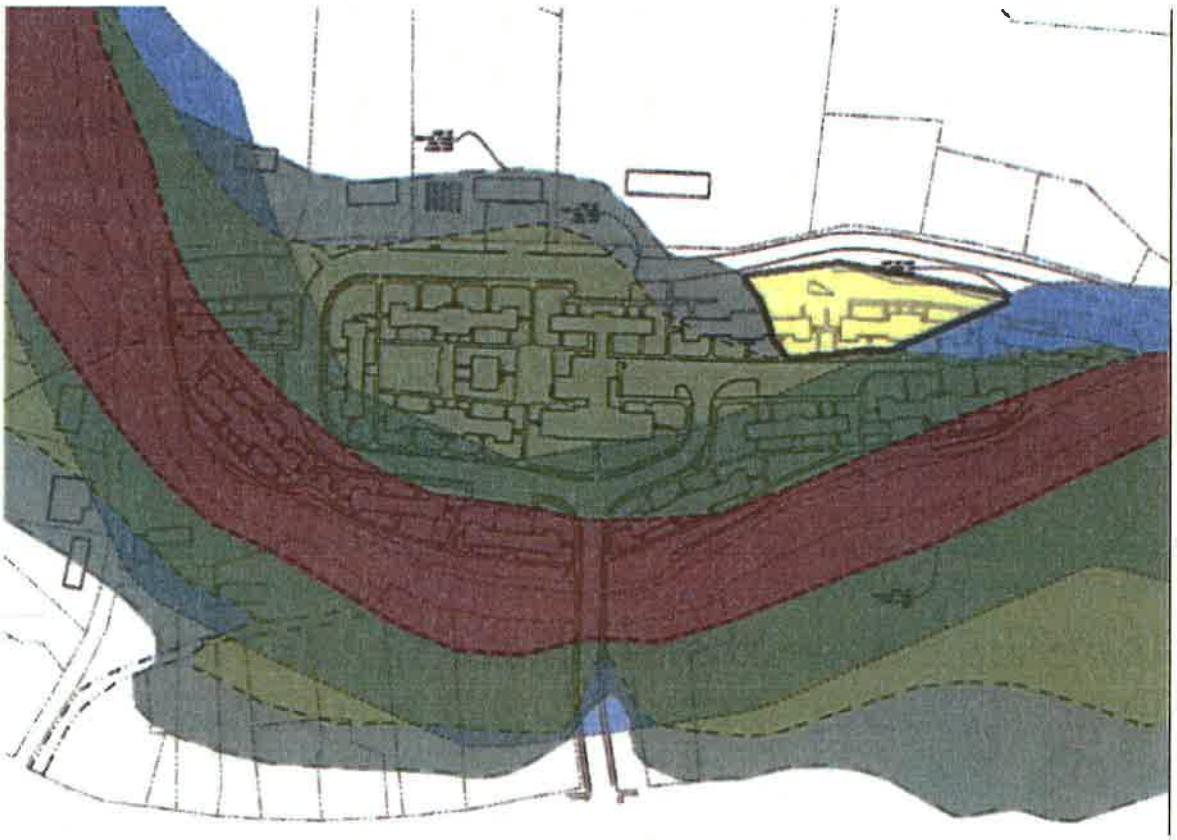
III. EXISTING CONDITIONS

The property is located on a low floodplain of the Whetstone Brook in the village of West Brattleboro. It is accessed by two roads, George Miller Drive and Melrose Street. There are 16 residential buildings and 2 nonresidential buildings. The single and two-story brick structures were built in 1965.

The property is located in a mapped flood zone: National Flood Insurance Program Special Flood Hazard Area (SFHA), with Base Flood Elevation (BFE) determined.

The property also sits in the mapped Fluvial Erosion Hazard (FEH) area. The FEH is a program guided by the Vermont River Management Section of the Agency of Natural Resources and typically administered locally. The FEH is not currently adopted by ordinance by the Town of Brattleboro. Any future Act 250 permitting would trigger jurisdictional review by the District Commission of the Natural Resources Board. The property is not currently an Act 250 property

There are 4 mapped Flood Insurance Rate Map (FIRM) cross sections and 4 interpolated sections, these sections establish Base Flood Elevations across the property. The BFE ranges from 445.3' to 432.0'. 17 of the 18 buildings are located in the SFHA. 15 of the buildings are below the Base Flood Elevation. 6 of the buildings (32 housing units) are either wholly or partially located in the Floodway (red). 9 other buildings are located in the 100 year flood plain (green). Each building is either wholly or partially in the FEH. The yellow portion of the property is not in a mapped flood hazard area. Interestingly, the yellow section suffered some of the more severe flood damage during Tropical Storm Irene.



The Whetstone Brook has a naturally narrow channel along the western edge of the property. Upstream is a wide, low flood plain. The narrowing between the wide flood plain upstream and the confined channel causes floodwaters to rise acutely at the upstream end of the development. Further, the narrow span of the George Miller Drive Bridge also presents a constriction point where floodwaters will back up. There are two mapped cross sections on each side of the bridge. The difference in Base Flood Elevation between the two is 5.2'

IV. METHODOLOGY

The challenge of the study was to provide a concise answer to a complex problem. Each of the three alternatives, and sub-alternatives, contain important implications to the three broad groups of stakeholders; Residents, the BHA and the Community. The evaluation process included preparing a schematic design for each alternative, calculating changes in base flood elevation and providing opinions of probable cost for the demolition and construction improvements. These figures were then compared to appraised real estate asset value and square footage replacement costs. Then the alternatives were reviewed against the needs of the stakeholders.

A. Alternatives:

1. As Is Alternative [A]

The 'As Is' Alternative retains the current layout and configuration of Melrose Terrace. Flood hazard risks would be unmitigated; safety of residents would remain unchanged and flood repair costs would be incurred consistent with the historical pattern.

a) As Is – BHA Operation **[A-1]**
Under BHA continued operation, elderly and disabled residents would be relocated to BHA property not subject to Executive Order 11988, which requires federal agencies to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Occupancy would entail converting the property to a private, or non-public entity.

b) As Is – Dispose of Property (Sale on the Open Market) **[A-2]**
The BHA could consider placing the property on the open market and seeking an alternative location for development.

2. Floodway Restoration, Floodwall Construction, Demolition of Buildings, Replace George Miller Drive Bridge. **[B]**

The floodway restoration alternative was expanded to include a subset of 3 different alternatives in order to capture the spectrum of costs, impacts and flood hazard mitigation. These alternatives rely on a combination of building a substantial flood wall to protect a portion of the existing buildings, removing buildings currently located in the floodway, excavating significant portions of the floodway to increase flood storage and increasing the span of the bridge crossing the Whetstone Brook.

a) Floodwall Only Alternative **[B-1]**
Construct a floodwall along the inside of Melrose Street around the north end of the housing development. The floodwall would be approximately 600 feet in length and six (6) feet high. Nine buildings would be protected, seven buildings unprotected.

b) Floodwall, Demolition, and Restore Floodway **[B-2]**
Demolish four buildings. Construct a floodwall along the outside of Melrose

Street around the north end of the housing development. The floodwall would be approximately 700 feet in length and four (4) feet high. Excavate an area of the floodway between the bridge and the upstream, northern end of the property. Ten buildings protected, two buildings remain in floodway.

c) Floodwall, Demolition, Restore Floodway, and New Bridge **[B-3]**
Demolish six buildings and construct a floodwall along the outside of Melrose Street around the north end of the housing development. The floodwall would be approximately 700 feet in length and three (3) feet high. Replace the George F Miller Drive bridge with a longer span and higher deck bridge. Excavate an area of the floodway starting downstream of the new bridge and continuing upstream to the northern end of the property. Ten buildings protected.

3. Demolition for Open Space or Redevelopment**[C]**
   a) Demolish buildings and clear the site. Maintain through access on Melrose Street. Maintain access to existing properties along Melrose Street. Leave as open space or Construct new, flood protected housing. **[C-1]**

B. Stakeholders:

1. Brattleboro Housing Authority
   The preferred outcome must be fiscally sustainable for the organization and in line with its mission to provide quality affordable housing opportunities in viable communities for lower income households.

2. The Community
   The community consists of varied stakeholders, including those that may benefit from improvements to Melrose Terrace and those to be impacted by changes. Community also refers to regulators, planners, emergency responders and others in charge of safeguarding resources of the town and state. Future plans must also meet the needs of the wider community.

C. Functional Impacts

1. Financial Impacts
   The study includes rough order of magnitude costs in order to understand the comparable financial burden of each alternative. The expectation is that the financial figures are not for budgetary planning but to understand the cost relationship of the alternatives.

2. Safety and Stream Function
   It is imperative that any future action and investment keep people safe from flooding and minimize the threat of damage to homes and property. This also includes developing an understanding of how physical changes to Melrose Terrace

infrastructure may affect the hydraulic function of the Whetstone Brook and the impact to surrounding properties upstream and downstream.

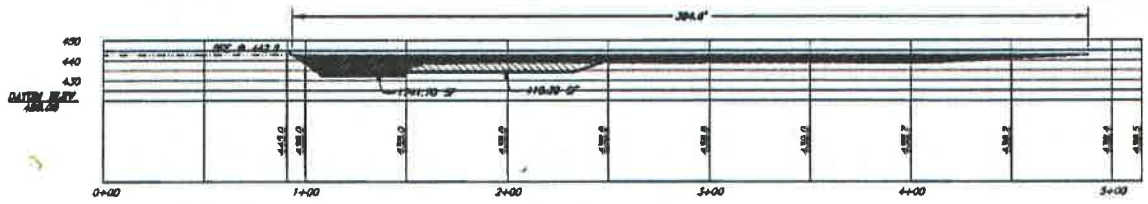
3. Site Function and Aesthetics
   It is also important that the internal daily functions of the development work for residents and future owners. The outcome will need to be functional in terms of building layout, utilities, vehicular and pedestrian circulation. The aesthetics of the final plan will be important to its ultimate success.

D. Schematic Design and Volume Calculations:

1. Cross Section Analysis
   Floodway restoration involves the excavation and removal of material in the floodway, theoretically increasing the storage capacity within the floodway and potentially decreasing the base flood elevation. Eight (8) project site cross sections were identified. The cross-sections included the full extent of the Whetstone Brook along the Melrose Terrace property including the floodway area and the floodway fringe (100 year SFHA).

   Comparing the existing cross sectional area available for flood storage with the area after excavation and floodwall construction results in a simplified analysis of flood storage impacts.

   The existing cross section area of flood storage capacity for each section was calculated using FEMA and interpolated base flood elevations.



FEMA SECTION "AX": FEMA REGULATORY FLOOD EL.=442.8

ALTERNATIVE 1

Existing Flood Plain Cross Section Area				
1741.7 sf				
Additional Flood Plain Cross Section Area				
410.3 sf				
BFE Reduction				
410.3	divide by	394.6	equals	1.0 BFE reduction
442.8	minus	1.0	equals	441.8 adjusted BFE

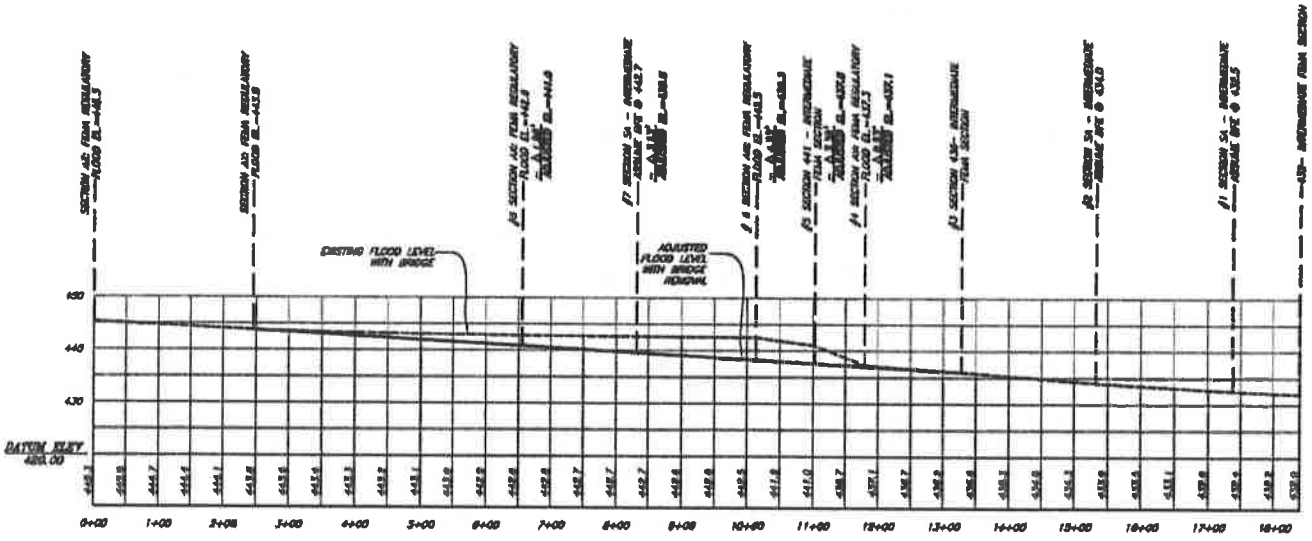
The next step was to calculate the potential increase of cross section flood storage capacity and the possible decrease in the base flood elevation. A proposed cross section area of floodway excavation was identified and quantified to determine excavation and flood storage volumes. In theory and in this analysis, the cross

section area of floodway storage capacity created by the floodway excavation decreased the base flood elevation.

The excavated/restored floodway analysis at each of the eight (8) cross sections indicated a decrease in the base flood elevation at each location. There is a wide range in the theoretical decreases in base flood elevations for each of the eight (8) locations.

The study includes the investigation of the benefits of the construction of floodwalls, either as a stand-alone mitigation approach or in conjunction with the floodway excavation/restoration. The initial floodway excavation/restoration analysis indicated that the floodway excavation/restoration by itself may not fully resolve the flooding hazards of all or portions of Melrose Terrace.

As the analysis progressed, it became evident that the George F Miller Drive Bridge has a large influence in the flooding hydraulics and the hydrology of Whetstone Brook, both upstream and downstream of Melrose Terrace.



As shown in the above longitudinal cross section, the effects of the flooding 'bulge' above the bridge would be meaningfully reduced with the replacement of the current bridge constraint.

V. ANALYSIS

As stated, the analysis of alternatives required a comparison of the calculated changes in base flood elevation to the relative cost of the improvements and the respective impact on flood hazard. The following are the outcomes.

A. 'As Is' Alternative:

The 'As Is' Alternative retains all buildings. BHA maintains flood hazard plans for hazard mitigation, preparation, evacuation and clean up. Flood insurance rates are grandfathered.

1. A-1 As Is Alternative - BHA Retains Ownership without Public Funding
   Retaining ownership of the property would necessitate a change in population to standard occupancy. Ownership without significant flood mitigation improvements means incurring the risks associated with annual or semi-annual flood events and living with the constant threat of a serious or catastrophic event as seen with Tropical Storm Irene.

   The insurance reimbursement costs for damage incurred during Tropical Storm Irene were $885,000. Another $300,000 (est.) was spent from the general budget and in-kind work.

   In 2013, the BHA spent $330,000 on flood hazard mitigation measures.

   Ongoing intangible costs

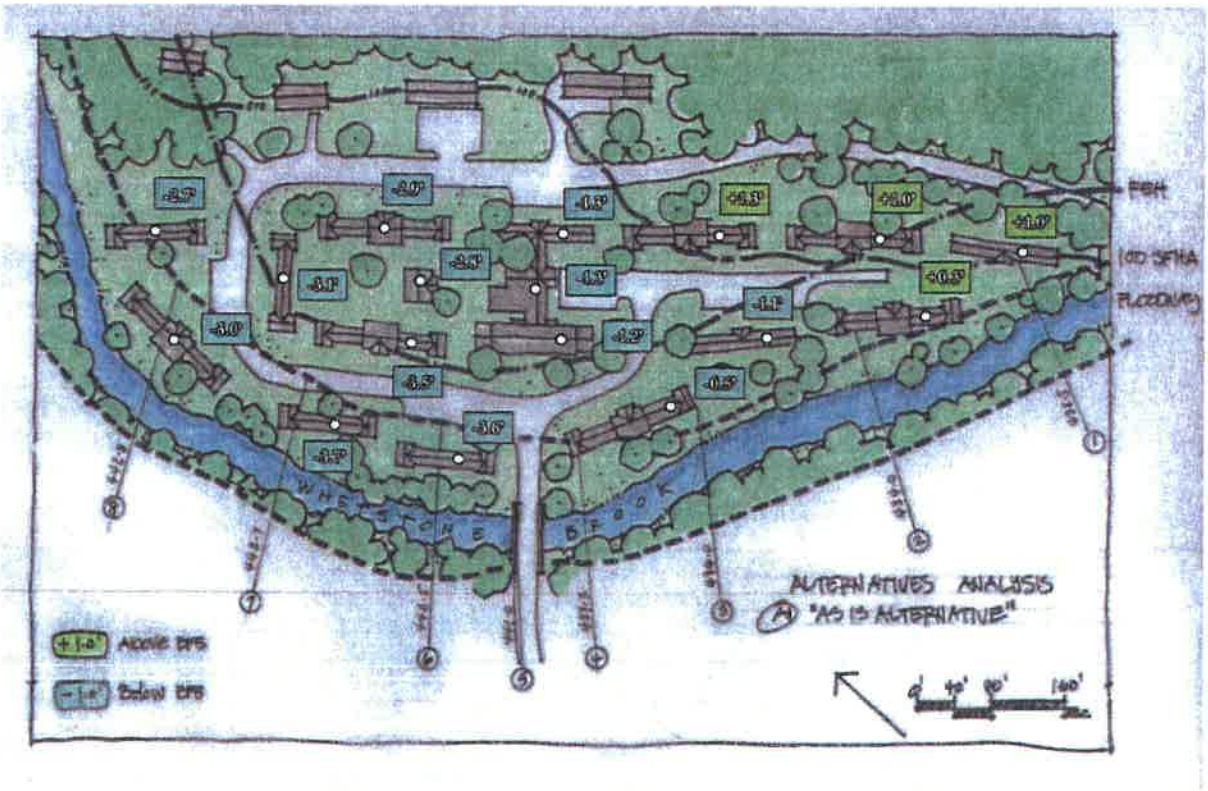
   - Regular flood events requiring Emergency Response
   - Added staff time for temporary flood prevention; sandbags, flood gates
   - Evacuations
   - Costs for cleanup and repairs
   - Burden of living with persistent threat of flooding

   In addition to the operational and financial challenge of operating a housing development in the SFHA, the Housing Authority is faced with a question of whether housing people in a flood hazard zone is consistent with its mission to provide safe, secure, accessible and affordable housing.

   For the residents of Melrose Terrace, it would mean living with, and being prepared for future flooding.

   For the Community, the 'As-Is' Alternative would result in maintaining the current condition: regular evacuations, upstream and downstream flooding.

2. A-2 As Is Alternative - BHA Divests Ownership
   The second "as-is" option for the BHA would be to sell the property. There are



several basic challenges to selling the property on the open market. Is it financeable? Is it insurable for a cost that is sustainable? Is there a market for the property?

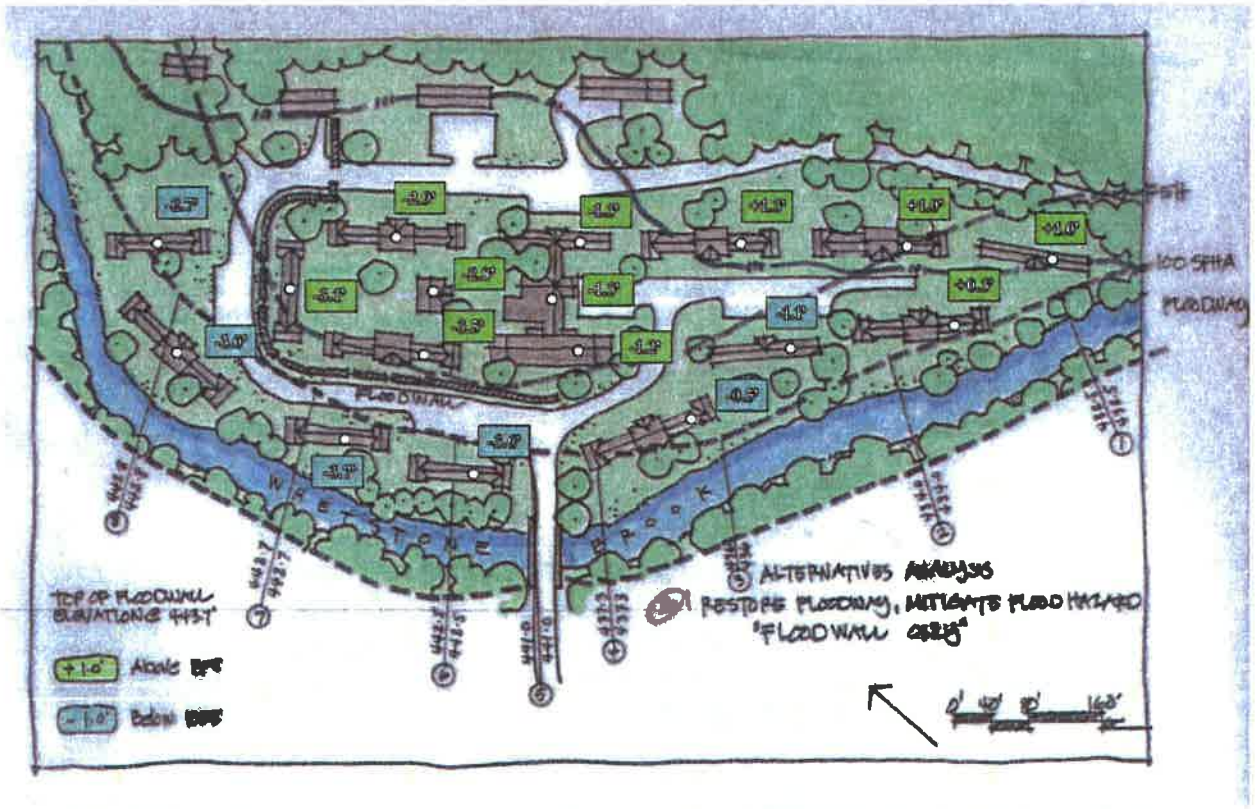
If the property is sold, the BHA could then explore options for developing replacement housing in another location.

B. Floodway Restoration, Floodwall Construction, Demolition of Buildings, Replace Bridge:

The analysis of the floodway restoration and flood hazard mitigation is represented on a spectrum of alternatives ranging from building a flood wall to full floodway restoration. The goal of the analysis is to arrive at a point where there is a balance of effectiveness, cost and impact. The initial goal was to discover if some portion of the existing housing would be protected in a meaningful way if the base flood elevation could be reduced, and/or if a flood wall was built.

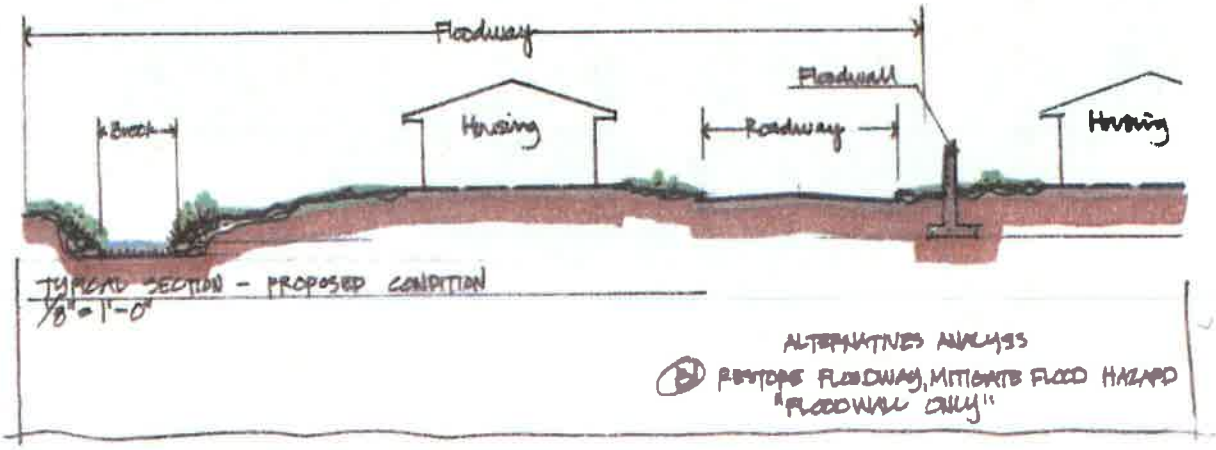
1. B-1 Mitigate Flood Hazard with Floodwall Only
   The first, lowest cost option that was studied was to build only a floodwall around the interior buildings of the development. The floodwall would be entirely outside the floodway and not subject to the permit restrictions associated with compensatory flood storage. The flood wall would be 600' long and start across from the end of the bridge. In order to protect the interior buildings from flooding, to FEMA standards,

the top of the wall would need to 1' above BFE. This would result in a 6' high wall above grade.



The concrete wall would be embedded to frost depth. Ideally the wall would have ornamental quality consistent with the development, brick faces with articulation and gates at walkways and buildings. The cost of the wall above grade is estimated to be $225,000.

Buildings outside the wall would not be protected.

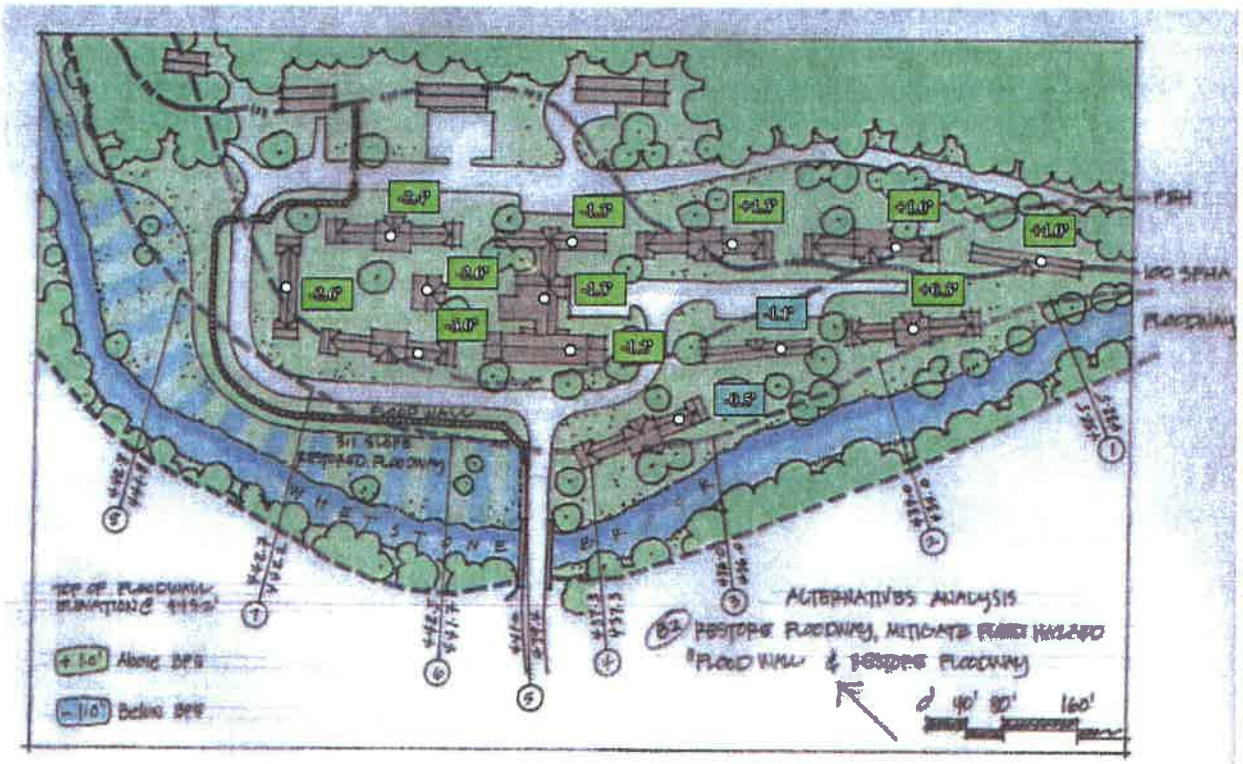


Installing only the floodwall would protect 10 of the buildings, leaving 6 unprotected. Financially, this would be a cost effective method to protect a large portion of the development. It would, however create some considerable drawbacks. First, the wall would be very high and somewhat imposing structure and flood gates would be difficult to manage. Secondly, the wall would create a physical barrier within the development.

The physical divide between residents could create a sense of inequality between the two types of buildings. This notion would be counter to the mission of the BHA.

Flood plain managers may not view option B-1 as favorably as other alternatives. While acceptable from a strict permitting point of view, by denying floodwaters access to the floodplain, without providing compensatory storage, flooding may be exacerbated on the outside of the wall and possibly impact upstream and downstream neighbors as well.

2. B-2 Demolition, Floodway Restoration and Floodwall Construction.
This scenario involves the demolition of 4 buildings, containing18 housing units, in the floodway, upstream of the bridge, and excavating the floodway to increase flood storage. The intent of the design is to provide enough additional flood storage to overall BFE and thereby mitigate flood hazard to the remaining buildings. There would still need to be a floodwall.



The excavation of the floodway would provide approximated 244,000 cubic feet of additional flood storage capacity and theoretically result in 0.6' reduction in overall BFE. That reduction in BFE was less than anticipated. Furthermore, the construction of the floodwall in an area of the floodway would require the provision of compensatory storage elsewhere.

By removing buildings from the floodway and providing compensatory storage, the floodwall could then be built on the outside of Melrose Street. The elevation of the wall can be reduced by 0.6' while the exposed height of the wall could be reduced to 4' by having the ability to provide more fill around it.

A lower wall, further from the residential units would reduce the visual impact of the wall. There would need to be fewer flood gates, although access points would be located along the wall in order to maintain a connection to the stream. The wall would be approximately 700' long.

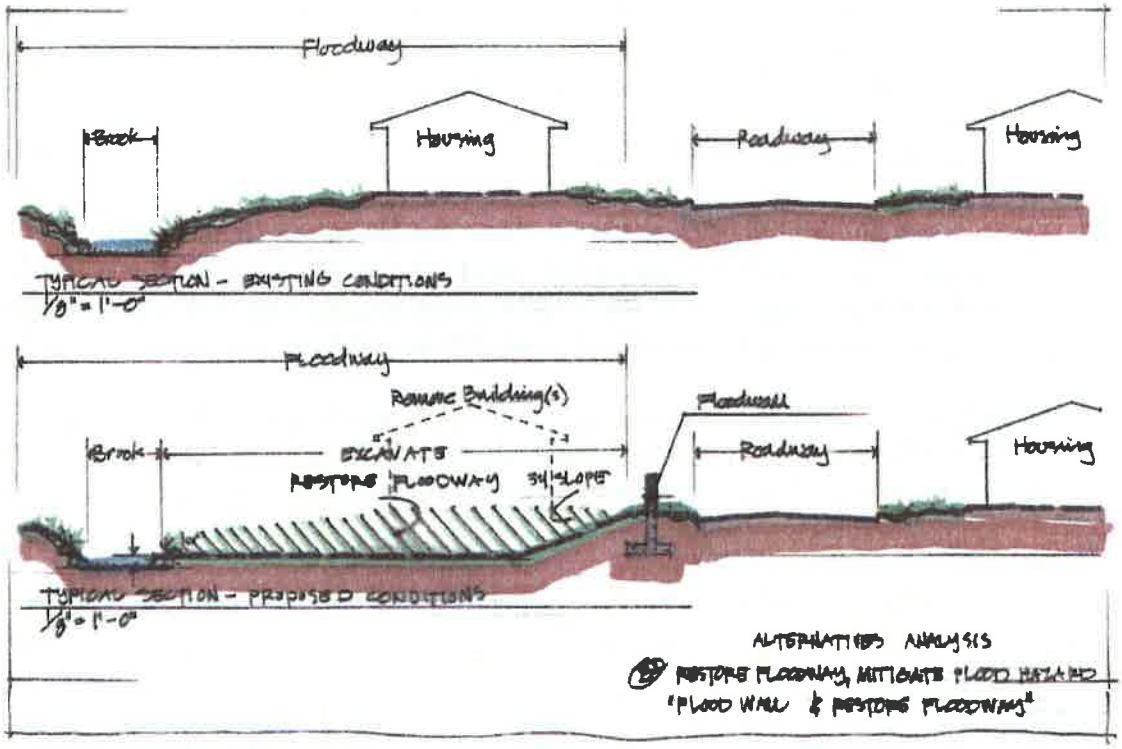
The opinion of probable costs associated with the improvements total roughly $850,000 as outlined below.

Alternative B-2	Construction Costs	
Flood Wall	700'	$288,750
Excavation	9,000 cu.yd.	$162,000
Demolition	4 Buildings	$319,600
Soft Costs	Hard Costs X 10%	$77,035
Total		**$847,385**

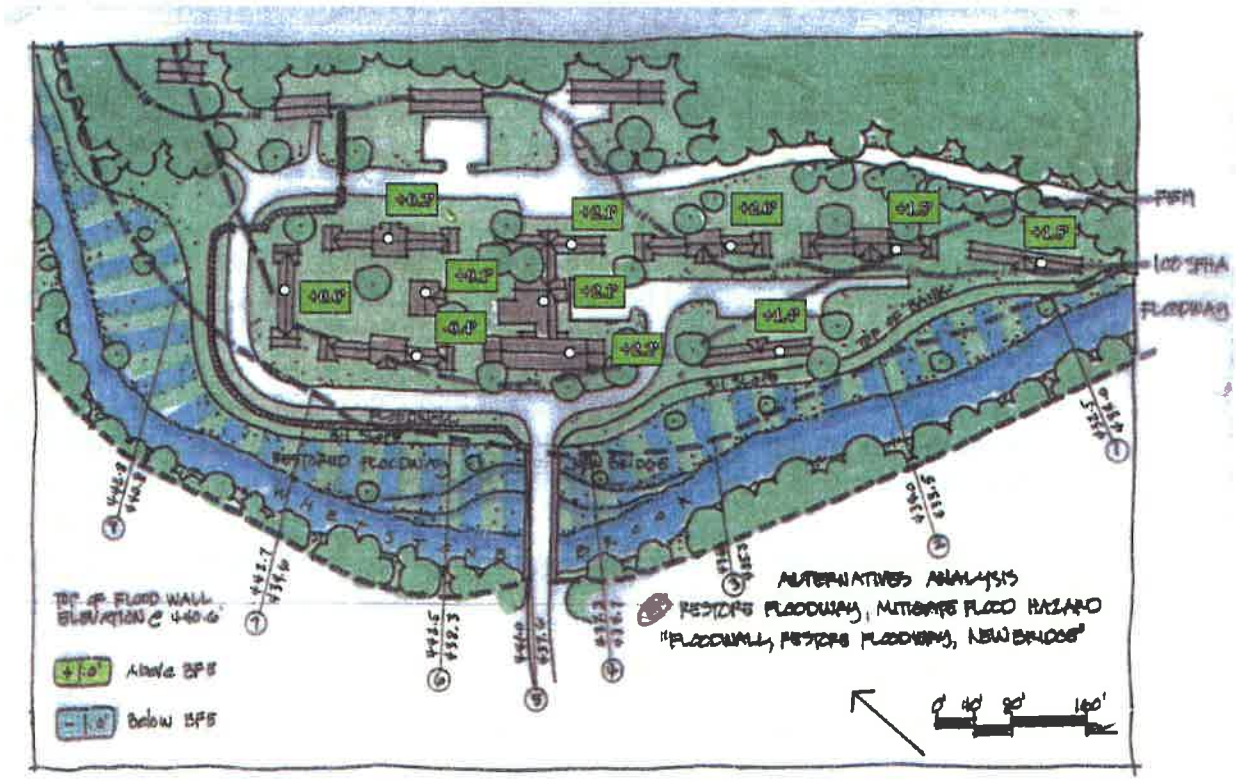
Alternative B-2 gives the BHA an opportunity to take meaningful action to mitigate flood hazard. The costs will be substantial, but retaining the real estate assets in a more protected state has real benefit to the organization. BHA would also benefit from providing improvements to the flood conditions beyond their property.

Removing 4 buildings and the construction of the floodwall would alter the character of the development, but the core would remain intact. For the residents of the 62 remaining units, living in flood protected housing would be a positive improvement.

Regulators, emergency and town planners would see benefit in increasing flood storage and reducing flood hazard and evacuations.

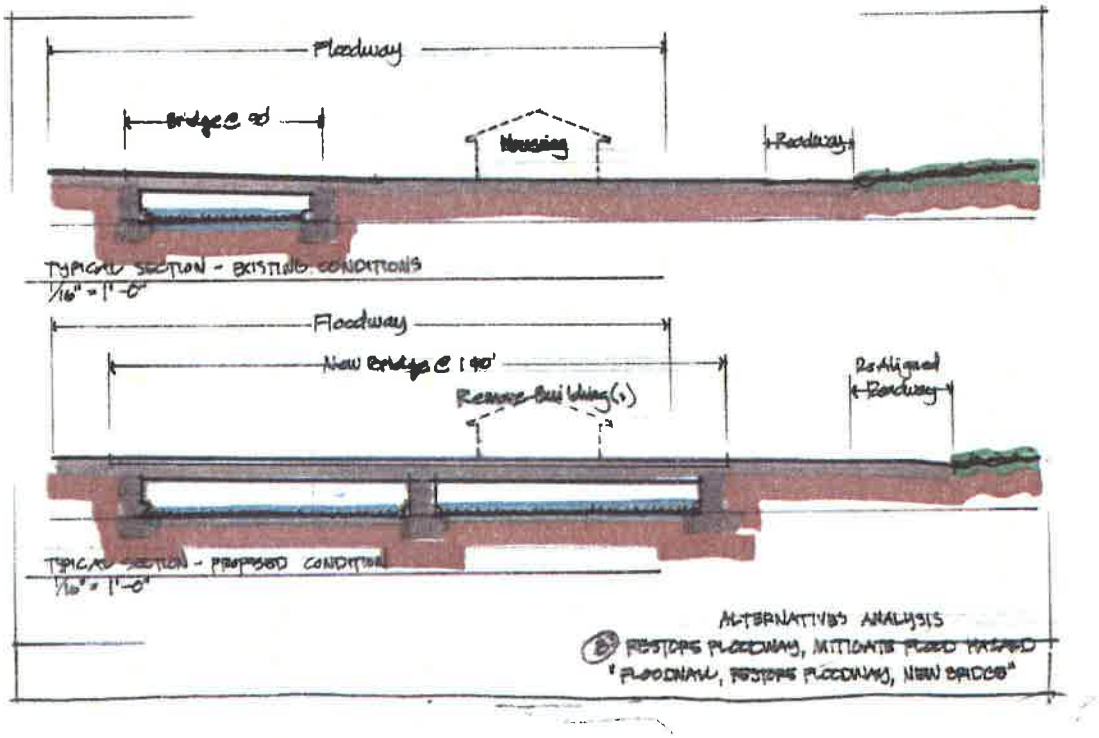


3. B-3 Demolition, Excavation, Floodwall and New Bridge
   Alternative B-3 expands on the notion that excavating material out of the floodway will improve flood hazard conditions. This scenario was prepared with the premise



that the bridge is the major constraint, exacerbating flood levels. This option proposes replacing the current bridge with a wider, higher bridge span and additional excavation of the floodway downstream of the bridge. A new bridge would most likely be the costliest alternative. It is also the alternative that provides the most safety and security for residents and neighbors.

B-3 includes the removal of 6 buildings with 30 units. The excavation of the floodway will provide a total of 475,000 cubic feet of flood storage. The floodwall design for B-2 (700') is replicated. The new bridge will provide a wider span and increased vertical clearance between BFE and the bridge supports.



The financial impact of full floodway excavation would mean an estimated construction cost of $2,700,000 including demolition, excavation, flood wall construction and construction of a new bridge.

Alternative B-3		Construction Costs
Flood Wall	700'	$288,750
Excavation	18,000 cu.yd.	$324,000
Demolition	6 Bldgs. & infrastructure	$479,500
Soft Costs	Hard Costs X 10%	$110,000
Bridge	Estimated	$1,500,000
Total		**$2,702,250**

The removal and replacement of the bridge would have a significant, positive effect on flood hazard conditions at Melrose Terrace. The BFE would be reduced by up to 3.6'. The floodwall would still be necessary, but approximately 2' lower than the

flood wall in option B-2 and less imposing.

This option provides the safer and secure solution to the BHA, but at the greatest cost. This alternative would only be feasible for BHA if outside funding could be brought into the project, particularly from state and local sources for the replacement of the bridge. The cost of replacement housing and significant construction costs make this option the most challenging for BHA.

From a residents' point of view, this option would change the character of the layout of the development, making it smaller and more private. The reduction of units would cut down on the social interaction and vibrancy of the development. The housing would be safer from flooding.

State regulators, emergency responders, town planners and neighbors would benefit immensely from the reduction in flood hazard. Emergency responders would be needed infrequently, neighbors would experience less flooding and regulators would see improved function in the floodway.

In order for Scenario B-3 to become a reality, it most likely would be undertaken in phases. The underlying premise for this scenario to move forward would be the bridge replacement and some form of cost sharing or state and/or federal funding for the bridge replacement.

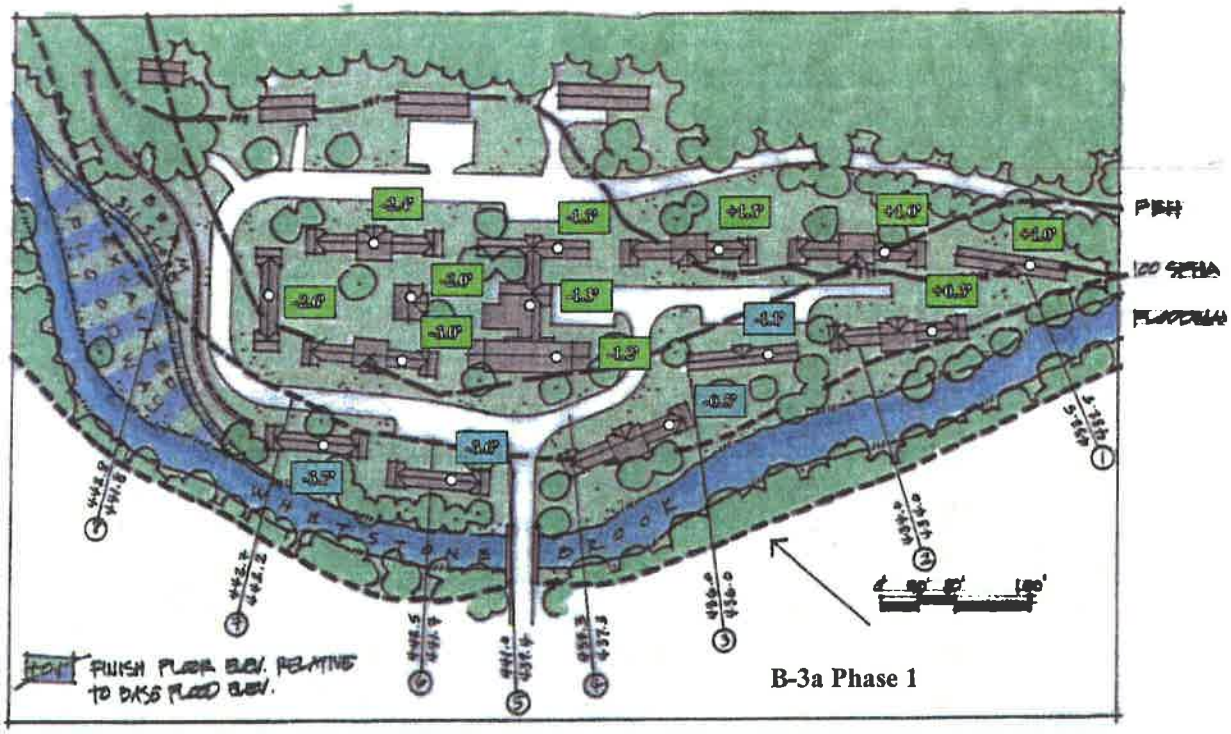
4. B-3a Initial Phase of Demolition, Excavation, Floodwall and New Bridge

Alternative B-3a Phase I arose as the team gained the understanding that the costs would be high and the schedule long for replacing the bridge. Option B-3a was developed as a possible first step that could be undertaken with a limited investment of time and money. The team did not want to lose sight of the benefit of replacing the bridge as it is the single biggest influence in causing the flood hazard in this zone.

The initial phase of this plan would include the demolition of two buildings in the flood way, excavation of the narrowest portion of the floodway where flooding problems have been acute, and the construciton of a low protective berm on the north and west side of Melrose Street. The initial phase could be completed within three years.

Phase II could include Alternative B-2 Demolition, Floodway Excavation and Floodwall Construction as outlined above. Phase II could be completed within 5-7 years.

Phase III could be Alternative B-3 Demoltion, Bridge Replacement, Floodway



Excavation, Floodwall Construction as outlined above. Phase III could be expected to be completed in 10-15 years

B-3a Phase 1		Construction Costs
Excavation	6000 cu.yd.	$108,000
Demolition	2 Bldgs. & infrastructure	$159,800
Earthen Berm	Solid Core, Grading	$85,000
Soft Costs	Hard Costs X 10%	$35,200
Total		**$388,000**

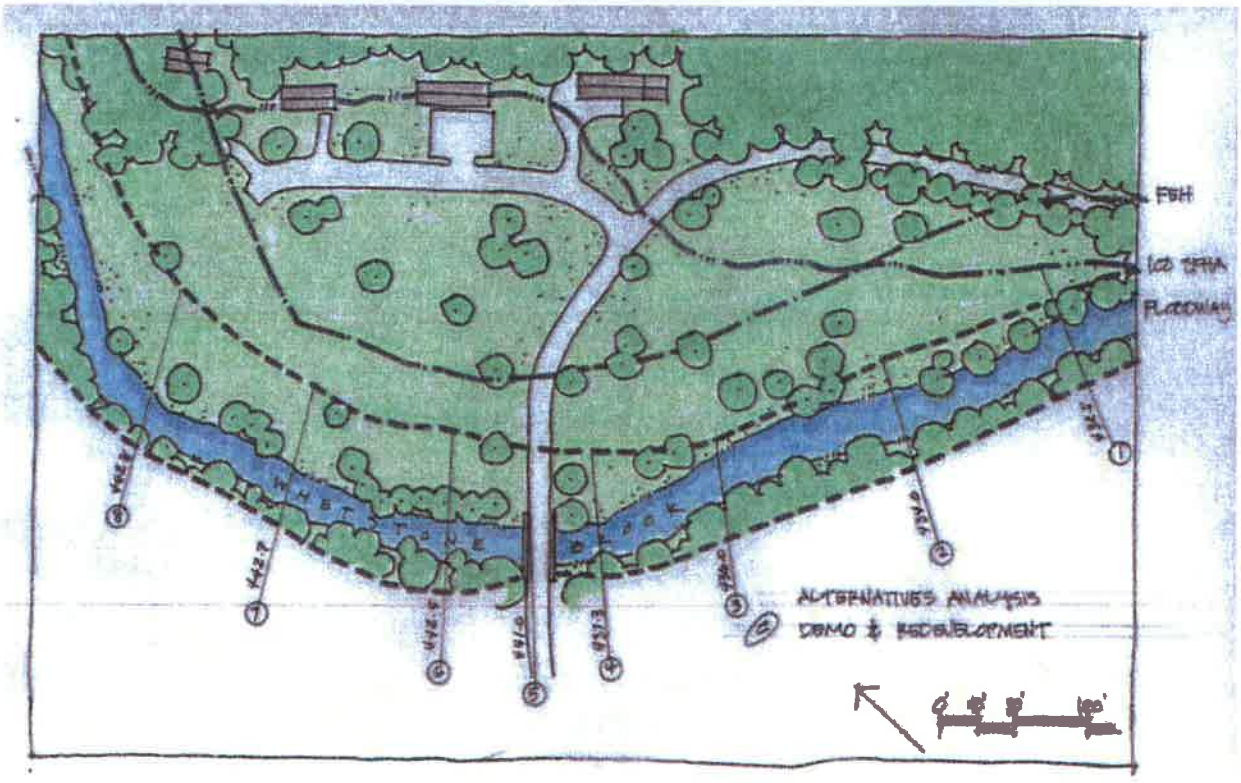
C. Demolition and Redevelopment

The concept behind demolition and redevelopment is to take down Melrose Terrace in its entirety, and build new housing at least 1'above Base Flood Elevation. Preliminary review of demolition and redevelopment highlights the steep costs of restoring the

floodplain. Still there are points worth noting and the scenario represents the other end of the spectrum of the analysis.

1. C-1 Demolition and Re-development
   A detailed feasibility study and analysis would be required to understand the full scope and cost of removal of all buildings and infrastructure. The cost could be expected to exceed 2 million dollars.

   The cleared property could be built up to grade to create flood proofed housing, but many federal funding programs limit financing to properties in the SFHA. Furthermore, the property is nearing 50 years of age, which could place it in a historic designation, adding further funding and permitting approval complexity.



Flood hazard for surrounding properties would not be significantly altered.

Regulators and flood plain managers would generally approve of restoring all flood plains to a natural condition. Demolition of the buildings and the creation of open space would create a condition most similar to a natural state. Wholesale redevelopment would allow the opportunity to balance natural flood hazard mitigation, while also providing the community with affordable housing. The floodway and fluvial erosion hazard zoned could be avoided.

VI. CONCLUSION

The BHA Whetstone Brook Capacity Study determined that there are viable alternatives to providing effective flood mitigation at Melrose Terrace. The costs of flood hazard mitigation are generally higher than conventional development, and the benefit to the community is complex and difficult to measure. Similarly, the market value of the housing stock does not match intrinsic value of the development as there are many qualitative values in aspects such as possible historic designation, community development, dense housing in a village center and established infrastructure.

The study provided technical analysis of flood mitigation measures and rough order of magnitude costs. There are also built in assumptions about the cost of replacement housing. The goal was to provide objective measures of the alternative development strategies.

The recommendation is to gather further technical, regulatory, financial and governmental input as a way of assessing the strategies that best serve the BHA and the community.

VII. REFERENCES

Memorandum: Whetstone Brook Alternatives Analysis. Milone and Macbroom June 15, 2012.

Brattleboro Housing Authority - Housing Strategy Guide. FEMA May 2012

Site Alternatives Study, Stevens & Associates, PC, October 2012.

Executive Orders 11990 & 11988

Federal Register/ Vol. 78, No. 221. Chapter 24 CFR parts 50, 55 and 58 November 2013.