Vermont Economic Resiliency Initiative [VERI]

Enosburgh, VT

Community Report
July 2015

VERMONT
AGENCY OF COMMERCE & COMMUNITY DEVELOPMENT
DEPARTMENT OF HOUSING & COMMUNITY DEVELOPMENT

Acknowledgements

The Vermont Economic Resiliency Initiative was partially supported by US Department of Commerce, Economic Development Administration (EDA). Thanks to EDA's Matthew Suchodolski and Debra Beavin for their support and guidance of the project. Thanks to the project team for their insight and expertise:

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Thanks also to the Vermont Department of Labor, the Vermont Division of Emergency Management and Homeland Security, Economic & Policy Resources, Inc, and the Office of the State Auditor for their assistance with data gathering and analysis.
Thanks to the consulting firms for their work developing the five community reports and recommendations. Their dedication, creativity and skill not only provided a strong work plan for the municipalities, but serve as models for all Vermont communities. Special thanks to Mary Nealon for her leadership in bringing this talented team together and Roy Schiff for his work as lead in Enosburgh.

- Bear Creek Environmental, LLC: Mary Nealon
- DuBois & King, Inc.: Matt Murawski
- Fitzgerald Environmental Associates, LLC: Evan Fitzgerald
- Landslide Natural Resource Planning, Inc.: Amy Sheldon
- Milone & MacBroom, Inc.: Roy Schiff

Thanks to the Town of Enosburgh, Village of Enosburg Falls and all those who participated in stakeholder meetings, community forums, morning coffee meetings and took the time to review, edit, comment and provide the local perspective for this project. Thanks to the members of the General Assembly, Selectboard, Planning Commission, town staff, the Chamber of Commerce, businesses and citizens. Your participation greatly improved the report.

Noelle MacKay, Commissioner of Housing and Community Development

Table of Contents

Figures and Tables

Appendices

Vermont Economic Resiliency Initiative (VERI): Enosburgh Executive Summary

In communities around Vermont, rapidly melting snow and torrential downpours bring nightmares of washed out bridges, closed roads, flooded basements and shuttered businesses. To calm these fears, Vermonters have been working to better understand the flood risks they face and identify and implement projects that reduce, avoid or minimize these risks. The goal: to protect lives, help businesses remain open and reduce costs to taxpayers for repetitive repair to infrastructure.

After Tropical Storm Irene, Governor Shumlin challenged us to "build back stronger than Irene found us." This project, the Vermont Economic Resiliency Initiative (VERI), is designed to help meet this challenge. It is modeled after a successful project in Bennington, Vermont that minimized business interruption and saved tax payers money by substantially reducing flood recovery costs, is designed to help meet that challenge (DHCD, 2015). With funding from the US Department of Commerce, Economic Development Administration (EDA), the Agency of Commerce and Community Development, working with the Agencies of Natural Resources and Transportation and the Regional Planning Commissions, launched VERI to help ensure Vermont recovers quickly and remains open for business after disaster strikes.

In the first phase of the project, the VERI team evaluated and ranked areas where economic activity and associated infrastructure are at high risk of flooding. Based on this state-wide assessment, input from the team's economic steering committee and interest from local municipalities, five areas in seven communities (Barre City and Town, Brandon, Brattleboro, the Town of Enosburg and Enosburg Falls Village, and Woodstock) were selected for a more detailed analysis of the local flood risks to the community and businesses.

The Town of Enosburgh and Enosburg Falls Village were selected as a pilot community as they represent an agricultural-based economy that is impacted by flooding and erosion. The community has worked to identify flood and erosion risks and projects are regularly implemented to strengthen the transportation network that is essential to access local farms and move agricultural products to market.

The VERI team hosted two community forums and has worked directly with local leaders, municipal staff, local businesses and interested citizens to determine the locations of greatest risk and cost, identify potential projects and highlight the work communities have accomplished to date to reduce the impact of floods. Based on data collection and analysis, along with community insight, the team evaluated local flood and erosion risk to business and infrastructure and identified strategies and projects that Enosburgh can implement to minimize rebuilding and recovery costs and ensure businesses stay open -- saving jobs and maintaining the local economy.

This report summarizes the team's work and identifies town-wide policy and program recommendations and 11 site-specific projects in Enosburgh, including four projects deemed high priority by the team of river scientists and engineers.

Municipal Policy and Program Recommendations

Top recommendations include the following:

- **Develop a Local Hazard Mitigation Plan for the Village of Enosburg Falls:** The Village of Enosburg Falls should begin drafting its local hazard mitigation plan and include top projects and strategies identified in this report. Having a hazard mitigation plan will make the Village eligible to apply for additional federal funding for infrastructure projects. It also qualifies the Village for additional state disaster aid from the Emergency Relief Assistance Fund (ERAF) – increasing state aid from 7.5% to 12.5% which reduces local costs.
- **Document Road, Sewer and Water Infrastructure Vulnerabilities in Municipal Plan and Develop Capital Plan:** Specific areas that were damaged, or have known vulnerabilities, should be documented so the communities can plan for their replacement in their long-term budgets, easing the impact on taxpayers. The Town and Village are encouraged to develop a capital improvement plan that incorporates the physical improvements recommended through the VERI project.
- **Update Policies to Prohibit Fill in Flood Hazard Areas:** Allowing landowners to fill low lying areas may help protect an individual property, but it can reduce the land's ability to slow and store flood water that can increase flood hazards to downstream property owners. The Town bylaws prohibit new fill except where necessary to elevate structures above the base flood elevation. The Village bylaws also prohibit fill but the language should be more explicit.

High Priority Specific Project Recommendations

Channel and Floodplain Improvements: These are projects that lower the risk of flooding and erosion to properties along the river through the improvement of natural river and floodplain functions. High priority recommendations in this category include:

- **Remove Berm along the Missisquoi River:** Removal of a portion of the berm near the Enosburgh-Berkshire town line is recommended to allow flood waters to spread into farm fields and reduce flooding along VT Route 105. The state has experience in berm removal to reduce flood and erosion risks and thus a moderate ease of implementation is anticipated for this project. The project would likely costs between $100,000 and $200,000. The project could be implemented over the next five years and reduce risks to local farms, businesses, and the highway into the Village.
- **Conserve Land Upstream of Boston Post Road:** River corridor conservation in an area upstream of Boston Post Road is recommended along Tyler Branch to protect the beaver pond complex and floodplain area that stores sediment and large woody debris. This broad storage area improves downstream channel stability, limits side-to-side movement of the channel and protects farmland from erosion in the Tyler Branch valley. The proposed corridor conservation project is anticipated to have a moderate ease of implementation. The

project would likely cost between $50,000 and $100,000. The project could be implemented over the next five years.

Infrastructure Improvements: These are projects that lower the risk of flooding and erosion to utilities, roadways and other municipal or state-owned infrastructure. Top recommendations include:

- **Improve the Surface and Enlarge Undersized Culverts on Hayes Farm Road and Davis Road:** When the Missisquoi River floods, traffic detours to Hayes Farm Road and Davis Road, among others. This detoured traffic can quickly deteriorate rural roads making travel difficult and increasing repair costs for municipal budgets. Undersized culverts also exist along the roads, making the road susceptible to flooding and erosion. Upgrading the road surface and replacing culverts will help ensure this route remains open for business during and after flooding. Work to completely improve both roads would cost more than $1 million and the project could be implemented over the next five years. However, some of these repairs are planned or already under way and the community could decide to accelerate this work.
- **Install Overflow Bridge or Install a New Wider Bridge on Boston Post Road South of the Missisquoi River and Elevate Low Spots along Vermont Route 105:** When the Missisquoi River floods, one of the first locations to overtop is the low spot on Boston Post Road. During high water, several low spots along VT Route 105 flood as well. To keep this vital commercial corridor open, this project proposes an overflow bridge or a new wider bridge and elevating several low spots on VT Route 105. The additional bridge would likely cost over $1 million and elevating the low spots on Route 105 could cost over $200,000. The project could be implemented over the next five years.

The team prepared concept designs for three of the high-priority projects – Missisquoi River berm removal, Tyler Branch corridor conservation, and improvement of Davis and Hayes Farm Roads – to help Enosburgh take the next steps and to create model project designs to help other communities learn from the VERI project.

Next Steps

As part of the ongoing community discussion regarding the VERI effort, the team recommends the following steps to incorporate the community's input into the final prioritization and advance the projects over time:

- Solicit input from individuals and businesses at future community meetings regarding specific projects and overall project prioritization.
- Prioritize one or two projects to pursue each year with assistance from the Vermont Department of Environmental Conservation and Northwest Regional Planning Commission staff to identify appropriate funding sources and partners.
- Apply for one or two grants each year to advance project development and designs.
- Implement projects as funding allows.
- Monitor project success.

Irene taught us many lessons -- a key one was that no one individual, business, organization, town or state agency can address and tackle large and complicated projects alone. Reducing the risk of future floods in Enosburgh will require partnerships, funding and time to implement. The Agency of Commerce and Community Development, its sister agencies and the Northwest Regional Planning Commission are committed to helping Enosburgh take the steps outlined in this report to save lives and protect jobs and its economy from future storms and floods. Flooding due to severe storms will happen again, the question is how can we best reduce the recovery costs to communities and ensure businesses remain open.

List of Acronyms

ACCD – Vermont Agency of Commerce and Community Development

ANR – Vermont Agency of Natural Resources

BFE – Base Flood Elevation

CRS – Community Rating System

DEC – Vermont Department of Environmental Conservation

DHCD – Vermont Department of Housing and Community Development

EDA – US Economic Development Administration

EPA – United States Environmental Protection Agency

ERAF – Emergency Relief Assistance Fund

FEA – Fitzgerald Environmental Associates, LLC

FEMA – Federal Emergency Management Agency

GIS – Geographic Information System

HMP – Hazard Mitigation Plan

LiDAR – Light Detection and Ranging

NFIP – National Flood Insurance Program

NRCS – Natural Resources Conservation Service

NRPC – Northwest Regional Planning Commission

SFHA – Special Flood Hazard Area

VERI – Vermont Economic Resiliency Initiative

VTRANS – Vermont Agency of Transportation

Glossary of Terms

Terms are bolded the first time they appear in the text.

100-Year Floodplain – The area that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. Also called 100-Year Flood Zone or 100-Year Flood Hazard Area.

500-Year Floodplain – The area that will be inundated by the flood event having a 0.2% chance of being equaled or exceeded in any given year. Also called 500-Year Flood Zone or 500-Year Flood Hazard Area.

Base Flood Elevation – The computed elevation to which floodwater is anticipated to rise during a 100-year flood.

Berm – An artificial ridge or embankment, e.g., a raised bank bordering a river that prevent flow out of the main channel.

Community Rating System (CRS) – Program that provides a flood insurance premium rate reduction based on a community's floodplain management activities. CRS recognizes community floodplain management activities that exceed the minimum NFIP standards. Besides the benefit of reduced insurance rates, CRS floodplain management activities enhance public safety, reduce damages to property and infrastructure, avoid economic disruption and losses, and protect the environment.

Confluence – The location where two or more river channels join.

Cross Section – A view or drawing that shows what a river channel or any other object looks like as if a cut has been made across it.

Culvert – A pipe or tunnel underground, usually under roads, that transports flowing water, sediment, debris and ice from one side to the other.

Emergency Relief Assistance Fund – This program allows towns in Vermont to increase the amount of state aid money they could receive as a match to federal aid for post-disaster recovery.

Erosion – The wearing away of rock or soil by flowing water.

Fill – A quantity of earth, stones, etc., for building up the level of an area of ground.

Floodplain – Area of land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge.

Floodway – The area immediately adjacent to the channel that must remain open to allow floodwaters to pass.

Flood Resiliency – The ability of individuals, communities, organizations and states to adapt to and recover from flooding hazards without compromising long-term prospects for development.

Hamlet – A small rural community.

Hazard Mitigation Plan – A document and planning process that provides actions to reduce the long-term risk to human life, property, and the economy from natural disasters.

Large Woody Debris – Large trees that find their way into a channel and are transported downstream and physically broken down. Large woody debris is typically removed from a channel

to reduce the risk of structure clogging, yet is important to leave in the channel to increase long-term channel stability and to maintain good fish habitat.

LiDAR – Elevation data generated by remote sensing the distance between a plane or satellite and the earth's surface.

Mass Wasting – The large-scale erosion of the valley wall that leads to large sediment loads in river channels that can remain active over long periods of time as the channel moves.

Mitigation – Any sustained action taken to reduce or eliminate the long-term risk to life and property from hazard events. It is an on-going process that occurs before, during, and after disasters and serves to break the cycle of repetitive damage and repair.

National Flood Insurance Program – A federally funded and locally implemented program to reduce the impacts of flooding through individual insurance policies and incentives for floodplain regulations.

No-rise Certification – A certification by an engineer that a project will not increase flood heights.

Riparian Buffer – Mixed composition, vegetated land adjacent to a stream separating it from other land uses.

Riprap – The application of rocks to reduce erosion and protect nearby infrastructure or private property. Also known as rock armoring.

Special Flood Hazard Area – The area that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. Also called 100-Year Flood Zone or 100-Year Flood Hazard Area.

State River Corridor – Area delineated by the Vermont Rivers Program adjacent to rivers and streams that provide functions that restore and maintain natural stability for a river. These areas are often at higher risk of erosion.

Tributary – A stream that flows into another, larger stream.

Project Overview

In 2013 the Vermont Agency of Commerce and Community Development (ACCD) received disaster recovery funding from the US Economic Development Administration (EDA) for the Vermont Economic Resiliency Initiative (VERI). The objectives of VERI are to:

1. Analyze threats to areas of economic activity and their associated infrastructure;
2. Develop plans to reduce impacts and avoid future losses and costs; and
3. Identify projects that communities and businesses can implement that maximize opportunities for businesses to stay open.

The overarching project goal is to help businesses and communities bounce back quickly when disaster strikes, saving time and money in recovery costs.

The primary objective of VERI is to develop strategies and projects to make businesses and communities more resilient to floods and other disasters.

VERI is led by ACCD's Vermont Department of Housing and Community Development (DHCD) in partnership with the Vermont Agency of Natural Resources (ANR), Vermont Agency of Transportation (VTrans), and Vermont's Regional Planning Commissions, which in Enosburgh is the Northwest Regional Planning Commission (NRPC). Early in the VERI process, these agencies mapped places where flood and **erosion** risks intersect with areas of economic activity and infrastructure state-wide. Five pilot areas were selected for a detailed risk assessment – Barre City and Town, Brandon, Brattleboro, Enosburgh Town/Enosburg Falls Village, and Woodstock. A team of river scientists and engineers from five Vermont consulting firms – Bear Creek Environmental, LLC, DuBois & King, Inc., Fitzgerald Environmental Associates, LLC, Landslide Natural Resource Planning, Inc., and Milone & MacBroom, Inc. – was hired to assess the rivers and **floodplains** and assist in developing strategies and projects to reduce the vulnerability of infrastructure and businesses to flood damage.

A number of factors played a role in the selection of the five communities for more detailed assessments. First, the project team ranked towns across the state by flood risk, economic activity and infrastructure at risk. Then the team looked at the twenty highest ranking communities and removed any that had undergone or had funding for similar analysis (e.g., Bennington and Waterbury). Next, the team strived to select five areas that represented different economic profiles (e.g., agriculture, tourism, downtowns) as well as different sizes. Other considerations included risk of future damage, economic factors and level of community engagement and interest. Together, these factors helped determine the five pilot communities.

Why was Enosburgh Selected?

Enosburgh was selected as a pilot community for the following reasons:

- Enosburgh has a farm-based economy located in the northwest corner of Vermont that is representative of the state's agricultural markets, dairy in particular;
- Flooding takes place along both Tyler Branch and the Missisquoi River impacting farming, the movement of agricultural goods, businesses and homes;
- Transportation infrastructure is threatened by flood and erosion risk in the area; and
- Previous efforts have been made by Enosburgh to identify flood and erosion risks.

Study Area

Enosburgh Town, which includes the Village of Enosburg Falls and several **hamlets**, is located in Franklin County in northwestern Vermont (Figure 1). The Town covers an area of approximately 49 square miles and 4,977 people live in the Town according to the 2010 population census.

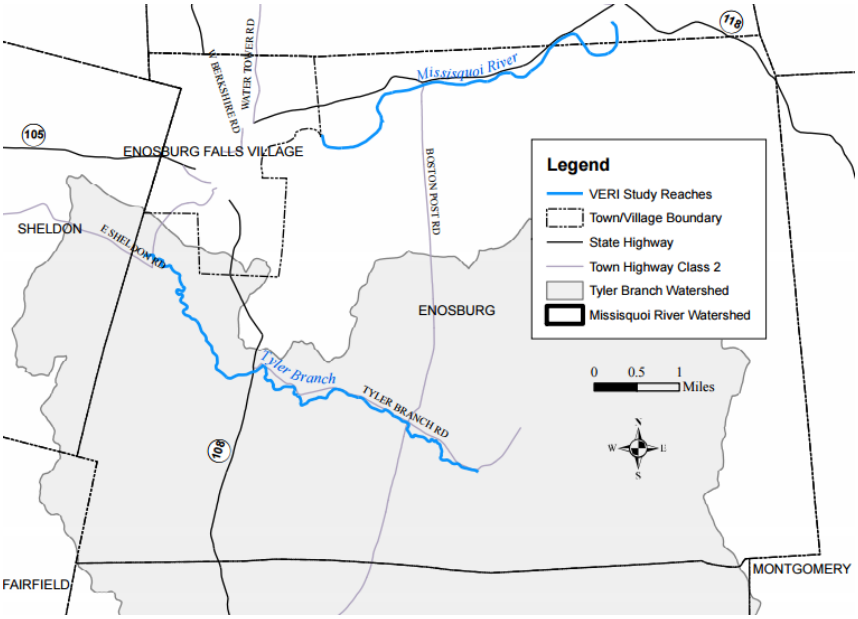

Figure 1: Project location map

Enosburgh is locally referred to as the "Dairy Capital of the World" given the dominance of farming. A quick drive along most roads reveals miles of farm fields divided by tree-lined rivers and streams with forested mountains in the backdrop to the east and Lake Champlain to the west. Fields are primarily used for dairy operations to graze cattle, produce hay, or produce silage. About half of the farm fields in the Town are conserved (4,167 acres according to the Vermont Land Trust) and thus will permanently remain in agricultural production.

Commercial development is concentrated in Enosburg Falls, with rural residential and commercial development spread out along roadways outside of the Village. A pocket of businesses exists along the Missisquoi River across VT Route 105 in the vicinity of the Dairy Center. The Village of Enosburg Falls contains businesses and homes. Homes and businesses are clustered along Tyler Branch near the intersection of Tyler Branch Road and Grange Hall Road in West Enosburgh.

Tyler Branch begins in the Cold Hollow Mountains in Bakersfield and Belvidere, and flows northwest through Enosburgh into the Missisquoi River. The 58 square mile watershed is mostly forested in the upper, steep areas (76%), agricultural fields in the flatter valley bottom areas (17%),

and pockets of developed lands (6%) (Troy et al., 2007). This project focuses on 5.3 miles of Tyler Branch from the **confluence** of Beaver Meadow Brook and Cold Hollow Brook downstream to the Enosburgh-Sheldon town line. Tyler Branch flows through broad floodplains with deposited river sediment (Figure 2) and narrow bedrock gorges (Figure 3) (Ruddell et al., 2009). Over the years, the river was **straightened** and moved towards the edges of its valley to create space for farm fields and roads. These changes, along with gravel dredging, have led to excessive sedimentation and channel instability in several locations. Generations of rock armor (i.e., **riprap**) are common on the outside bends of the river to limit its movement (Figure 4). Many of the flood and erosion risks identified in this and previous projects stem from placing infrastructure too close to the river and river management practices.

Figure 2: Broad Tyler Branch floodplain (Source: FEA, 2014)

The Missisquoi River is one of the larger rivers in Vermont, draining 1,200 square miles of northern Vermont and southern Quebec (Missisquoi River Basin Association). The river originates in the mountains of Lowell and then generally flows west for 88 miles before entering into Missisquoi Bay and Lake Champlain. Forestland on the steeper slopes is the most abundant land use (53%), while agricultural land dominates the valley bottom and floodplains as the second most abundant land use (24%) (VT stream geomorphic data).

Figure 3: Bedrock gorge on Tyler Branch near West Enosburgh (Source: FEA, 2014)

The Missisquoi River channel in this area is impounded behind the Enosburg Falls Dam owned by the Enosburg Electric Department. The water backs up behind the dam for about 2.5 miles under normal flow, or to approximately one mile downstream of the bridge at Boston Post Road. The ponded water leads to increased sedimentation in this area. The Missisquoi River channel has nearly 30% of its banks armored to protect infrastructure and farm fields. **Large woody debris** and ice jams are common in this area due to the low channel slope (0.02%) and the backed-up water behind the Enosburg Falls Dam.

Floodplain exists, yet some of it is separated from the channel with **berms** to prevent flooding and erosion of agricultural fields.

Research and Outreach

A kick-off meeting took place in September 2014 to initiate the project and to share information. Following this meeting, the team reviewed existing information about the Town of Enosburgh, Enosburg Falls Village, Tyler Branch, and the Missisquoi River. Data included past river assessment data, local bylaws, floodplain and river corridor mapping, town plans, topography maps and aerial photographs (Appendix A). River scientists and engineers on the team conducted a site walk along the Tyler Branch project area, while a windshield survey with periodic site visits was conducted at the Missisquoi River project area. The primary objectives of the field work included to:

- Explore how the rivers have changed since past field work and assessments;
- Explore evidence of past flood and erosion damages;
- Identify businesses, infrastructure, and homes vulnerable to flood and erosion risks;
- Assemble a list of alternatives to protect businesses and infrastructure; and
- Collect data to create concept designs for high priority alternatives.

Figure 4: Old rock armor on the outside of the channel bend is common along most of Tyler Branch (Source: MMI, 2014)

DHCD and the NRPC hosted the first of two Community Forums at the Enosburgh Emergency Services Building on October 29, 2014 (Figure 5). Several community members, business owners and homeowners from the area attended the forum. Some background about the VERI study was provided by DHCD Commissioner Noelle MacKay and site information was provided by Roy Schiff of Milone & MacBroom, Inc., and then the floor was open for ideas and questions from community members, and discussion with the group.

Enosburgh community members highlighted successfully completed and ongoing flood resilience projects carried out by the Town, including:

- Tree plantings by the Missisquoi River Basin Association to stabilize the bank;
- Stream protection regulations based on river corridors;
- A new bridge at Boston Post Road;
- A conservation easement next to the Tyler Branch Road Bridge; and
- A **culvert** replacement on Boston Post Road.

Participants also highlighted areas of hazard and risk including:

- Spring flooding and woody debris;
- Annual Missisquoi River flooding along VT Route 105 that diverts traffic to smaller roads that get damaged;
- The Hopkins Road Bridge over the Trout River floods annually and regularly needs repairs; and
- Flooding and erosion at Boston Post Road and near Vaillancourt's Garage on Tyler Branch.

Community members also outlined the following potential projects to reduce flooding.

- The full length of Hayes Farm Road is in poor shape and needs repairs and culvert upgrades to handle detour traffic during Missisquoi River flooding;
- Landslide near Courser Road along Tyler Branch needs stabilization;
- Recreational vehicles stored for the year in the campground off of Sand Hill Road should be moved out of floodplain to prevent future losses;
- Continue cover cropping; and
- Possible berm removal along Tyler Branch near Grange Hall Road.

Figure 5: Chair of the Enosburgh Select Board Larry Gervais and DHCD Commissioner Noelle MacKay kick off the 1st Enosburgh Community Forum (Source: MMI, 2014)

The community specific strategies suggested by participants in the workshops and meetings, along with the research completed by the VERI team, were used to develop the recommendations outlined in this report to help the community prepare for, manage, and decrease risk, and reduce the economic costs of future losses due to flooding.

In the sections that follow, the team has outlined specific projects, as well as plan and bylaw updates, that can help ensure businesses remain open and infrastructure continues to function. The team included estimated costs, funding sources and impacts associated with implementing the suggested priority projects.

Flood History and Town Accomplishments

Enosburgh Town experiences regular property and infrastructure damage from flooding along Tyler Branch and the Missisquoi River. With input from the NRPC and the community, the team has identified key flood risks in Enosburgh.

Flood History and Risk

Minor flooding occurs nearly every spring in the project area, particularly along the Missisquoi River. Ice jams are common and tend to cause bank and field erosion. For example, an ice jam flood occurred in 2000 on the Missisquoi River that led to one to two feet of water on portions of VT Route 105 between Enosburg Falls and East Berkshire with an estimated $20,000 in damages (Appendix B).

The worst flood to date was in 1927 and many homes and barns were destroyed and livestock was washed away. The North Enosburgh Covered Bridge and electric power house at the dam were lost and many roads were inundated.

Missisquoi River stream gauge data document four 25-year floods in the past 20 years. The gauge data also show that more frequent and larger floods are likely to come (Collins, 2009; NMFS, 2011; Armstrong et al., 2012).

Figure 6: Deposited sediment and eroding banks upstream of Tyler Branch Road Bridge (Source: FEA, 2014)

The Flood Ready Vermont Summary Report for Enosburgh indicates that twenty-one buildings exist in the FEMA-mapped **Special Flood Hazard Area** (SFHA), of which only three (14%) have flood insurance (Appendix C). Agricultural fields occupy most of the **100-year floodplain** in Enosburgh.

Seven businesses and homes exist in the floodplain along Tyler Branch over the project site. Approximately 4,500 feet of Tyler Branch Road make up the edge of the 100-year floodplain (25% of the road length in the project area) and are vulnerable to erosion. The floodplain abruptly narrows at Tyler Branch Road Bridge located between Duffy Hill Road and VT Route 108, and excessive erosion is taking place in the area (MMI, 2008, 2009) (Figure 6).

Ten additional businesses and homes are within the Tyler Branch **state river corridor**, the area where the river is most likely to move on the valley floor (ANR, 2014a). One of these buildings is the Town Garage and sand/salt storage area. The town is considering ways to protect this asset in

the event of a large flood. The mapped river corridor contains 10,300 feet of Tyler Branch Road (40% of the road length in the project area).

The 100-year floodplain along the Missisquoi River in the project area contains portions of nine farm buildings and homes. Approximately 2,500 feet of VT Route 105 is in the floodplain between Enosburg Falls and East Berkshire (10% of the total road length between these two points). The river corridor contains an additional seven structures that are vulnerable along the Missisquoi River.

Figure 7: Tyler branch Road is threatened by erosion from the river and rock armoring is common along the embankment. (Source: FEA, 2014)

Flood and erosion risks at the Enosburgh VERI project area largely influence the rural transportation network in Enosburgh. The following issues were noted:

- Tyler Branch Road is threatened by erosion from the river and rock armoring is common along the embankment (Figure 7).
- VT Route 105 has several low spots and is prone to flooding every several years.
- Boston Post Road is susceptible to both local flood and erosion hazards (Figure 8).
- Duffy Hill Road is prone to flooding.
- Hopkins Bridge Road is prone to flood and erosion along the Trout River damages and is a location of repeat damages.

Figure 8: Spring flooding on the Missisquoi River at Boston Post Road (Source: NRCS, 2011)

Davis Road and Hayes Farm Road tend to deteriorate in spring thaw conditions when Missisquoi River flooding diverts traffic to them. During the first community forum, community members noted that spring flood detours (Appendix D) can deteriorate the smaller roads as they thaw. This requires expensive repairs that puts pressure on municipal budgets. These detours also extend the milk trucks routes and make it harder for people to get to work.

Town Accomplishments

Enosburgh has worked hard over the past several years to gain a better understanding of flood and erosion risks, and to reduce the threats to businesses, farms, infrastructure, and homes. They have conducted assessments of the river and worked to implement recommendations outlined in these studies. The town protects its rivers and streams from development with regulations based on the state river corridors.

Town Wide Flood Policy

In 2014, the State of Vermont established an **Emergency Relief Assistance Fund** (ERAF) to provide matching funding for federal assistance after federally declared disasters. This program allows towns in Vermont to increase the amount of state aid money they can receive as a match to federal aid for post-disaster recovery. By taking certain steps to become more prepared and resilient, a town can be eligible for increased state aid money. Certain damage costs from federally declared disasters are reimbursed 75% by federal money. The State of Vermont contributes a minimum of 7.5% of the total cost, but if a town takes additional steps, the state aid can increase to 12.5% or 17.5% of the cost, leaving less for the town itself to pay (State of Vermont, 2015).

Enosburgh's existing policies, plans and programs qualify the town to receive 12.5% state funding with the Village qualifying for 7.5 % (Table 1). A key next step for these communities is to protect river corridors or protect flood hazard areas from new encroachment and participate in the FEMA **Community Rating System** (CRS).

Table 1: How Enosburgh Town and Enosburg Falls Village Met Their ERAF Match

ERAF Rating	Town 12.5%	Village 12.5%
Participate in the **National Flood Insurance Program**	Yes	Yes
Adopt 2013 State Road & Bridge Standards	Yes	Yes
Adopt Local Emergency Operations Plan	Yes	Yes
Adopt Local **Hazard Mitigation Plan**	Yes	No
Step to increase State aid to 17.5% (one needed to qualify)		
Adopt no new development in a River Corridor	No	No
Adopt no new development in Flood Hazard areas and participate in the federal Community Rating System	No	No
State ERAF Match	**12.5%**	**7.5%**

Other key bylaws that reduce risk and provide protection include:

- Stream buffer regulations to protect water quality and keep buildings and property a safe distance from flood waters (intermittent streams 25 feet; unnamed rivers and streams 50

feet; named rivers and streams 110 feet; and lakes and ponds 50 feet). The recommended buffer widths are based on the state river corridor.

- Six of the zoning districts in the Village of Enosburg Falls require setbacks from rivers and streams where no structures can be built. The setback is 50 feet in agriculture/rural residential, high-density residential zone, low-density residential and recreational zones. The setback is 100 feet in commercial and industrial zones.
- The town follows the minimum floodplain protection standards of the National Flood Insurance Program (NFIP). The village follows the minimum standards with the exception of allowing development in the **floodway** with a **no-rise certification.**

Site Specific

Although widespread costly flood and erosion damages are not common in Enosburgh along Tyler Branch and the Missisquoi River, the Town has implemented practices to protect infrastructure and reduce risks to businesses and homes. A culvert was recently replaced on Stonehouse Road near the intersection with Howrigan Road that was prone to flooding. Rock armor was placed at the low spots along Boston Post Road near the Missisquoi River and at Duffy Hill Road near Tyler Branch to reduce erosion. The VT Route 108 Bridge over Tyler Branch was replaced and widened to pass more water. The old left bridge footing was left in place to minimize construction impacts and project cost, and the remnant footing does not increase flood and erosion risk.

Given the prevalence of flooding of farm fields, cover cropping and other agricultural practices such as crop rotation and no-till corn are helping reduce erosion potential and keeping the land productive and out of the river and lake. During the Community Forum, it was noted that the University of Vermont Extension is piloting a program to plant cover crops using a helicopter on some Enosburgh farms.

Strategies and Projects to Protect Enosburgh

The team has developed a list of recommended strategies and projects to protect Enosburgh's businesses and infrastructure during future floods. Based on data collection and analysis, review of the town plan and bylaws, previous reports and community input, the team developed a list of flood **mitigation** objectives for Tyler Branch and the Missisquoi River to address town-specific flood damages. These objectives include:

1. Improving local roads to better accommodate detours from VT Route 105 when the Missisquoi River floods;
2. Removing berms where risk reduction will take place, such as reducing Missisquoi River flooding along VT Route 105 and reducing Tyler Branch ice jam flooding near Grange Hall Road; and
3. Conserving floodplain lands that reduce downstream flood and erosion risks to farm fields, businesses, infrastructure, and private property.

Strategies and projects for Enosburgh are summarized below, including municipal policy and program recommendations and site-specific project recommendations.

Municipal Policy and Program Recommendations

Reducing the impacts of floods involves an ongoing process of evaluating and adjusting policies to minimize risks through protection, prevention and education. Accordingly, the VERI team first reviewed Enosburgh's Municipal Plan and land use regulations to identify the policies they contain and those that are absent. The team also reviewed related plans for capital improvements, conservation, emergency and preparedness and continuity of operations. These documents were reviewed with the goal of identifying gaps and opportunities to improve the flood preparedness, safety and resilience of residents, visitors, businesses and local government.

The team then used the US Environmental Protection Agency's (EPA) **flood resiliency** checklist that was developed from a study in the Mad River Valley in Vermont (US EPA, 2014). This checklist includes overall strategies to improve flood resilience as well as specific strategies to conserve land and discourage development in river corridors; to protect people, businesses, and facilities in vulnerable settlements; to direct development to safer areas; and to implement and coordinate stormwater management practices throughout the whole watershed.

The checklist review found that Enosburgh currently employs 28 of 56 items on the checklist including regulatory measures to limit development in areas subject to flooding, and utilizing steep slope development regulations (Appendix E).

The results of the review identified 13 planning or policy opportunities in Enosburgh and Enosburg Falls Village that were then organized into four groups: Regulations, Community Planning, Emergency Planning, and Education and Outreach. The distribution of opportunities to improve policy and program is show in Table 2.

Table 2: Categories of Municipal Policies and Programs		
Category	**Description/Overview**	**Policies or Programs**
Land Use Regulations	Avoid and minimize land use conflicts around watershed resources that help lower the risk of flooding and/or erosion to properties.	3
Community Planning	Develop long term goals, recommendations and budgets to improve flood resilience.	3
Emergency Planning	Specific projects for supporting mitigation and recovery actions for flooding and other hazards.	4
Education and Outreach	Programs targeted at critical businesses and vulnerable populations to educate them about flood risk, mitigation and recovery.	3

The results of the plan and policy reviews were then combined and scored with either a one (ineffective), three (limited) or five (effective) using the following three objectives:

1. Reduces flood risk (proposed project lowers the flood level);
2. Reduces erosion risk (proposed project lessens the vulnerability to erosion); and
3. Protects businesses, infrastructure and property.

The three scores were added to provide a total score. Cost and ease of implementation, political realities and limitations as well as input from the community were also considered. To assist the town with implementation, potential partners and funding sources were identified. Each recommendation was further explained and next steps were identified. This information was compiled into easy to read charts found in Appendix F.

The highest ranked regulatory changes included developing adopting regulations to minimize conflicts between rivers and development. Recommended town plan updates included expanding the flood resilience element, documenting road, sewer and water infrastructure vulnerabilities, developing capital and hazard mitigation plans and identifying floodplain for conservation.

The top priority policy and program recommendations were presented at the community forum and local feedback was incorporated into the final prioritization, below.

- **Develop a Local Hazard Mitigation Plan for the Village of Enosburg Falls.** The Village of Enosburg Falls should begin drafting its local hazard mitigation plan (HMP) and include top projects and strategies identified in this report. Having a hazard mitigation plan will also make the Village eligible to apply for additional federal funding for infrastructure projects. It also qualifies the Village for additional state disaster aid from the Emergency Relief Assistance Fund (ERAF) – increased state aid from 7.5% to 12.5% which reduces local costs.

- **Document road, sewer, and water infrastructure vulnerabilities in municipal plan and develop capital plans.** Specific areas that were damaged or have known vulnerabilities should be documented so the communities can plan for their replacement in their long-term budgets, easing the impact on taxpayers. The Town is encouraged to develop a capital improvement plan that incorporates the physical improvements recommended through the VERI project.
- **Update policies to prohibit fill in flood hazard areas.** Allowing landowners to **fill** low lying areas may help protect an individual property, but it can reduce the land's ability to slow and store the extra flood water and it can increase flood hazards to downstream property owners. The Town bylaws prohibit new fill except where necessary to elevate structures above the **base flood elevation**. The Village bylaws also prohibit fill but the language should be more explicit.

Local stakeholders (residents, businesses, planning commission, Selectboard, etc.) are encouraged to review these recommendations and seek assistance from the identified partners and programs and take these steps to reduce flood risk over time.

Specific Project Recommendations

Based on field data, analysis, existing information, and community input, the team prepared a list of recommended projects to protect businesses and infrastructure (Appendix G) along with accompanying maps (Appendix H). The projects were grouped into four categories based on their approach to mitigating risks (Table 3).

Table 3: Project Types

Category	Description	Number of Projects
Building and Site Improvements	Lowers the risk of flooding and erosion to specific properties through improvements to the building and surroundings (e.g., sealing building to prevent water infiltration).	1
Channel and Floodplain Management	Lowers the risk of flooding and erosion to properties along the river through the improvement of natural river and floodplain functions (e.g., tree plantings along unstable river banks and berm removal to reconnect floodplain).	5
Infrastructure Improvements	Lowers the risk of flooding and erosion to roadways and other municipal or state-owned infrastructure (e.g., increasing the size of bridges and culverts to pass more flood waters and improving road surfaces for safer travel).	5
Public Safety Improvements	Lowers the risk of flooding and erosion to properties through the avoidance of future flood risks (e.g., FEMA buyouts of properties highly vulnerable to flooding).	0

To begin, the team screened and prioritized each project. Each project received a score of one (ineffective), three (limited) or five (effective) for the three objectives:

1. Reduces flood risk (proposed project lowers the flood level);
2. Reduces erosion risk (proposed project lessens the vulnerability to erosion); and
3. Protects businesses, infrastructure and property.

The three scores were added to provide a total score, which was then weighted based on the importance of the project in the region. Projects that would result in a regional economic boost and help keep businesses open were given the greatest weight, while projects that would offer minimal economic benefit to the business economy were assigned a lesser weight. Many of the high priority projects are from the Infrastructure Improvements category, as those at-risk areas potentially affect the greatest number of community members and businesses.

Project partners and stakeholders, including representatives from DHCD, ANR, NRPC, and the Town of Enosburgh and Village of Enosburg Falls, provided feedback on a draft list of mitigation strategies and their priorities in April 2015. The feedback was incorporated into the final prioritization of projects. The eleven identified mitigation projects apply to nineteen distinct sites (See Appendix H). Below are brief descriptions of the high priority projects from each of the project categories described in Table 3. A summary of efforts to develop conceptual designs for two of the high priority projects follows, with additional supporting information provided in Appendices I and J.

Figure 9: Flood, sediment, and wood storage area proposed for conservation in the upper Tyler Branch (Source: FEA, 2014)

Figure 10: Undersized culvert on a tributary of the Missisquoi River at Hayes Farm Road (Source: FEA, 2014)

Channel and Floodplain Management

Remove Berm Along the Missisquoi River: The berm is located one mile west of the intersection of VT Route 105 and VT Route 108, near the Enosburgh-Berkshire town line. The berm is approximately 3,000 feet long and varies in height between one and five feet. Removal of an estimated 950 feet would help spread flood waters and reduce VT Route 105 flooding. This would reduce flooding, protect local businesses, and limit the disruption of the movement of goods in Enosburgh.

The state has experience in berm removal to reduce flood and erosion risks and thus a moderated ease of implementation is anticipated for this project. An initial ballpark project cost is between $100,000 and $200,000. The project could be implemented over the next 5 years. (See the Conceptual Design Section for more details).

Figure 11: Missisquoi River flooding at low spot on Boston Post Road looking downstream. Note the ice chunks on the floodplain indicating recent flood flow locations (Source: Staci Pomeroy, ANR, March 29, 2006)

Conserve Land Upstream of Boston Post Road: River corridor conservation about 1,700 feet upstream of Boston Post Road along Tyler Branch would help protect the beaver pond complex and floodplain area that stores sediment and large woody debris (Figure 9). This broad storage area improves downstream channel stability, limits movement side-to-side and protects farmland from erosion in the Tyler Branch valley. Corridor conservation was recommended in past assessment work on Tyler Branch (Ruddell et al., 2009). Based on the current assessment, corridor conservation continues to be an important approach to reducing risks. This project should include stabilization of the Tyler Branch Road embankment that has some localized erosion in the proposed conservation area.

The proposed corridor conservation project is anticipated to have a moderate ease of implementation. The project would likely cost between $50,000 and $100,000. The project could be implemented over the next 5 years. (See the Conceptual Design Section for more details).

Infrastructure Improvements

Improve Hayes Farm Road and Davis Road: When the Missisquoi River floods, the traffic detours to the Hayes Farm Road and Davis Road, among others. If detours take place during spring

thaw, the roads deteriorate making travel difficult and that require costly repairs that impact municipal budgets. Undersized culverts also exist along the roads (Figure 10) making the road susceptible to flooding and erosion. The improvement of these detour routes (i.e., upgrading the road surface and replacing culverts) was noted by the community as a way to maintain business activity during and after flooding.

The proposed road upgrades are anticipated to have a moderate ease of implementation as rural road construction is familiar practice in the state. The project to fully restore both roads would cost more than $1 million. The project could be implemented over the next five years, although some repairs have been under way and the community may be interested in prioritizing the completion of this work sooner. (See the Conceptual Design Section for more details).

Install Overflow Bridge or a New Wider Bridge on Boston Post Road at the Missisquoi River and Elevate Lows Spots along VT Route 105: When the Missisquoi River floods, one of the first locations to overtop is the low spot on Boston Post Road just south of the bridge over the channel. Both flood waters and ice chunks pass over the road (Figure 11). During high water on the Missisquoi River, several low spots along VT Route 105 get flooded after the Boston Post Road is wet (Figure 12). This project proposes a wider bridge or an overflow bridge, and elevating several low spots on VT Route 105 that would reduce flooding, protect local businesses and allow the movement of goods and workers to continue while flood waters safely pass downstream.

This project would be difficult to implement given the high cost and complex design for bridges. The existing bridge was built in 1928 and is very narrow and thus needs replacing. Perhaps the bridge could be lengthened to span the flood-prone area when it is replaced. Elevating the VT Route 105 low spots could take place as part of VTrans roadway resurfacing, yet hydraulic modeling is likely needed for design to be sure that elevating the road does not block floodplain and create additional flood risks. The additional bridge would likely cost over $1 million and the VT Route 105 elevation could cost over $200,000. The project could be implemented over the next five years.

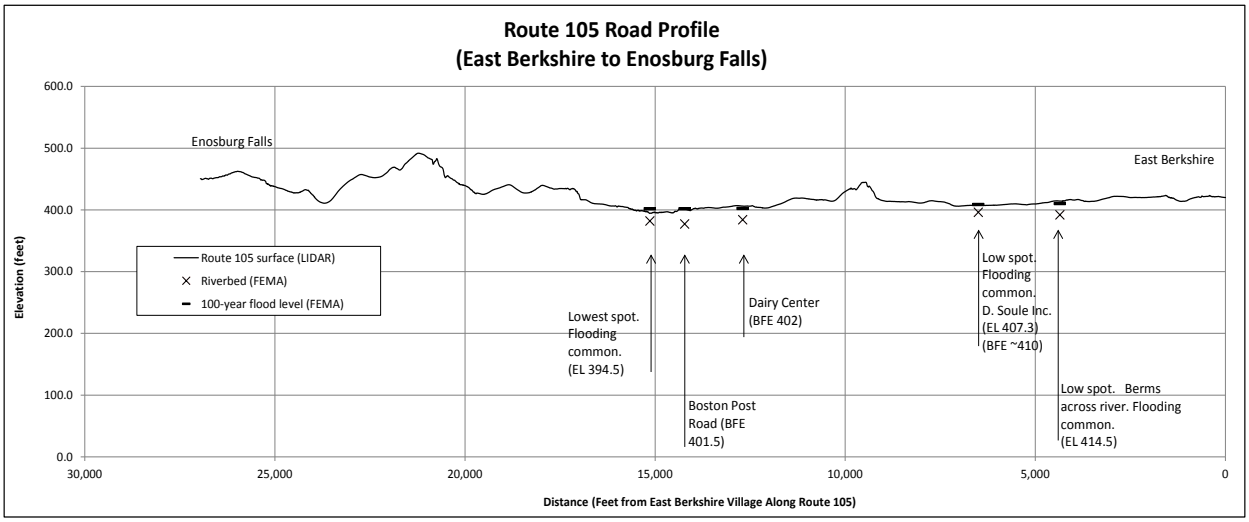

Figure 12: Profile of VT Route 105 showing low spots where the 100-year flood, or base flood elevation (BFE) is above the road surface.

Conceptual Designs

Using input from the community and our team's professional judgment of priority flood mitigation projects that would provide multiple benefits to the community, the team developed conceptual designs for three high-priority projects. These projects include a floodplain reconnection through the removal of an old berm, the conservation of a river corridor in a storage area, and rural road improvements. The conceptual designs include enough detail to apply for most funding opportunities to advance the design toward implementation.

Missisquoi River Berm Removal

Overview and Objectives

There is a berm along the south bank of the Missisquoi River about one mile west of the intersection of VT Route 105 and VT Route 118. The berm begins to take shape on the western side of a large bend in the river where the channel is next to VT Route 105, and runs beneath a narrow tree line along the river. The berm appears to be blocking floodplain access along a portion of the Missisquoi River directing flood flows towards VT Route 105.

The objective of this project is to reduce flooding along VT Route 105 to allow local and regional businesses to function during small flood scenarios and increase flooding in the floodplain. However, if the town wanted to move forward with this, they should assess any erosion risks to the farm field located in the floodplain that would arise from berm removal. Such erosion could impact crops and farm income so should be considered.

Data Collection and Alternatives Analysis

Due to site conditions, this concept design was prepared primarily using **LiDAR** data and distant field observations. This information will need to be updated with accurate field data in a future design phase.

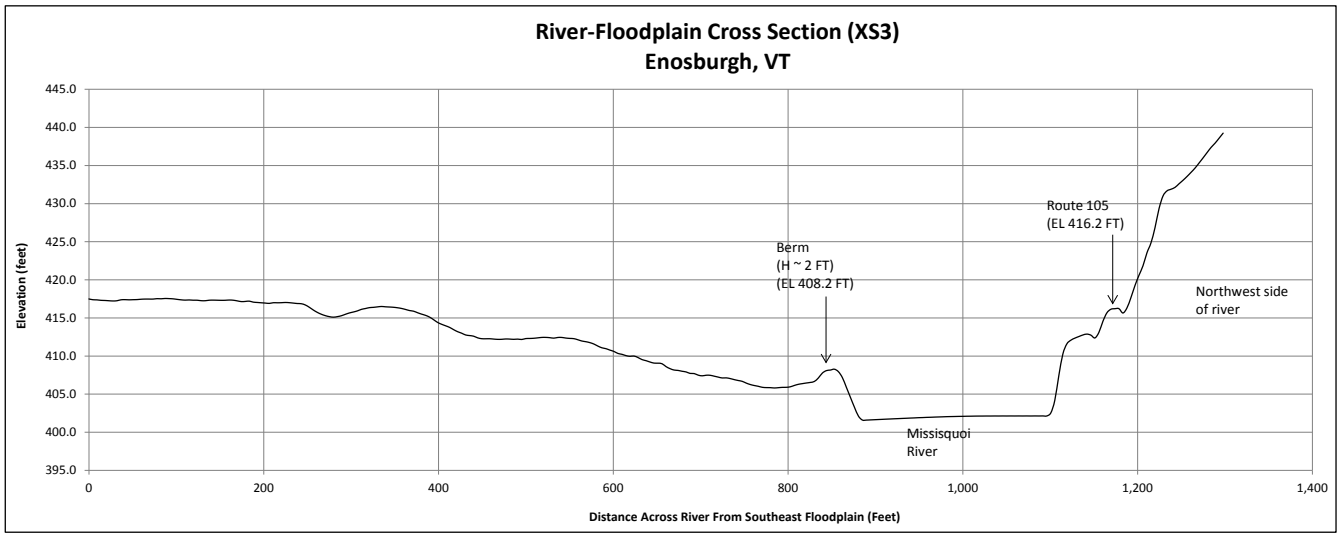

Figure 13: Cross section of berm along Missisquoi River isolating floodplain. VT Route 105 is eight feet above the top of the berm. Berm removal is not recommended in this area.

Cross sections were cut using the LiDAR elevation data to explore the shape and length of the berm (Appendix I). The berm is the usual trapezoidal shape with a height that varies between one foot and five feet (Figure 13). The base width of the berm typically varies between 20 feet and 40 feet. The estimated berm length is 3,000 feet.

The elevation of the top of the berm, the floodplain elevations on both sides of the river, and the elevation of VT Route 105 were used to initially identify the location and length of berm to remove. Berm removal is not recommended where the berm is small and where the road is much higher than both the berm and floodplain since the benefits do not justify the costs and construction impacts (See Figure 13). Where the road and top of berm approach the same elevation, berm removal and floodplain reconnection are cost-effective to reduce flood impacts and are recommended (See Figure 14).

The alternatives analysis to identify how much berm to remove resulted in a proposed removal length of approximately 950 feet. This number will be refined during future design.

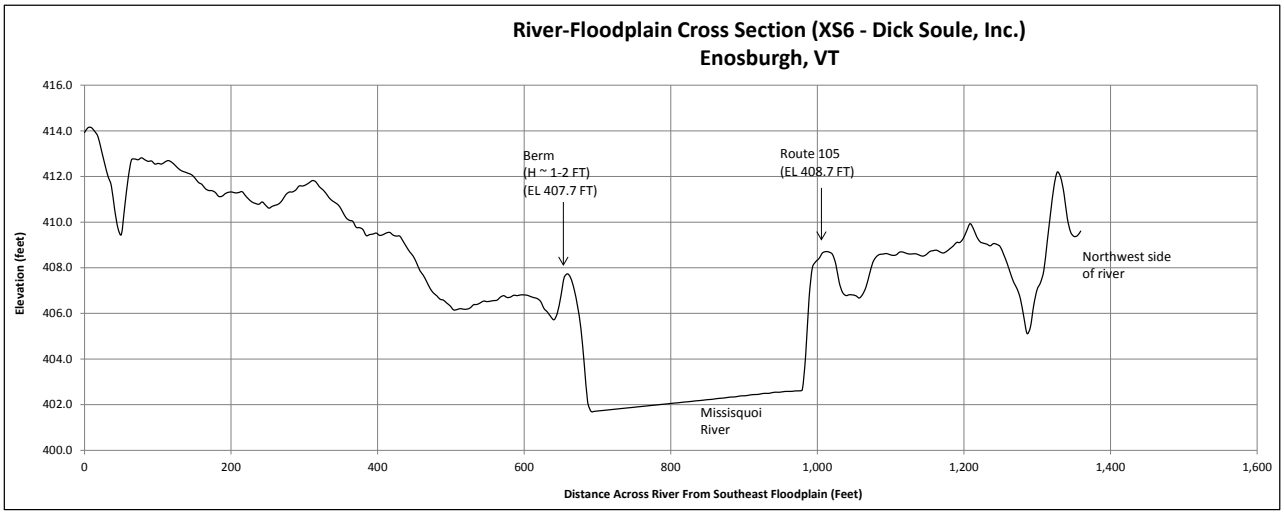

Figure 14: Cross section of berm along Missisquoi River isolating floodplain. VT Route 105 is one foot above the top of the berm. Berm removal is recommended in this area.

Conceptual Design

Proposed berm removal would consists of clearing trees and excavating 950 feet of berm down to the elevation of the nearby floodplain, hauling the excavated fill to an upland disposal site, and replanting the disturbed area. Berm removal construction is easy to perform given that the work takes place out of the river channel and water control is not needed. Minimal sediment and erosion controls are needed since the site is located on flat ground. The primary precautions to take during construction include minimizing the length of time soils are exposed and being prepared to cover exposed material with erosion control fabric if an intense rain occurs.

This work could be completed by any contractor with a medium to large excavator and several dump trucks. A storage location for the excavated fill will be required. The berm removal is estimated to generate 3,300 cubic yard of material in addition to the cleared plant material. The

estimated cost that includes final design, permitting, bid assistance, construction, and construction oversight is $120,000.

A negative aspect of this project is the required removal of riverside trees that are located on the berm along the south bank of the Missisquoi River. The plantings that would take place following construction should include trees and shrubs that are commonly found in naturally vegetated **riparian buffers**. This will both filter overland flow towards the river channel and provide stabilization of surface soils when the river overtops its banks.

Steps for Project Implementation

The following next steps are required to advance this project.

- Outreach to landowners – Explore willingness to implement berm removal and secure permission to access field. The landowner may want the fill and timber generated during the project and may have a suitable disposal site in the area.
- Survey, design and permit the project – Permits will likely include Vermont Construction General Permit and a local floodplain permit.
- Seek funding to implement the project – Possible funding sources for this work include ANR Ecosystem Restoration Program, FEMA hazard mitigation grant program, FEMA pre-disaster mitigation fund, US Fish and Wildlife Service, and Vermont Agency of Transportation.
- Bid project for construction.
- Construction.
- Monitor site to compare new flood patterns with predicted changes.

Project Benefits

The implementation of this project is anticipated to provide increased floodplain access to the channel that will result in the following benefits:

- Lower flood levels along VT Route 105 that will reduce disruptions of business;
- A shorter duration of flooding that will allow a quicker return to business when a flood does take place;
- Improved movement of goods and services along VT Route 105; and
- Reduced flood risk to seven local businesses.

Tyler Branch Corridor Conservation

Project Overview and Objectives

The main recommendation from the past river assessment was to conserve the river corridor along Tyler Branch to allow the channel to reach a most stable state (Ruddell et al., 2009). This recommendation still applies. During the site walk for this project, a sediment and debris storage area with an unstable channel was identified near the upstream end of the project site (See Figure 9). The flood and sediment storage in this area is important to maintaining the stability of downstream

areas that have been straightened and armored in the past. The objectives of this project are to conserve the river corridor to reduce flood and erosion hazards along Tyler Branch where local farms and road infrastructure exist.

Data Collection and Alternatives Analysis

A site reconnaissance walk was performed in the subject area and the migrating channel, stored sediment, stored woody debris, and a large floodable area were documented. Bank erosion and slides of valley wall material (i.e., **mass wasting**) occurs in this area. GIS parcel lines were reviewed to estimate the size of the conservation area. Three parcels would be involved in the project that would result in the conservation of 20 acres. The parcel on the north side of the river would conserve ten acres, the parcel on the south side of the river six acres, and to the parcel to the west four acres (Appendix J).

Some areas of the Tyler Branch Road embankment are eroding in this area and thus if conservation does take place, stabilization of the road embankment should be considered as part of this project since the road is located at the northern edge of the proposed corridor. The conservation project and road protection project can both be accomplished together.

Conceptual Design

The conserved area would contain the river corridor and FEMA 100-year floodplain, as well as some areas just beyond the corridor where signs of flooding were observed in the field. The main objective of the conservation easement is to purchase development rights or hold an easement on the land to prevent any form of channel management or floodplain activity that could lead to channel encroachment. Were this to happen, stored sediment and debris would be forced downstream, activating channel movement that could threaten downstream farm fields, infrastructure and other property.

The estimated landowner payment for this easement is $20,000 (about $1,000 per acre) based on an initial calculation by ANR using the river corridor easement payment calculator. Other costs for establishing the easement for project scoping, preparing documents, survey, title search, and legal document filing could run $20,000 (personal communication, Staci Pomeroy, ANR). The total project cost is thus $40,000.

Steps for Project Implementation

The following next steps are required to advance this project.

- Outreach to landowners to explore willingness to conserve parcels.
- Determine easement type and identify possible funding sources. Potential funders for a river corridor easement to protect downstream agricultural lands include Vermont Department of Environmental Conservation Rivers Program, Vermont Housing and Conservation Board, Vermont Land Trust, ANR Ecosystem Restoration Program, and the Natural Resources Conservation Service Conservation Reserve Enhancement Program.
- Secure easement.

- Monitor site and track conditions.

Project Benefits

The implementation of this project will prevent development from ever taking place in the river corridor in this storage area along Tyler Branch and will provide the following benefits:

- Maintain downstream channel stability, reducing loss of farm land due to erosion;
- Control downstream risk to public infrastructure; and
- Control downstream risk to private property located near the river.

Local Road Improvements on Detour Routes Used During Missisquoi River Flooding

Project Overview and Objectives

Following concerns voiced at the first Community Forum about flooding along the Missisquoi River and deteriorated detour route conditions, the Enosburgh project area was expanded to include sections of both Tyler Branch and the Missisquoi River. The combination of flooding and poor local road condition impacts businesses and movement of goods. Although this alternative does not directly reduce flooding, if the detour roads were improved businesses would not be as impacted and would experience a quicker return to normal operations when the Missisquoi River floods.

The objective of this project is to improve the road surfaces of Hayes Farm Road and Davis Road, and replace two undersized culverts to improve local detour routes used when flooding along VT Route 105 takes place.

Data Collection and Alternatives Analysis

The detour routes were mapped (see Appendix D) and the routes were travelled to investigate road surface and culvert condition. Site observations were made with heavy snowpack and plowed roads so the sites need to be revisited once the snow melts to confirm findings. The ideal time to finalize the road observations is spring to see how the roads function during thaw and mud season, when they are likely at their worst condition.

The surfaces of both Davis Road and Hayes Farm Road were deteriorated for most of their lengths. The surface of Davis Road is drained earth/gravel from Boston Post Road to west of Thompson Lane (6,100 feet) (E911 GIS roads layer). The road turns to gravel travelling west to the Enosburg Falls Village line (3,600 feet). In the Village, Davis Road is paved until it ends at Stonehouse Road and turns into Hayes Farm Road (570 feet). The paved portion of Davis Road has potholes, large areas of missing pavement, and cracks along the pavement edges. The unpaved portions have a rough surface and frost heaves. At a minimum the paved surface of Davis Road should be repaired. The complete rehabilitation of the road base and surface over its full two mile length would greatly improve travel in this area.

Hayes Farm Road is paved for its full length (2,800 feet). The entire road surface is in poor condition. Potholes and areas of missing pavement exist, especially in the vicinity of culvert

crossings where it appears that flow has overtopped the road. Resurfacing of the entire road is needed. Some road base improvements are also likely needed.

Undersized culverts exist along the roadways. A six foot corrugated metal pipe with mitered ends conveys a **tributary** of the Missisquoi River under Davis Road just west of Gervais Family Farm (Figure 15). Signs of flow overtopping the roadway exist. The drainage area at the culvert is 1.2 square miles and the design flow taken as the 25-year flood for local roads (VTrans, 2001) is 80 cubic feet per second (Olson, 2002). Structure width in Vermont is now initially set based on the channel bankfull width (Schiff et al., 2014; ANR, 2014b). The estimated bankfull width of the channel is 14 feet (DEC, 2006). The culvert width is 42% of the channel width. The undersized structure needs to be replaced to properly pass water, sediment, debris and ice.

A five foot wide by four foot tall concrete box culvert conveys a tributary of the Missisquoi River under Hayes Farm Road just west of the intersection with Stonehouse Road (See Figure 10). Signs of flow overtopping the roadway exist and chunks of loose pavement are located in the area. The drainage area at this culvert is 1.5 square miles. The design flow is 82 cubic feet per second (Olson, 2002) and the estimated channel bankfull width is 15.7 feet (DEC, 2006). The culvert width is 54% of the channel width. The undersized structure needs to be replaced.

Figure 15: Undersized culvert on a tributary of the Missisquoi River at Davis Road (Source: FEA, 2014)

Conceptual Design

The conceptual design includes pavement resurfacing and sub-base improvements for the full length of Davis Road and Hayes Farm Road. The two undersized culverts are proposed to be upgraded to match the channel bankfull width.

This roadway improvement project is common transportation upgrade work that a range of contractors could complete. In all, two miles of Davis Road and half a mile of Hayes Farm Road will be improved. The design assumes that the portion of Davis Road with drained earth sub-base needs a full restoration (Appendix K). The team anticipates that some of the gravel portion of Davis Road, as well as some reclaimed pavement, can be used for sub-base so the cost for this section will be lower. A partial restoration of the Hayes Road sub-base is anticipated. The estimated cost to upgrade Davis Road and Hayes Farm Road to paved surfaces is $1 million.

Culvert upgrades would include two new structures. The culvert under Davis Road would have a width of 14 feet and a length of 40 feet. The estimated costs for this structure is $85,000, based on

current structure costs and similar recent projects in the state and region. The culvert under Hayes Farm Road would have a width of nearly 16 feet and a length of 40 feet. The estimated cost for this structure is $90,000. Adding the construction costs together and including final design, permitting, bid assistance, and construction oversight, the total estimated cost for the road improvement project is $1.5 million.

Steps for Project Implementation

The following next steps are required to advance this project.

- Verify right-of-way outreach to land owners.
- Survey, design and permit the project. Permits will likely include Vermont Construction General Permit, a local floodplain permit, US Army Corps of Engineers General Permit for the culverts, and a VTrans permit. The design will need to explore the road sub-base condition to understand how much road base needs improvement.
- Seek funding for the project. Possible funding sources for this work include Better Back Roads, Vermont Agency of Transportation Local Transportation Enhancement Grant, US Fish and Wildlife Service for the culverts that will also improve fish passage, and the US Federal Highway Administration.
- Bid project for construction.
- Construct project

Project Benefits

The implementation of this project is anticipated to improve Davis and Hayes Farm Roads that will result in the following benefits:

- Provide a safer detour route during Missisquoi River flooding to allow for business to carry on during semi-annual flooding;
- Improve local travel between farms and into Enosburg Falls;
- Improved movement of goods and services locally and in region; and
- Reduced flood risk to three farms.

Next Steps

On April 30, 2015 the team hosted the second community forum to share the list of policy and project recommendations to decrease flood risk for the Town of Enosburgh and Enosburg Village. At the forum, community members asked questions, provided input and helped rank the proposed list of priority recommendations.

The projects that the meeting attendees ranked highest included improving the road surface and enlarging undersized culverts on detour routes used when the Missisquoi River floods. This includes improvements to the Davis Road, Hayes Farm Road, Perley Road and Longley Bridge Road. Conserving a wetland complex along the Tyler Branch upstream from the Boston Post Road also ranked high. The policy and program recommendations did not receive as many votes as the implementation projects but adopting river corridor protection bylaws and expanding riparian zones did receive interest from meeting participants.

Since the second community forum, both the Village and Town have made progress on implementing many of the recommendations. The Town integrated eight of the VERI implementation projects into their Local Hazard Mitigation Plan which has been submitted to FEMA for approval. The Town is also exploring mid/long-term options for relocating their town garage out of the Special Flood Hazard Area and securing their salt storage area. The Village has received Better Back Roads funding to complete an erosion inventory and capital budget. The Village is also seeking funding to develop a Local Hazard Mitigation Plan.

The tables included in Appendices F and G provide a comprehensive list of recommended priority projects for the Enosburgh to further discuss, explore, and advance as resources permit. The conceptual designs summarized above and in Appendices I and J are intended to provide examples for how to advance high priority projects to the next level and acquire funding for final design and implementation. As part of the ongoing community discussion regarding the VERI effort, the team recommends the following steps to incorporate the community's input into the final prioritization and advance the projects over time:

- Solicit input from individuals and businesses at future community meetings regarding specific projects and overall project prioritization.
- Prioritize one to two projects to pursue each year with assistance from DEC and NRPC staff to identify appropriate funding sources and partners.
- Apply for one to two grants each year to advance project development and/or designs.
- Implement projects as funding allows.
- Monitor project success.

Implementing these projects and updating related flood policies will, over time, help Enosburgh become safer and more resilient to future floods and there are a number of organizations and

programs that can help. For example, the NRPC can help gather and review sample bylaws, capital plans and hazard mitigation plans and help draft town specific language for review and local adoption. DHCD's Municipal Planning Grants http://accd.vermont.gov/strong_communities/opportunities/funding/overview/municipal_planning_grants , the Vermont Rivers Program http://www.anr.state.vt.us/dec/waterq/rivers.htm and www.floodready.vermont.gov can help support these efforts. The Vermont Land Trust http://www.vlt.org/ can assist landowner's protection of critical floodplain with easements. The State's Hazard Mitigation Grant Program http://vem.vermont.gov/mitigation can help implement projects identified in the Hazard Mitigation Plan. The Vermont Small Business Development Center http://www.vtsbdc.org/ has offered extensive disaster assistance to businesses as well as compiling a great guide for owners to navigate these programs. And several federal and state programs can assist in funding the recommendations outlined in the report. Working together we can reduce the risk and financial burden of future flooding events.

Education and Outreach

Vermont has a long tradition of managing its rivers to limit or prevent flood damage including armoring riverbanks with rocks, moving or straightening river channels and building dams and berms. Despite these efforts, flooding is the most common natural disaster in Vermont (ANR). Tropical Storm Irene showed Vermonters that rivers and streams are powerful and tend to make their own way during a flood. Because we cannot reliably control flooding, educating citizens, business and property owners about rivers and potential flood risks within their communities is critical.

> *"We all have short memories when it comes to flooding. It's just human nature to think it couldn't happen here again anytime soon."*
>
> Chris Campany, Executive Director
> Windham Regional Commission

Ongoing community education and outreach is an important part of any effort to promote flood safety and to protect local business and economies. Ultimately, the better informed everyone in the community is about the behavior of local rivers and streams, the more likely it is that they will make sound decisions.

Make Information Readily Available: Easy access to river and floodplain information is an essential way to help citizens and businesses incorporate flood risks into decisions they make. Most communities offer printed information at the town office or library as well as on town webpages.

Common Handouts or Webpage Information Includes:

- Maps of the local flood hazard areas and the permitting requirements in the floodplain.
- Information about flood insurance and floodproofing buildings.
- Information about how rivers, streams and watersheds work.
- Benefits of green infrastructure and conservation of existing floodplain.

Actively Engage: Many communities work to increase the understanding of rivers and risks via email or by posting information on their local Front Porch Forum. Communities often include flood maps and permitting information in their town meeting reports and other municipal mailings like sewer and water bills. Others promote awareness of flood history and risk by placing high water lines on prominent buildings in the community.

However, education and outreach efforts should not be the sole responsibility of local governments, and community groups like chambers of commerce, downtown business associations, neighborhood groups, and watershed organizations are encouraged to partner with state, regional and local groups to offer local workshops and education sessions.

Potential Workshop Topics and Partners and Presenters:

- Flood Insurance and What You Need to Know (Department of Finance Regulation, Division of Emergency Management and Homeland Security, Vermont League of Cities and Towns)
- Developing a Continuity of Operations Plan (Small Business Development Centers, Regional Planning Commissions, Regional Development Corporations)
- Resilient Road Designs to Reduce Recurring Damage and Improve Water Quality (Agency of Natural Resources, Agency of Transportation)
- Planning for Resilience (Regional Planning Commissions)
- Flood Risk, Preparedness and Safety (Division of Emergency Management and Homeland Security, Regional Planning Commissions)
- Extreme Weather and Climate Change (Agency of Natural Resources, Vermont Natural Recourses Council)
- How Rivers, Streams and Watersheds Work (Agency of Natural Resources, Vermont Natural Resources Council, Vermont Land Trust)
- Low Cost Techniques to Reduce Flooding and Improve Water Quality (Agency of Natural Resources, Vermont Natural Resources Council, Regional Planning Commissions, Vermont League of Cities and Towns)

Invest in Staff Training and Certification: In many of Vermont's cities and towns, floodplain management is just one of many responsibilities of the local planning office or zoning administrator. Yet, administration of a floodplain ordinance is quite complex and the consequences of limited staff time and understanding of the regulations can easily allow inappropriate development in dangerous areas. The consequences of granting improper variances and not enforcing against violations may preclude the community from participating in the federal flood insurance program. Therefore, local government officials are strongly encouraged to support staff training and certification in floodplain management.

What Can Individuals Do to Reduce their Risks?

Most of us remember to annually change the batteries in our smoke alarms to reduce the risk of fire, but few of us prepare for floods or disasters. Since 2000, Vermont has had more than one federally-declared disaster per year and floods have occurred nearly everywhere in the state (ANR, 2015). Buildings located in a 100-year floodplain have 1% chance of being flooded every year. In other words, over a 30 year period (length of most home mortgages), there is a 26% chance of a 100-year flood (USGS, 2015).

The good news is that there are many steps that individuals can take to reduce the risks, loss, disruption and costs associated with flooding. Understanding what the risks of flooding are for your home and family will help you:

- Make sure that you have the right amount of insurance coverage.
- Protect your home and take steps to limit potential damage.
- Prepare plans detailing how your family will respond if flooding looks likely.
- Practice so family members know what actions to take in the event of a flood or upon receiving a flood warning.

Steps to Reduce Risks

- **Identify Flood Risk.** The first step is to identify your risk so you can plan appropriately. Floodplain maps are available at most town offices or click this link http://floodready.vermont.gov/assessment/vt_floodready_atlas to find out if your home or apartment is in an area where floods could potentially happen. Once you have assessed your flood risk, review your insurance coverage.

- **Review Insurance Policies.** Homeowners' or renters' insurance helps pay to repair or rebuild your home and replace personal property due to a covered loss, however it does not cover any damages caused by floods or your rent and living expenses while your home is rebuilt. All insurance policies have overall policy limits and specific limits for different types of coverage. Your insurance agent can help you determine what is covered and what is excluded and check to make sure your coverage is adequate for your needs. However, insurance is complicated and it's a good idea to have your lawyer review your policy, consider various scenarios and help you identify any gaps in your insurance coverage.

- **Fill Gaps in Your Insurance Coverage.** If your home is underinsured at the time of a loss, there is frequently a penalty or reduction in the amount the insurance company will pay for the loss. Property insurance also does not cover flood damages or your expenses if you cannot live in your home due to flood damages. All homeowners who live in flood-prone areas should carry flood insurance. Flood insurance is available for your home and personal property and can be obtained from your local agent.

- **Floodproof and Elevate Utilities.** The cost of flood insurance may be reduced with building modifications. Contact your planning and zoning office to learn more about

building and construction techniques that can both reduce risks and save money. Examples of the various approaches to reduce flooding in buildings are available here http://accd.vermont.gov/sites/accd/files/Flood_Mitigation_Case_Studies_Final.pdf

- **Plan Ahead.** Draft an emergency response and communications plan (family phone numbers) for your home and family. Use the process as an opportunity to bring family members together to discuss the roles needed during an emergency and how best to assign responsibilities. Make sure you have a designated place to meet other family members in the event of an emergency. Also, don't forget to plan for individuals with special needs like prescription medication and for your pets as many public shelters or hotels do not allow animals.
    - Pack an emergency kit and make sure family members know where it is located.
    - Keep copies of your insurance policy, computer data and other important documents like tax returns and financial information safe from flooding on upper floors or stored offsite.
    - Document your home and possessions with photos or video to help simplify the insurance claims process. Generally, the more detailed documentation (receipts, serial numbers, etc.) you can supply during the claims process, the fewer problems you will experience.

- **Train and Practice.** Many of us participate in fire drills at work or school, but few of us practice at home for disasters. Training and practicing your emergency response and communications plan will help assure the plan is workable and family members understand their roles and responsibilities.

- **Pay Attention to Emergency Alerts.** Listen to local news and weather reports for any potential flood warnings in your area. If you know a storm is headed your way, fill up your gas tank in case you must evacuate. (If the power is out, it is not always easy to find an operating gas station.) If you must evacuate, try to contact your employer and let them know your plans. Having a plan and a few extra minutes to evacuate can make a difference.

FEMA http://www.ready.gov/make-a-plan and the Vermont Division of Emergency Management and Homeland Security http://vem.vermont.gov/preparedness/hazards/floods both provide more detailed information on how to prepare and protect your home and family from disasters and floods.

What Can Businesses Do to Reduce their Risks?

According to FEMA, nearly 40% of businesses do not reopen after a disaster and data from the US Small Business Administration indicates that over 90% of businesses fail within two years after being struck by a disaster.

It can take years to repair the damage to the building, furnishings, equipment and inventory. Disasters can also require businesses to relocate or cease operation temporarily, which may lead to canceled contracts and customers going elsewhere for goods or services. Even if the event does not

impact the business directly, severe weather from snow or rain or even extended power outages can strand employees at home and complicate deliveries.

Identifying your risk can significantly reduce potential damages and business recovery costs. Understanding what the risks of flooding are for your business will help you:

- Make sure that you have the right insurance coverage for business interruption.
- Plan ahead and take steps like developing a continuity of operations plan to limit potential damage.
- Train employees so they know what actions to take in the event of a disaster or after receiving a flood warning.

Steps to Reduce Risks

- **Identify Flood Risk.** Since 2000, Vermont has had more than one federally-declared disaster per year and floods have occurred nearly everywhere in the state (ANR). Identifying your risk is a good place to start. Floodplain maps are available at most town offices or click here http://floodready.vermont.gov/assessment/vt_floodready_atlas to find out if your business is in an area where floods could potentially happen. Once you have assessed your flood risk, review your insurance coverage.

- **Review Insurance Policies.** Many types of disasters are not covered under normal insurance policies and funding or loans from government agencies is often too little and too late. All insurance policies have overall policy limits and specific limits for different types of coverage and any business located in a flood-prone area should carry flood insurance. Also check to make sure your insurance includes business interruption coverage and that it reimburses other unexpected costs (like service interruptions from lost power or Internet access, law suits and unemployment compensation claims filed by employees). Business interruption insurance compensates a business for lost income, expenses and profits if a disaster, such as a flood, closes your doors. Your insurance agent can help you determine what is covered and what is excluded and check to make sure your coverage is adequate for your needs. However, insurance is complicated and it's a good idea to have your lawyer review your policy, consider various scenarios and help you identify any gaps in your insurance coverage.

- **Floodproof and Elevate Utilities.** The cost of flood insurance may be reduced with building modifications. Contact your planning and zoning office to learn more about building and construction techniques that can both reduce risks and save money. Examples of the various approaches to reduce flooding in buildings are available here http://accd.vermont.gov/sites/accd/files/Flood_Mitigation_Case_Studies_Final.pdf

- **Plan Ahead.** There are also a number of low-cost steps you can take to reduce the impacts of a flood. At a minimum, regularly back up computer data and store important tax and financial records and information such as your insurance policy details in a flood safe place.

Documenting your building, furnishings, equipment and inventory with photos or video can speed the insurance claims process.

All businesses should have a continuity of operations plan. A continuity of operations plan is a written document that outlines how your business will respond and recover from a flood or other disaster. At a minimum, your plan should include:

- A list of important contacts including your insurance company, key customers and vendors and evacuation contacts for staff.
- A map showing locations of important equipment to relocate (computers and servers) and where to shut off electricity, gas and other services.
- Procedures to protect your property and minimize business disruption – e.g. remote back up of computer files, a plan to relocate inventory or livestock.
- A back up location to conduct business while the building is being repaired.

Having a continuity of operations plan will help you identify and assign essential tasks that will help minimize the damage caused by flooding. Training and practice will help assure the plan is workable and employees are properly trained.

The Vermont Small Business Development Center http://www.vtsbdc.org and many of Vermont's Regional Development Corporations http://accd.vermont.gov/business/partners/rdc and Regional Planning Commissions http://www.vapda.org can also provide training and one-on-one assistance to help your business develop a continuity of operations plan.

CERF+ (Craft Emergency Relief Fund + Artists' Emergency Resources) offers tailored disaster guidance and recourses for artists (http://studioprotector.org/OnlineGuide/DisasterPlanning/DisasterSpecificPlanningResources.aspx).

- **Train and Practice.** Employees need to understand flood warnings and what to do when they get one. This includes understanding the dangers of flooding and how to evacuate the building safely. Train all staff on procedures to shut down the business and how to deploy loss reduction measures like relocating equipment and inventory to upper floors and deploying door and window dams reduce flooding. Finally, remember that flooding can also affect employees' ability to work, as their priority may be to protect their home and family first.

- **Pay Attention to Emergency Alerts.** Listen to local news and weather reports for any potential flood warnings in your area. Having a continuity of operations plan and a few extra minutes to evacuate can save lives and your business.

The US Small Business Administration https://www.sba.gov/content/disaster-preparedness offers more detailed information on how to prepare and protect your employees and business and from disasters and floods.

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Appendix A:

Data Collection

Name	Description	Source
Economic Assets	Mapping of local businesses and farm fields	Northwest Regional Planning Commission (NRPC)
Enosburgh and Enosburg Falls – Floodplain and River Corridor Regulation Overview	Summary of buffers, setbacks, and flood hazard regulations	NRPC
Tyler Branch Geomorphic Assessment	Data and maps of channel stability and aquatic habitat, and recommended actions to improve river stability and reduce flood hazards	(Ruddell et al., 2009); Vermont Agency of Natural Resources (ANR)
Missisquoi River Geomorphic Assessment	Data and maps of channel stability and aquatic habitat, and recommended actions to improve river stability and reduce flood hazards	ANR
Tyler Branch Bank Erosion Study	Information on alternatives analysis and ultimate conservation project near Tyler Branch Road Bridge	(MMI, 2008, 2009)
FEMA 100-year Floodplain	Mapping of 100-year floodplain digitized and adjusted with new topography for this project	(FEMA, 1980), NRPC, FEA
Vermont River Corridor	State-mapped erosion hazard area where river is most likely to be located	ANR, 2015
LIDAR-Derived Contour Data for Franklin County	Aerial photography and GIS layers for contour lines	Upper Missisquoi Flight in 2010
Flood Resiliency Projects	Information about completed projects and flood resiliency efforts initiated by the Town	Town of Enosburgh
Highway Map and Vermont Route 105 Pavement Conditions	Map showing all roads in town and condition of pavement on Vermont Route 105	Vermont Agency of Transportation (VTrans)
Repeat Damage Maps	Mapping of repeat damage sites associated with FEMA-declared disasters	Vermont Agency of Commerce and Community Development (ACCD), FEMA
Aerial photographs	Current and historical aerial photographs	Accessed via Google Earth
Enosburgh Town Plan	Town guide	Town of Enosburgh
Photographs	Miscellaneous photographs of project area	NRPC, Internet, MMI, FEA

Appendix B:

Enosburgh Flood History and Summary of Damages

Enosburgh- Summary of Damages

- The Missisquoi River traverses through most of Franklin County. In Enosburgh, it runs through the northwest section of town. The Tyler Branch watershed, located in the foothills of the Cold Hollow Mountains, encompasses approximately 58 square miles in Franklin County and approximately 27 square miles in Enosburgh Town. It is a major tributary of the Missisquoi River. Tributaries of Tyler Branch include Bogue Branch, The Branch and Beaver Meadow Brook.

- Flooding is a natural occurrence. Minor flooding occurs nearly every spring, particularly along the Missisquoi River when melting snow combines with spring rainfall flows from the surrounding mountains, in combination with the influence of ice jams. Ice jams have not caused any major damage in Enosburgh, but they have contributed to field and overbank erosion.

- There are USGS gages on the Missisquoi River at it outlet in Swanton, downstream of Enosburgh Town and in East Berkshire, on the Town's northern border. Based on the USGS data, several floods events greater than 25 year discharge have occurred over the last 20 years including the year 1992, on July 15, 1997 and on January 8 and March 28, 1998.

- The worst natural flood of historic record occurred in November 1927. During that event, 3.2 inches of rain accumulated in 24 hours with 6.35 inches falling for the entire period. Many homes were destroyed. Barns and livestock were washed away. The North Enosburgh covered bridge was swept away and many roads were inundated. The Enosburg Falls dam had a crest of 16 feet above the top of the dam. The electric power house at the bridge was washed away[1].

- Other floods of minor impact occurred causing relatively minor damage to the community specifically in 1936 and 1940.

- A mentioned previously, the January 15, 1996 winter storm (FEMA 1101-DR) triggered flooding throughout the Town and County. The flooding damaged many roads throughout town.

- On July 4th, 1996 a heavy rain event again overwhelmed local drainages and damaged many town highways.

- During the night of July 14th through to the morning of July 15th, 1997, heavy rain fell continuously throughout eastern Franklin County (FEMA-1184-DR). Several roads,

[1] FEMA, 1980. Town of Enosburgh and Village of Enosburg Falls Flood Insurance Study. Federal Emergency Management Agency, Washington, DC.

bridges and culverts were damaged in Town. An estimated cost of repairs from FEMA reports and from interviews with the Town Road Foreman were approximately $4,530.

- A stalled cold front over Northern New England on February 28th, 2000 brought steady rain to the area. Ice jams formed along the Missisquoi River which produced 1 to 2 feet of water along Route 105 between Enosburg Falls and East Berkshire. Flooding receded on the 29th. There was an estimated $20,000 in damages.

- Based on interviews with local residents, there was also a relatively large flood event which occurred on June 5th, 2002. Several roads were flooded. There was an estimated $25,000 in property damages between the towns of Enosburgh, Richford and Montgomery.

- On September 23rd, 2004 a disaster declaration (FEMA-1559-DR) was declared due to severe storms and flooding from August 12th through September 12th, 2004. Franklin County was included in the disaster declaration. Flooding occurred as a result of heavy rain produced from Tropical Storm Francis. The town highway crew replaced one culvert on TH1 (Tyler Branch Road). Estimated cost of repairs from FEMA reports and testimony from the Road Foreman were approximately $7,050. Also, approximately $60,000 in State emergency funds was used to repair a bridge on TH2 (Boston Post Road).

- A powerful storm tracked northeast across Ontario and Quebec provinces on January 18, 2006. Ahead of this storm, brisk south winds caused temperatures to rise into the 40s creating snow melt. Widespread rainfall of 1.5 to 2.5 inches fell during the night and continued through the early afternoon of the following day. Increased run-off caused widespread field flooding and ponding of water on local roads. Localized ice jams along the Missisquoi River near East Highgate caused flooding and left large ice chunks along Route 78 and Route 105 between Enosburg and Berkshire. There was an estimated $10,000 in damages.

- On May 19th and 20th, 2006, heavy rains fell throughout the state resulting in 3.72 inches of rain in Enosburgh. The Town Highway Department recorded $23,975 in damages to local roads.

- A strong storm system tracked through the county on July 3rd, 2006 creating heavy rain throughout the town. The Town Highway Department recorded $51,356 in damages and repair to the local roads.

- On June 4, 2007 (FEMA-1698-DR) and August 24, 2007 (FEMA-1715-DR), Franklin County was on the edge of a strong frontal system that brought heavy rain which damaged road infrastructure along TH11 (Woodward Neighborhood Road), TH1 (Perley Road) and TH30 (Bogue Road). Franklin County was not part of the disaster declaration, but the Town of Enosburgh received funding from the State Better Back Roads Program to repair damage culverts, roads and bridges.

- A series of storms affected the entire state from June 14-17, 2008, (DR 1778). Stronger storms on Monday June 16 produced up to 1 inch hail. These storms also produced heavy rainfall, but were moving more quickly. No flooding resulted. On Tuesday June 17th strong thunderstorms produced pea sized hail and heavy rain in the Trout River basin in northwest Vermont. Flash flooding occurred in the eastern parts of Franklin County.

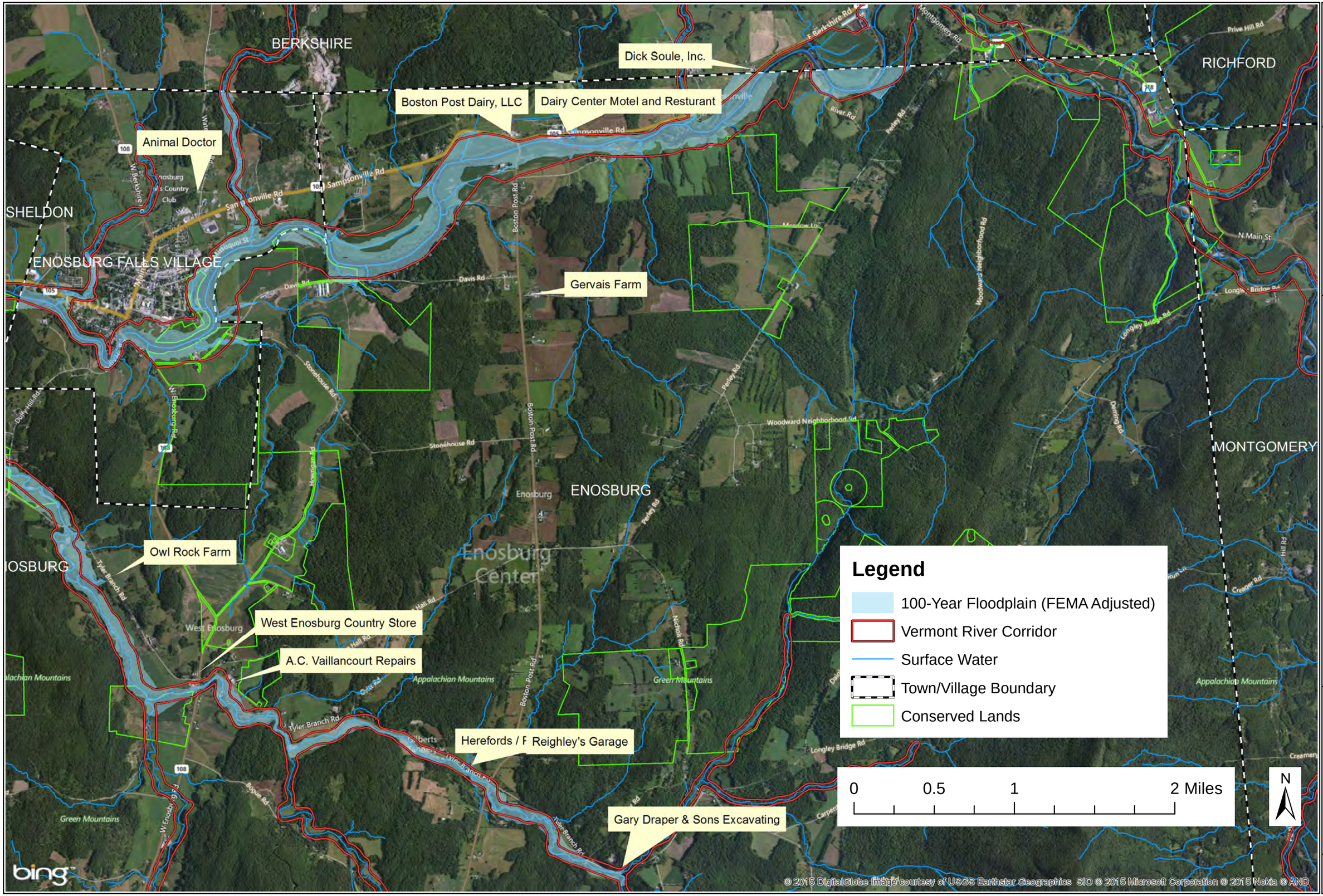
- The year 2011 was a record year for flooding in the state of Vermont. The first floods occurred over a two-week period in April and May of 2011 (DR 1995, 4043). These floods impacted the northern half of the state, including the counties of Addison, Chittenden, Essex, Franklin, Grand Isle, Lamoille, Orleans, Washington, and Windham. The damage totaled over$1.8 million in FEMA assistance. In the spring, heavy rains in late March/early April on top of a deep late season snowpack resulted in riverine flooding and sent Lake Champlain well over the 500-year flood elevation breaking the 140-year-old peak stage elevation. Additional spring runoff events resulted in Lake Champlain being above base flood elevation for more than a month. High lake levels coupled with wind driven waves in excess of 3 feet resulted in major flood damages for shoreline communities.

- Additionally, flooding and fluvial erosion caused by Tropical Storm Irene was catastrophic, destroying property and taking lives, and again eliciting a disaster declaration (DR-4022). The details and impacts of Tropical Storm Irene are provided in the Hurricanes/Tropical Storms section of this risk assessment. However, it is important to underscore that the majority of damages resulting from Tropical Storm Irene were due to flooding and fluvial erosion.

- In addition to free-flowing flood events, there is documented history of ice jams. On March 6, 1979 and ice jam event resulted in a flood elevation 3 feet above the November 3, 1927, flood. The impact of ice jams affects VT105 near Berkshire.
- Transportation facilities that parallel the Missisquoi River are subject to periodic flooding, such as the sections of State Route 105 near Berkshire. Public Utilities such as water mains and electric lines as well as bridge crossings are also vulnerable to flooding damages.

Appendix C:
Adjusted FEMA 100-Year Floodplain and the Vermont River Corridor

The 100 year floodplain (FEMA, 1980) was previously digitized by the Northwest Regional Planning Commission and then adjusted by Fitzgerald Environmental Associates during VERI using LiDAR-derived elevation data



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SOURCE(S):

FEMA Floodplain
Digitization by NRPC
Floodplain updates by FEA
Site Mapping by MMI
VCGI data
Bing Maps Aerial Photography

FEMA 100-YEAR FLOODPLAIN AND VT RIVER CORRIDOR

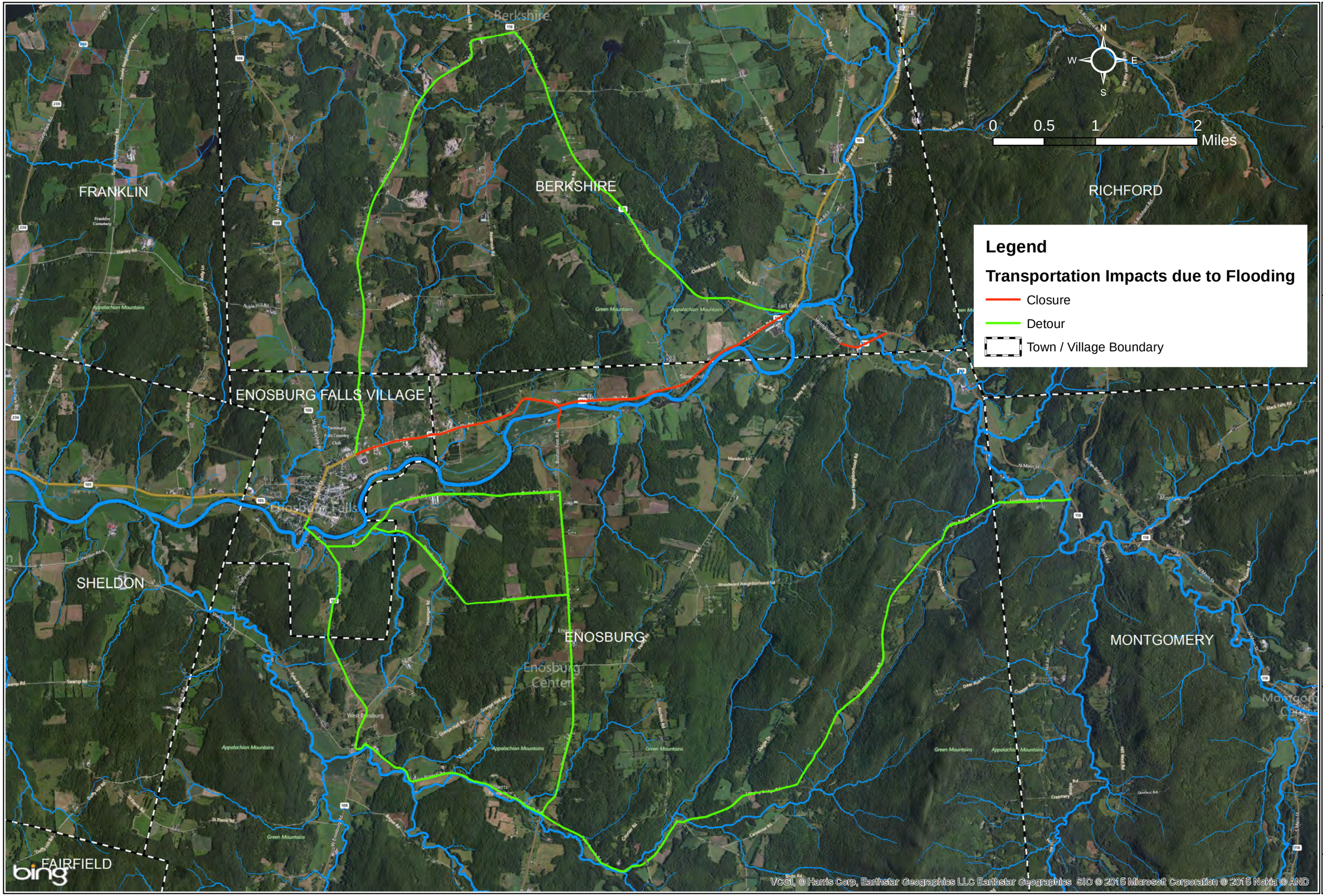
VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MMI#: 5507-01
MXD: VERI_Enosburg_FEMA_RC.mxd
1st Version: March 3, 2014
Revision: March 6, 2015
Scale: See scale bar.

Appendix D:

Common Road Closures and Detours



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SOURCE(S):
Detour Analysis by NRPC
Vermont Center for Geographic Information
Bing Maps Aerial Photography

ROAD CLOSURES OR DETOURS DUE TO FLOODING

VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MM1#: 5507-01
MXD: VERI_Enosburg_Transportation
1st Version: December 1, 2014
Revision: December 24, 2014
Scale: See scale bar

Appendix E:

Enosburgh Flood Resilience Checklist

Flood Resilience Checklist

Is your community prepared for a possible flood? Completing this flood resilience checklist can help you begin to answer that question. This checklist was developed as part of the U.S. Environmental Protection Agency's Smart Growth Implementation Assistance project in the state of Vermont. More information about the project can be found by reading the full report, *Planning for Flood Recovery and Long-Term Resilience in Vermont*, found online at www.epa.gov/smartgrowth/sgia_communities.htm#rec1.

What is the Flood Resilience Checklist?

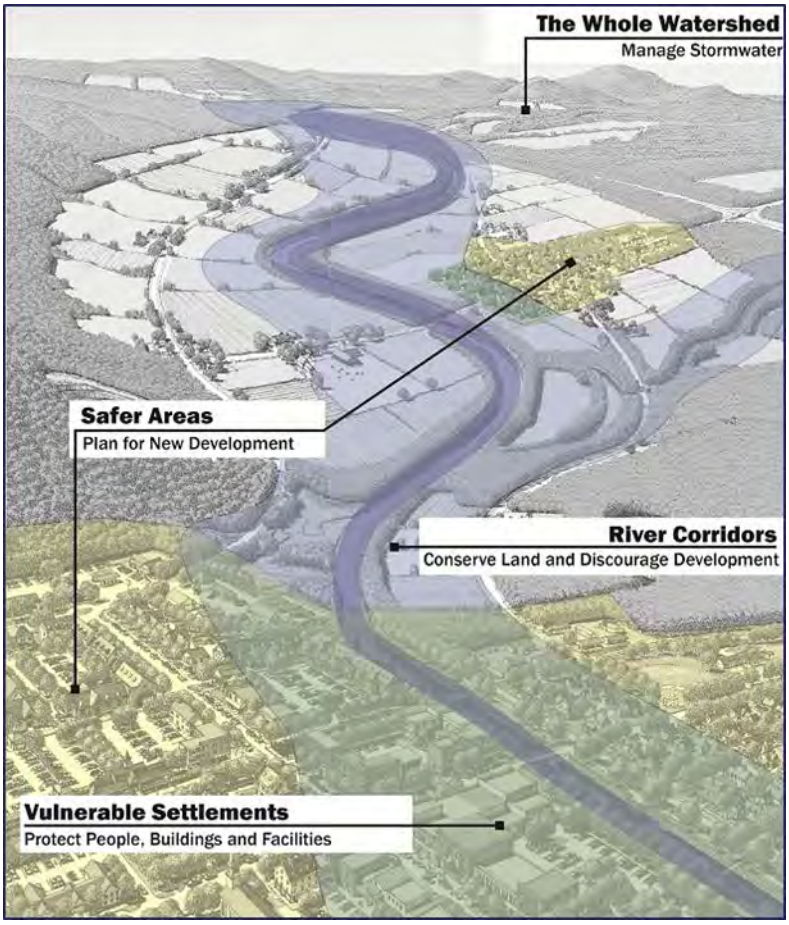
This checklist includes overall strategies to improve flood resilience as well as specific strategies to conserve land and discourage development in river corridors; to protect people, businesses, and facilities in vulnerable settlements; to direct development to safer areas; and to implement and coordinate stormwater management practices throughout the whole watershed.

Who should use it?

This checklist can help communities identify opportunities to improve their resilience to future floods through policy and regulatory tools, including comprehensive plans, Hazard Mitigation Plans, local land use codes and regulations, and non-regulatory programs implemented at the local level. Local government departments such as community planning, public works, and emergency services; elected and appointed local officials; and other community organizations and nonprofits can use the checklist to assess their community's readiness to prepare for, deal with, and recover from floods.

Why is it important?

Completing this checklist is the first step in assessing how well a community is positioned to avoid and/or reduce flood damage and to recover from floods. If a community is not yet using some of the strategies listed in the checklist and would like to, the policy options and resources listed in the *Planning for Flood Recovery and Long-Term Resilience in Vermont* report can provide ideas for how to begin implementing these approaches.



This graphic illustrates the four categories of approaches to enhance resilience to future floods. Credit: Vermont Agency of Commerce and Community Development.

FLOOD RESILIENCE CHECKLIST

Overall Strategies to Enhance Flood Resilience
(Learn more in Section 2, pp. 9-11 of
Planning for Flood Recovery and Long-Term Resilience in Vermont)

1. Does the community's comprehensive plan have a hazard element or flood planning section?	■ Yes	☐ No
a. Does the comprehensive plan cross-reference the local Hazard Mitigation Plan and any disaster recovery plans?	■ Yes	☐ No
b. Does the comprehensive plan identify flood- and erosion-prone areas, including river corridor and fluvial erosion hazard areas, if applicable?	■ Yes	☐ No
c. Did the local government emergency response personnel, flood plain manager, and department of public works participate in developing/updating the comprehensive plan?	■ Yes	☐ No
2. Does the community have a local Hazard Mitigation Plan approved by the Federal Emergency Management Agency (FEMA) and the state emergency management agency?	☐ Yes	■ No
a. Does the Hazard Mitigation Plan cross-reference the local comprehensive plan?	■ Yes	☐ No
b. Was the local government planner or zoning administrator involved in developing/updating the Hazard Mitigation Plan?	☐ Yes	■ No
c. Were groups such as local businesses, schools, hospitals/medical facilities, agricultural landowners, and others who could be affected by floods involved in the Hazard Mitigation Plan drafting process?	■ Yes	☐ No
d. Were other local governments in the watershed involved to coordinate responses and strategies?	■ Yes	☐ No
e. Does the Hazard Mitigation Plan emphasize non-structural pre-disaster mitigation measures such as acquiring flood-prone lands and adopting No Adverse Impact flood plain regulations?	■ Yes	☐ No
f. Does the Hazard Mitigation Plan encourage using green infrastructure techniques to help prevent flooding?	☐ Yes	■ No
g. Does the Hazard Mitigation Plan identify projects that could be included in pre-disaster grant applications and does it expedite the application process for post-disaster Hazard Mitigation Grant Program acquisitions?	■ Yes	☐ No
3. Do other community plans (e.g., open space or parks plans) require or encourage green infrastructure techniques?	☐ Yes	■ No

FLOOD RESILIENCE CHECKLIST		
4. Do all community plans consider possible impacts of climate change on areas that are likely to be flooded?	☐ Yes	■ No
5. Are structural flood mitigation approaches (such as repairing bridges, culverts, and levees) and non-structural approaches (such as green infrastructure) that require significant investment of resources coordinated with local capital improvement plans and prioritized in the budget?	☐ Yes	■ No
6. Does the community participate in the National Flood Insurance Program Community Rating System?	■ Yes	☐ No
Conserve Land and Discourage Development in River Corridors (Learn more in Section 3.A, pp. 14-19 of *Planning for Flood Recovery and Long-Term Resilience in Vermont*)		
1. Has the community implemented non-regulatory strategies to conserve land in river corridors, such as:		
a. Acquisition of land (or conservation easements on land) to allow for stormwater absorption, river channel adjustment, or other flood resilience benefits?	■ Yes	☐ No
b. Buyouts of properties that are frequently flooded?	☐ Yes	■ No
c. Transfer of development rights program that targets flood-prone areas as sending areas and safer areas as receiving areas?	☐ Yes	■ No
d. Tax incentives for conserving vulnerable land?	☐ Yes	■ No
e. Incentives for restoring riparian and wetland vegetation in areas subject to erosion and flooding?	☐ Yes	■ No
2. Has the community encouraged agricultural and other landowners to implement pre-disaster mitigation measures, such as:		
a. Storing hay bales and equipment in areas less likely to be flooded?	☐ Yes	■ No
b. Installing ponds or swales to capture stormwater?	☐ Yes	■ No
c. Planting vegetation that can tolerate inundation?	■ Yes	☐ No
d. Using land management practices to improve the capability of the soil on their lands to retain water?	■ Yes	☐ No
3. Has the community adopted flood plain development limits that go beyond FEMA's minimum standards for Special Flood Hazard Areas and also prohibit or reduce any new encroachment and fill in river corridors and Fluvial Erosion Hazard areas?	☐ Yes	■ No

FLOOD RESILIENCE CHECKLIST		
4. Has the community implemented development regulations that incorporate approaches and standards to protect land in vulnerable areas, including:		
a. Fluvial erosion hazard zoning?	☐ Yes	■ No
b. Agricultural or open space zoning?	■ Yes	☐ No
c. Conservation or cluster subdivision ordinances, where appropriate?	■ Yes	☐ No
d. Other zoning or regulatory tools that limit development in areas subject to flooding, including river corridors and Special Flood Hazard Areas?	■ Yes	☐ No
Protect People, Buildings, and Facilities in Vulnerable Settlements (Learn more in Section 3.B, pp. 19-26 of *Planning for Flood Recovery and Long-Term Resilience in Vermont*)		
1. Do the local comprehensive plan and Hazard Mitigation Plan identify developed areas that have been or are likely to be flooded?	■ Yes	☐ No
a. If so, does the comprehensive plan discourage development in those areas or require strategies to reduce damage to buildings during floods (such as elevating heating, ventilation, and air conditioning (HVAC) systems and flood-proofing basements)?	■ Yes	☐ No
b. Does the Hazard Mitigation Plan identify critical facilities and infrastructure that are located in vulnerable areas and should be protected, repaired, or relocated (e.g., town facilities, bridges, roads, and wastewater facilities)?	■ Yes	☐ No
2. Do land development regulations and building codes promote safer building and rebuilding in flood-prone areas? Specifically:		
a. Do zoning or flood plain regulations require elevation of two or more feet above base flood elevation?	☐ Yes	■ No
b. Does the community have the ability to establish a temporary post-disaster building moratorium on all new development?	☐ Yes	■ No
c. Have non-conforming use and structure standards been revised to encourage safer rebuilding in flood-prone areas?	☐ Yes	■ No
d. Has the community adopted the International Building Code or American Society of Civil Engineers (ASCE) standards that promote flood-resistant building?	☐ Yes	■ No
e. Does the community plan for costs associated with follow-up inspection and enforcement of land development regulations and building codes?	☐ Yes	■ No

FLOOD RESILIENCE CHECKLIST		
3. Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity in any new redevelopment projects such as adding new parks and open space and allowing space along the river's edge for the river to move during high-water events?	☐ Yes	■ No
4. Is the community planning for development (e.g., parks, river-based recreation) along the river's edge that will help connect people to the river AND accommodate water during floods?	■ Yes	☐ No
5. Does the comprehensive plan or Hazard Mitigation Plan discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or special assessment district)?	■ Yes	☐ No
Plan for and Encourage New Development in Safer Areas (Learn more in Section 3.C, pp. 26-27 of *Planning for Flood Recovery and Long-Term Resilience in Vermont*)		
1. Does the local comprehensive plan or Hazard Mitigation Plan clearly identify safer growth areas in the community?	■ Yes	☐ No
2. Has the community adopted policies to encourage development in these areas?	■ Yes	☐ No
3. Has the community planned for new development in safer areas to ensure that it is compact, walkable, and has a variety of uses?	■ Yes	☐ No
4. Has the community changed their land use codes and regulations to allow for this type of development?	■ Yes	☐ No
5. Have land development regulations been audited to ensure that development in safer areas meets the community's needs for off-street parking requirements, building height and density, front-yard setbacks and that these regulations do not unintentionally inhibit development in these areas?	☐ Yes	■ No
6. Do capital improvement plans and budgets support development in preferred safer growth areas (e.g., through investment in wastewater treatment facilities and roads)?	☐ Yes	■ No
7. Have building codes been upgraded to promote more flood-resistant building in safer locations?	☐ Yes	■ No

FLOOD RESILIENCE CHECKLIST

Implement Stormwater Management Techniques throughout the Whole Watershed
(Learn more in Section 3.D, pp. 27-31 of *Planning for Flood Recovery and Long-Term Resilience in Vermont*)

1. Has the community coordinated with neighboring jurisdictions to explore a watershed-wide approach to stormwater management?	☐ Yes	■ No
2. Has the community developed a stormwater utility to serve as a funding source for stormwater management activities?	☐ Yes	■ No
3. Has the community implemented strategies to reduce stormwater runoff from roads, driveways, and parking lots?	■ Yes	☐ No
4. Do stormwater management regulations apply to areas beyond those that are regulated by federal or state stormwater regulations?	☐ Yes	■ No
5. Do stormwater management regulations encourage the use of green infrastructure techniques?	☐ Yes	■ No
6. Has the community adopted tree protection measures?	☐ Yes	■ No
7. Has the community adopted steep slope development regulations?	■ Yes	☐ No
8. Has the community adopted riparian and wetland buffer requirements?	■ Yes	☐ No

Appendix F:

Municipal Policy and Program Recommendations

Municipal Policies and Program Recommendations:
Reducing flood risk involves a continuous process of policy evaluation and adjustments to minimize risks through protection, prevention and education. The VERI team reviewed municipal policies, regulations and procedures looking for opportunities to protect people, businesses and infrastructure from flooding within Enosburg Falls and Enosburgh Town. This review aims to support ongoing community discussion on changes that enhance public safety, reduce damages to property and public infrastructure and avoid business disruptions.

The team review included Enosburg's municipal plan, hazard mitigation plan, and land use regulations to identify what flood-related policies they contain or lack. The review also land trusts, emergency training and preparedness programs and business operations plans. Local stakeholders (residents, businesses, planning commission, village trustee boards, selectboards, etc.) are encouraged to review these recommendations and seek assistance from the identified partners and programs and take these steps to reduce Enosburg's flood risk over time.

Emergency Relief Assistance Fund (ERAF).
This is a state program that outlines the steps communities can take to increase the state's share of disaster recovery assistance.

	Enosburgh Town	**Enosburg Falls Village**
Steps to increase State aid to 12.5%		
Participate in the National Flood Insurance Program	Yes-Effective 6/19/1996	Yes-Effective 1/02/1981
Adopt 2013 State Road & Bridge Standards	Yes- Adopted 3/18/2013	Yes-Adopted 1/28/2014
Adopt Local Emergency Operations Plan	Yes- Adopted 7/22/2014	Yes- Incorporated into Town LEOP
Adopt Local Hazard Mitigation Plan	Yes- 2015 draft LHMP in process of securing FEMA approval	No
Step to increase State aid to 17.5% (one needed to qualify)		
Adopt no new development in a River Corridor	No	No
Adopt no new development in Flood Hazard areas and participate in the Federal Community Rating System	No	No
State ERAF Match	**12.5%**	**7.5%**

Steps to increase state match to 12.5%:

- **Participate in the National Flood Insurance Program (NFIP).**
- **Adopt Town Road and Bridge Standards** consistent with or exceeding those listed under the most current version of *Town Road & Bridge Standards in the* Handbook for Local Officials (also known as the "Orange Book"), published by the Vermont Agency of Transportation. The Standards were last updated on 1/23/2013.
- **Annually Update and Adopt Emergency Operation Plan (EOP).** During a disaster, having quick access to town contacts for all of the critical systems (water, sewer, electricity) and vulnerable populations is indispensable. The EOP should be updated and adopted annually after town meeting but before May 1st.
- **Develop a Local Hazard Mitigation Plan (LHMP)** that meets the provisions of 44 CFR § 201.6 that has been approved by the local community, and is approved or in the process of securing final approval by FEMA. LHMP should document past infrastructure damage, highlight vulnerabilities, list future municipal infrastructure mitigation projects and recommend changes to the municipal plan and bylaws that will enable implementation of hazard mitigation strategies.

Steps to increase state match to 17.5%:

- **Adopt river corridor protection areas.** Flood damage in Vermont also is caused by bank erosion from swollen rivers within river corridors. Stream banks can fail causing structures to be undermined or fall into the river. Consider prohibiting development in the mapped river corridor in the town and village zoning bylaws' flood overlay section, **or**
- **Adopt flood hazard protection areas and participate in the Federal Community Rating System (CRS) Program.** Consider prohibiting development in the mapped flood hazard areas in the town and village zoning bylaws' flood overlay section as well as joining the FEMA CRS Program. This program reduces flood insurance rates through discounts – which vary according to the community's efforts – reflect the reduced flood risk to property owners resulting from community plans, policies and procedures.

Next Steps:

- The Village of Enosburg Falls should begin drafting a Local Hazard Mitigation Plan and integrating mitigation strategies identified as part of the VERI project. NRPC can provide technical assistance in this effort. This would enable the Village to receive a 12.5% state ERAF match.
- The Town and Village should explore participation in the FEMA Community Rating System (CRS) so as to secure a discount on flood insurance. The NRPC and the Vermont ANR Floodplain Manager can help the communities evaluate the potential benefits and costs for CRS participation.
- Enosburgh Town and the NRPC should ensure that the mitigation strategies identified as part of the VERI project are incorporated into the current LHMP draft.
- Enosburgh's LEOP (including the Village) should be updated annually to maintain their current state ERAF match.

Local Land Use Regulations:
The review identified opportunities to improve local land use regulations (zoning bylaws) to reduce vulnerability to future floods. The Village and Town currently have separate land use regulations but anticipate merging their bylaws next year.

- **Encourage development outside of the floodway**. The floodway is the fastest moving part of the stream or river during a flood. Buildings and other objects in a floodway can be washed downstream, and cause culverts and bridges to clog with debris resulting in significant property damage. In Enosburgh Town, new structures are prohibited in the floodway, but substantial improvements to existing structures may be approved via conditional use approval. In the Village, development in the floodway "is prohibited unless a registered professional engineer certifies that the proposed development will not result in any increase in flood levels during the occurrence of the base flood." This is a difficult regulation to satisfy and it may essentially prohibit development in the floodway, but does leave open the possibility.
- **Encourage development outside of the flood hazard area**. New development in the floodplain puts owners at risk and reduces available floodplain. This can worsen flooding and puts emergency responders, the public and downstream property owners at risk. In the Town and Village bylaws, new structures in the Special Flood Hazard Area (100-year floodplain) are conditional. New and substantially improved structures are to be located above base flood elevation. The Town bylaws also specify that mobile homes are to be 1 ft. above base flood elevation while the Village bylaws do not include this regulation.
- **Update policies allowing fill in flood hazard areas.** Allowing landowners to fill low lying areas may help protect an individual property, but it can reduce the land's ability to slow and store the extra flood water and it can increase flood hazards to downstream property owners. The Town bylaws prohibit new fill except where necessary to elevate structures above the base flood elevation. The Village bylaws also prohibit fill but the language should be more explicit

Next Steps:

- The Town and Village anticipate merging their bylaws next year. This will be an opportunity to ensure consistency between the flood hazard and stream buffer regulations.
- The Town and Village should consider updating their flood hazard regulations to further restrict new development in the Special Hazard Flood Area and/or require new or substantially improved structures to be 1-3 ft. above the base flood elevation.

Town Plans:
Municipal plans and capital improvement plans can be updated to incorporate lessons learned and identify opportunities to reduce hazards and improve preparedness.

- **Expand flood resilience element in the municipal plan.** The Town and Village have a joint municipal plan that was adopted in March, 2015. The recommendations of the VERI project should be incorporated into the plan when it is next updated in 2020.
- **Document road, sewer, and water infrastructure vulnerabilities in municipal plan and develop capital plans.** Specific areas that were damaged or have known vulnerabilities should be documented so the communities can plan for their replacement in their long-term budgets, easing the impact on taxpayers. The Town is encouraged to develop a capital improvement plan that incorporates the physical improvements recommended through the VERI project.
- **Identify areas for conservation in the municipal plan.** The VERI team has highlighted the importance of protecting the river corridor along Tyler Branch upstream of the Boston Post Road. This corridor has an extensive beaver pond complex and floodplain that stores sediment and large woody debris which improves downstream channel stability, limits the lateral movement of the channel and protects farmland from erosion in the Tyler Branch valley. The need to conserve this corridor (and other intact floodplains) should be including incorporated in the municipal plan during the next update.

Next Steps:

- NRPC, Vermont League of Cities and Towns (VLCT) or consultants can help the Planning Commissions gather and review sample capital budgets and plans and help the town draft specific language for review and local adoption.
- The State's Municipal Planning Grants are designed to help towns and planning commissions hire experts to review and update plans and capital budgets. Annually the grants are due September 30.
- The Town with assistance from the NRPC, should update the bridge and culvert inventory to identify potential deficiencies and estimate replacement costs. Needed improvements should be incorporated into a Capital Improvement Plan.

Emergency Planning:

The review identified a number of opportunities to improve immediate emergency preparedness and recovery for the community (hazard mitigation and local emergency operation plans).

- **Incorporate VERI mitigation strategies into the Enosburgh Town Local Hazard Mitigation Plan (LHMP).** VERI mitigation strategies should be integrated into the Town's LHMP. This could enable the Town to receive state and federal funding for these projects.
- **Develop a Local Hazard Mitigation Plan for the Village of Enosburg Falls.** The Village of Enosburg Falls should begin drafting a LHMP and integrating mitigation strategies identified as part of the VERI project. Having a LHMP will also make the Village eligible to apply for additional federal funding for infrastructure projects and this would enable the Village to receive a 12.5% state ERAF match instead of their current rate of 7.5%.

- **Encourage regional revolving loan funds** to modify lending terms to reduce (or eliminate) interest for loans distributed to help businesses recover from declared disasters.
- **Incorporate VERI strategies and implementation recommendations into the Comprehensive Economic Development Strategy (CEDS) for the Northern Vermont Economic Development District (NVEDD).** The NVEDD is in the process of developing a CEDS for the northern tier of Vermont. VERI implementation recommendations will be evaluated and integrated into the CEDS as appropriate.

Next Steps:

- The State's Hazard Mitigation Planning Grant http://vem.vermont.gov/hmgp_11.2.12 are designed to help towns and planning commissions update their mitigation plan as well as implement the projects described within it. The grants are available when federal disaster funds have been earmarked for Vermont and are due on a rolling basis. NRPC can provide technical assistance to help the Village draft a Local Hazard Mitigation Plan.
- For several years after a declared disaster, state and federal funding is available from USDA and HUD in addition to FEMA. The Community Development Block Grant program has a Disaster Recovery sub grant that can help towns rebuild infrastructure.
- The NRPC will evaluate their Brownfield Revolving Loan Fund to identify opportunities to link the funding to projects that promote or enhance resiliency.

Education and Outreach:

- **Promote and educate property owners on the value of flood insurance**. Homeowners' insurance does not pay for any flood related damage. Only flood insurance through the National Flood Insurance Program does. FEMA's National Flood Insurance Program as September 30, 2014, the Town of Enosburgh has four policies in force and the Village of Enosburg Falls has three policies in force. This represents about 30% of the structures estimated to be in the Special Flood Hazard Area.
- **Help businesses plan for disasters**. If a home is damaged or washed away, occupants can go stay in a hotel, with friend or family, or find a rental. When a business is flooded, it is much harder or impossible to relocate. Continuity of operations plans outlines the steps business can take during and after a disaster to reduce disruption and losses.
- **Educate landlords and contractors about local regulations:** Many landlords and contractors may not understand the requirements for rebuilding after a flood. Specific standards must be met to maintain eligibility for flood insurance and other federal grants.

Next Steps:

- The Small Business Administration offers loans and refinancing of existing loans to consumers as well as businesses and non-profits after disasters The Vermont Small

Business Development Center has offered extensive disaster assistance to businesses as well as compiling a great guide for owners to navigate these programs.

- The state's Flood Ready website for information about local flood hazards and regulations for each community as well as
    - River corridor and flood hazard maps
    - Examples of Town Plans, Local Emergency Operations Plans and Hazard Mitigation Plans
    - Flood data compiled by community and region including:
        - The number public buildings in the Special Flood Hazard Area (SFHA)
        - The number of buildings in the flood hazard area that have insurance

Enosburgh and Enosburg Falls

Town-wide Policy and Program Options

Vermont Economic Resiliency Initiative (VERI)

Legend

● Effective ◒ Limited ○ Ineffective

* Priority rating based on degree of community benefit

		OBJECTIVES			FEASIBILITY					
Recommendation	**Priority***	**Reduces Flood Risk**	**Reduces Erosion Risk**	**Protects Businesses, Infrastructure, and Property**	**Ease of Implementation**	**Cost Range**	**Potential Partners**	**Potential Grants**	**Explanation**	**Next Steps**
Land Use Regulations										
Encourage development outside of the floodway.	**High**	●	●	●	Easy	< $10K	RPC, VLCT, Consultant	MPG	The floodway is the fastest moving part of the stream or river during a flood. Buildings and other objects in a floodway can be washed downstream, and cause culverts and bridges to clog with debris resulting in significant property damage. In Enosburgh Town, new structures are prohibited in the floodway, but substantial improvements to existing structures may be approved via conditional use approval. In the Village, development in the floodway "is prohibited unless a registered professional engineer certifies that the proposed development will not result in any increase in flood levels during the occurrence of the base flood." This is a difficult regulation to satisfy and it may essentially prohibit development in the floodway, but does leave open the possibility.	Contact Town Planner and Planning Commission
Encourage development outside of the flood hazard and ANR mapped river corridor areas	**High**	●	●	●	Moderate	< $10K	DEC River Management Program, RPC, VLCT, Consultant	MPG	New development in the floodplain puts owners at risk and reduces available floodplain. This can worsen flooding and puts emergency responders, the public and downstream property owners at risk. In the Town and Village bylaws, new structures in the Special Flood Hazard Area (100-year floodplain) are conditional. New and substantially improved structures are to be located above base flood elevation. The Town bylaws also specify that mobile homes are to be 1 ft. above base flood elevation while the Village bylaws do not include this regulation.	Contact Town Planner and Planning Commission
Update policies allowing fill in flood hazard areas.	**High**	●	○	●	Easy	< $10K	RPC, VLCT, Consultant	MPG	Allowing landowners to fill low lying areas may help protect an individual property, but it can reduce the land's ability to slow and store the extra flood water and it can increase flood hazards to downstream property owners. The Town bylaws prohibit new fill except where necessary to elevate structures above the base flood elevation. The Village bylaws also prohibit fill but the language should be more explicit	Contact Town Planner and Planning Commission
Town Plan										
Expand flood resilience element in the municipal plan.	**High**	●	●	●	Moderate	< $10K	RPC, VLCT, Consultant	MPG	The Town and Village have a joint municipal plan that was adopted in March, 2015. The recommendations of the VERI project should be incorporated into the plan when it is next updated in 2020.	Contact Town Planner and Planning Commission
Document road, sewer, and water infrastructure vulnerabilities in municipal plan and develop capital plans.	**High**	○	○	●	Easy	< $10K	RPC, VLCT, Consultant	MPG	Specific areas that were damaged or have known vulnerabilities should be documented so the communities can plan for their replacement in their long-term budgets, easing the impact on taxpayers. The Town is encouraged to develop a capital improvement plan that incorporates the physical improvements recommended through the VERI project.	Contact Town Planner and Planning Commission
Identify areas for conservation.	**Medium**	●	●	●	Easy	< $10K	DEC River Management Program, RPC, Consultant	DEC-ERP	The VERI team has highlighted the importance of protecting the river corridor along Tyler Branch upstream of the Boston Post Road. This corridor has an extensive beaver pond complex and floodplain that stores sediment and large woody debris which improves downstream channel stability, limits the lateral movement of the channel and protects farmland from erosion in the Tyler Branch valley. The need to conserve this corridor (and other intact floodplains) should be including incorporated in the municipal plan during the next update.	Contact Conservation Commission

[1]**Reduces Flood Risk** - The proposed project/ strategy lowers the flood level. [2]**Reduces Erosion Risk** - The proposed project/ strategy lessens the vulnerability of a location to erosion.

Enosburgh and Enosburg Falls

Town-wide Policy and Program Options

Vermont Economic Resiliency Initiative (VERI)

Legend

● Effective ◓ Limited ○ Ineffective

* Priority rating based on degree of community benefit

		OBJECTIVES			FEASIBILITY					
Recommendation	**Priority***	**Reduces Flood Risk**	**Reduces Erosion Risk**	**Protects Businesses, Infrastructure, and Property**	**Ease of Implementation**	**Cost Range**	**Potential Partners**	**Potential Grants**	**Explanation**	**Next Steps**
Emergency Planning										
Encourage regional revolving loan funds	**High**	○	○	●	Difficult	??	Chamber, local churches, committees	EDA grants	Towns will recover much more quickly after a disaster if they create a local fund to address urgent needs as federal and state money are slow to arrive. Towns could offer loans to modify lending terms to reduce (or eliminate) interest for loans distributed to help businesses recover from declared disasters.	Work with local committee
Incorporate VERI mitigation strategies into the Enosburgh Town Local Hazard Mitigation Plan (LHMP).	**High**	●	●	●	Easy	< $10K	RPC, town	HMGP grants	VERI mitigation strategies should be integrated into the Town's LHMP. This could enable the Town to receive state and federal funding for these projects.	Work with town Emergency Management Director.
Develop a Local Hazard Mitigation Plan for the Village of Enosburg Falls	**High**	●	●	●	Easy	< $10K	Schools, RPC, Town	HMGP grants	The Village of Enosburg Falls should begin drafting a LHMP and integrating mitigation strategies identified as part of the VERI project. Having a LHMP will also make the Village eligible to apply for additional federal funding for infrastructure projects and this would enable the Village to receive a 12.5% state ERAF match instead of their current rate of 7.5%.	Work with town Emergency Management Director.
Incorporate VERI strategies and implementation recommendations into the Comprehensive Economic Development Strategy (CEDS) for the Northern Vermont Economic Development District (NVEDD)	**Medium**	○	○	●	Moderate	< $10K	Homeowners Associations	HMGP grants	The NVEDD is in the process of developing a CEDS for the northern tier of Vermont. VERI implementation recommendations will be evaluated and integrated into the CEDS as appropriate.	Work with NVEDD and local CEDS steering committee
Education and Outreach										
Promote and educate property owners on the value of flood insurance.	**High**	○	○	●	Easy	< $10K	Chamber, Homeowners Associations	HMGP grants	Homeowners' insurance does not pay for any flood related damage. Only flood insurance through the National Flood Insurance Program does. FEMA's National Flood Insurance Program as September 30, 2014, the Town of Enosburgh has four policies in force and the Village of Enosburg Falls has three policies in force. This represents about 30% of the structures estimated to be in the Special Flood Hazard Area	Gather NFIP informational materials for distribution, and reach out to real estate agents.
Help businesses plan for disasters.	**Medium**	○	○	●	Easy	< $10K	Chamber, Rotary	EDA grants	If a home is damaged or washed away, occupants can go stay in a hotel, with friend or family, or find a rental. When a business is flooded, it is much harder to relocate. Continuity of operations plans outlines the steps business can take during and after a disaster to reduce disruption and losses.	Offer continuity of operations planning training for businesses.
Educate landlords and contractors about local regulations.	**High**	○	○	●	Moderate	< $10K	Realtors	HMGP grants	Many landlords and contractors may not understand the requirements for rebuilding after a flood. Specific standards must be met to maintain eligibility for flood insurance and other federal grants.	Reach out to landlords and contractors.

[1]**Reduces Flood Risk** - The proposed project/ strategy lowers the flood level. [2]**Reduces Erosion Risk** - The proposed project/ strategy lessens the vulnerability of a location to erosion.

Appendix G:

Table of Recommended Projects to Protect Businesses and Infrastructure

Enosburgh

Recommended Projects to Protect Businesses and Infrastructure
Vermont Economic Resiliency Initiative (VERI)
March 31, 2015

Legend
● Effective ◒ Limited ○ Ineffective

* Priority rating based on objectives and potential business impact

				OBJECTIVES			FEASIBILITY			
Project	**What is At Risk?**	**Potential Business Impacts**	**Priority***	**Reduces Flood Risk[1]**	**Reduces Erosion Risk[2]**	**Protects Businesses, Infrastructure, and Property**	**Ease of Implementation**	**Cost Range**	**Estimated Time for Implementation**	**Comments**
Building and Site Improvements										
Move Town Garage, create secure salt storage area, or improve river bank and channel stability **(see site 10)**	Town Garage, stored equipment, and stockpiled materials	Local highway operations essential for all businesses	Medium	○	◒	●	Difficult	$100K-$200K	2-5 years	Town garage is in the 100-year floodplain and river corridor. Alternative location desired so maintenance vehicles and materials not prone to damage and loss Setting is chronic water quality issue as materials wash into river with runoff. Improve bank stability to reduce erosion risk.
Channel and Floodplain Management										
Berm removal along the south bank of the Missisquoi River about 1 mile west of intersection of Routes 105 and 118 **(see site 20)**	Route 105 and Dick Soule, Inc.	7 businesses, about 50 employees, several farms, and regional connection to Village	**High**	◒	●	◒	Moderate	$100K-$200K	2-5 years	Berm located along the south bank of the Missisquoi River adjacent to farm field / floodplain. Berm increases flood levels along Route 105 and the frequency of road overtopping. Removal of ~ 950 feet of berm would reduce flooding.
Corridor conservation about 1,700 feet upstream of Boston Post Road **(see sites 2 and 3)**	Valley bottom farm land, Town roads, private drives, homes	Downstream farmland and homes	**High**	◒	●	◒	Moderate	$50K-$100K	2-5 years	The number one recommendation in the geomorphic assessment (RC, 2009) was conserve the corridor to allow for a stable channel and less erosion. This site is the best corridor conservation location with a lot of sediment and large wood stored in the area that is important to protect downstream farm land and roads in most of the valley.
Berm removal about 1,000 feet upstream of the intersection of Tyler Branch Road and Grange Hall Road to spread flood flows **(see site 7)**	Tyler Branch Road and Vaillancourt Repairs	2 businesses, 3 farms, 10 employees, and homes	Medium	◒	●	◒	Easy	$50K-$100K	2-5 years	A berm is located along the north bank to try and protect a hayfield. The berm confines flows, and increases erosion potential. Berm removal would reduce erosion potential and minimize erosion risk along Tyler Branch Road. Active bank failures would likely reduce.
Expand cover cropping and other best practices on valley bottom farmland along the Missisquoi River and Tyler Branch to reduce potential damages due to flooding and erosion	Soil and crop loss on farm fields	Local farm operations	Low	○	◒	◒	Moderate	$100K-$200K	2-5 years	Cover cropping taking place in the watershed due to UVM extension projects. Methods need refinement to reduce soil loss and protect agriculture fields. Timing of cover crop application was the primary implementation challenge.
Targeted sediment dredging at road crossings and confluences with high sediment buildup **(see sites 6, 8, and 12)**	Adjacent property and infrastructure	Several local businesses, farms, and homes	Low	○	○	○	Moderate	$100K-$200K	1-2 years	Sediment backed up at crossings, constrictions, and tight bends and the channel is most unstable in these locations. Sediment removal in these locations would result in short-term risk reduction , yet long-term risks would be created due to increased erosion hazards locally and over a larger section of the channel.

[1]**Reduces Flood Risk** - The proposed project/strategy lowers the flood level.
[2]**Reduces Erosion Risk** - The proposed project/strategy slows flood waters and lessons vulnerability to erosion.

Enosburgh

Recommended Projects to Protect Businesses and Infrastructure
Vermont Economic Resiliency Initiative (VERI)
March 31, 2015

Legend
● Effective ◒ Limited ○ Ineffective

* Priority rating based on objectives and potential business impact

				OBJECTIVES			FEASIBILITY			
Project	**What is At Risk?**	**Potential Business Impacts**	**Priority***	**Reduces Flood Risk[1]**	**Reduces Erosion Risk[2]**	**Protects Businesses, Infrastructure, and Property**	**Ease of Implementation**	**Cost Range**	**Estimated Time for Implementation**	**Comments**
Infrastructure Improvements										
Improve road surfaces and enlarge undersized culverts on detour routes used when the Missisquoi River floods (e.g., Davis Road, Hayes Farm Road, Perley Road, and Longley Bridge Road) **(see sites 23, 24, and 25)**	Movement of goods and access to farms and Village	Three farms and regional connection to Village, about 70 employees	**High**	◒	◒	●	Moderate	>$200K	2-5 years	Key operational concern in Town and Village. When Missisquoi River floods traffic detoured to dirt roads during wet / thaw periods. Roads get damaged complicating travel. Structures on these roads are undersized (structure width is about 50% of the channel width). Road surfaces are deteriorated. The flood / winter road damage connects the strategies along Tyler Branch to those along the Missisquoi River annually or semi-annually. (See road closure and detour map.)
Install overflow structure on Boston Post Road at approach to bridge over the Missisquoi River that regularly floods and elevate low spots on Route 105 near edge of valley **(see site 21)**	Movement of goods and access to farms and Village	6 businesses, several farms, and regional connection to Village	**High**	○	○	●	Difficult	>$200K	2-5 years	Missisquoi River floods every one to two years leading to road closures and traffic detours. An overflow culvert could be installed on Boston Post Road south of the existing bridge over the Missisquoi River to reduce closures. Pavement condition along Route 105 is mostly poor in this location so the low spots (see road profile) could be elevated during anticipated resurfacing. Note that only spots along the valley wall should be elevated in order to not further confine flooding.
Improve road and river stability and realign channel upstream of bedrock gorge near intersection of Tyler Branch Road and Grange Hall Road **(see site 9)**	Tyler Branch Road, businesses, farms, and Town Garage	2 businesses, 3 farms, 10 employees, and homes	Medium	○	◒	●	Moderate	$100K-$200K	1-2 years	Tyler Branch Road and Grange Hall Road are at risk due to flow hitting the road embankments. Some protection already exists yet some is failing. Provide appropriate channel width and stabilize bank. Heavily travelled roads for area and active channel with erosion history. Could include realigning the channel.
Improve bridge alignment over Tyler Branch about 3,500 feet upstream of Duffy Hill Road **(see site 13)**	Bridge, Tyler Branch Road, and farm land	Several farms and connection to Village	Medium	◒	●	◒	Difficult	>$200K	>5 years	Skewed bridge in area leading to sediment buildup and unstable channel. Channel movement anticipated in near term that would strand eroded bank in field. Buffer planting and river corridor easement exist in this location.
Stabilize utility poles in river corridor **(see sites 1, 4, 5, and 11)**	Power and communications	Several local businesses, farms, and homes	Low	○	◒	◒	Easy	$50K-$100K	2-5 years	Several poles located along river are vulnerable to erosion damages. One pole downstream of The Branch apparently serves a sugar house. Other poles run along Tyler Branch Road. One pole upstream of Boston Post Road is undermined and in danger of erosion.
Public Safety Improvements										
None.										
Update Town Bylaws										
Adopt river corridor protection bylaws	Farm fields and future businesses and homes	Local businesses, farms, and homes	High	◒	◒	●	Difficult	$10K-$50K	2-5 years	Update existing buffer regulations to limit use in floodplains to agriculture, open space, and recreation, unless otherwise approved through regulatory measures.
Update flood hazard regulations to further limit floodplain development	Farm fields and future businesses and homes	Local businesses, farms, and homes	High	◒	◒	◒	Difficult	$10K-$50K	2-5 years	Limit development in the 100-year floodplain in the Town and prohibit all development in the mapped floodway. FEMA mapping needs to be updated with new data.
Maintain and expand riparian zone protection to reduce bank erosion potential and conflicts	Farm fields and future businesses and homes	Local businesses, farms, and homes	High	◒	◒	●	Difficult	$10K-$50K	2-5 years	Protect the water quality of the Missisquoi River and its tributary streams by promoting riparian zone management to aid in the prevention of bank erosion.

Appendix H:

Maps Showing Recommended Projects to Protect Businesses and Infrastructure

Site Number	Site Description	Notes
1	Along Tyler Branch Road, East of Boston Post Road	Stabilize Utility Pole
2	Floodplains East of Boston Post Road	Floodplain Conservation
3	Floodplains East of Boston Post Road	Floodplain Conservation
4	Along Tyler Branch Road, West of Boston Post Road	Improve Stability of Channel, Bank, and Utility
5	Along Tyler Branch Road, East of Ovitt Road	Improve Stability of Channel, Bank, and Utility
6	Confluence of Tyler Branch and Bogue Branch	Sediment Removal

Vaillancourt Farm

Commercial Site

Herefords / Pattee Family Farm

Reighley's Garage

Ovitt Rd

Tyler Branch Rd

Boston Post Rd

Pine Ln

ENOSBURG

Appalachian Mountains

Green Mountains

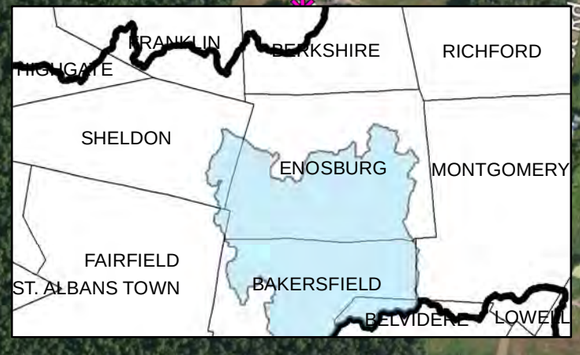
Appalachian Mountains

Legend

- Local Economic Asset
- Mitigation Site
- Surface Water
- Vermont River Corridor
- 100-Year Floodplain (FEMA Adjusted)
- Conserved Lands
- Town/Village Boundary

0 0.125 0.25 0.5 Miles

N



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SOURCE(S):
Field Data Collected by MMI and FEA
Site Mapping by MMI
Economic Assets by NRPC
Vermont Center for Geographic Information
Bing Maps Aerial Photography

PROJECTS TO PROTECT BUSINESSES AND INFRASTRUCTURE

VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MMI#: 5507-01
MXD: VERI_Enosburg_site map.mxd
1st Version: December 1, 2014
Revision: March 5, 2015
Scale: See scale bar.

Map 1

Site Number	Site Description	Notes
7	Floodplain upstream of Grange Hall Road	Berm Removal
8	Upstream of Grange Hall Road	Sediment Removal
9	Upstream of Grange Hall Road	Improve River Stability and Realign Channel
10	Downstream of Route 108	Move Town Garage, Improve River Stability
11	Floodplain between Tyler Branch Road and Route 108	Stabilize Utility Pole
12	Upstream of Tyler Branch Road Bridge	Sediment Removal
13	Tyler Branch Road Bridge	Adjust Bridge Alignment

Legend

- Local Economic Asset
- Mitigation Site
- Surface Water
- Vermont River Corridor
- 100-Year Floodplain (FEMA Adjusted)
- Conserved Lands
- Town/Village Boundary

0 0.125 0.25 0.5 Miles

N

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PROJECTS TO PROTECT BUSINESSES AND INFRASTRUCTURE

VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MMI#: 5507-01
MXD: VERI_Enosburg_site map.mxd
1st Version: December 1, 2014
Revision: March 5, 2015
Scale: See scale bar.

Map 2

Site Number	Site Description	Notes
20	Missisquoi River near East Berkshire Village	Berm Removal and Elevate Road
21	Boston Post Road South of Missisquoi River Bridge	Elevate Road and Install Overflow Culvert
22	Route 105 to the West of Boston Post Road	Elevate Road
23	Davis Road	Improve Road Surface and Enlarge Culvert
24	Hayes Farm Road	Improve Road Surface and Enlarge Culvert
25	Longley Bridge Road (Trout River, Not pictured here)	Improve River Bank and Channel Stability

Dick Soule, Inc.

20

Coyote Customs Auto

Boston Post Dairy, LLC

Dairy Center Motel and Resturant

22

21

Richard Green Inc.

Enosburg's Nutshell Storage

Animal Doctor

ENOSBURG FALLS VILLAGE

The Leach Family, Inc.

McDonald's Restaurant

ENOSBURG

Gervais Farm

23

Garden Gate Matting and Framing

Stephan Harrness Barn

24

Legend

- Local Economic Asset
- Mitigation Site
- Surface Water
- Vermont River Corridor
- 100-Year Floodplain (FEMA Adjusted)
- Conserved Lands
- Town/Village Boundary

0 0.25 0.5 1 Miles

N

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SOURCE(S):
Field Data Collected by MMI and FEA
Site Mapping by MMI
Economic Assets by NRPC
Vermont Center for Geographic Information
Bing Maps Aerial Photography

PROJECTS TO PROTECT BUSINESSES AND INFRASTRUCTURE

VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MMI#: 5507-01
MXD: VERI_Enosburg_site map.mxd
1st Version: December 1, 2014
Revision: February 13, 2015
Scale: See scale bar.

Map 3

Appendix I:

Missisquoi River Berm Removal Concept Plan

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SOURCE(S):
Field Data Collected by MMI and FEA
Phase 2 SGA Part 1 - The Johnson Company
Phase 2 SGA Part 2 - Redstart Consulting
River Corridor Plan - Redstart Consulting
Vermont Center for Geographic Information
Bing Maps Aerial Photography

MISSISQUOI RIVER BERM REMOVAL

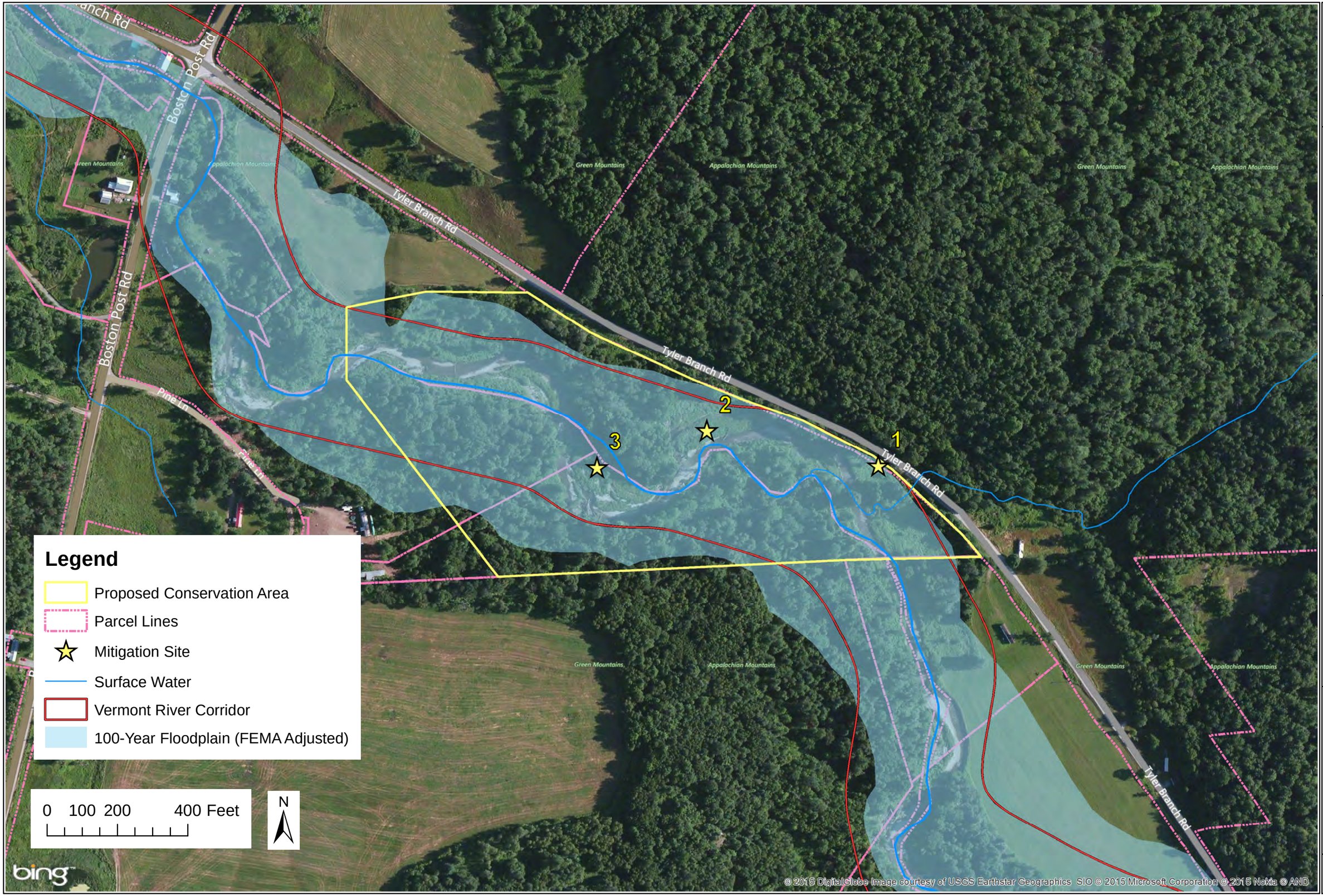
VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MMI#: 5507-01
MXD: VERI_Enosburg_MissBermRemoval.mdx
1st Version: October 6, 2014
Revision: March 5, 2015
Scale: See scale bar.

Appendix J:

Tyler Branch Corridor Conservation Project Concept Plan



SOURCE(S):

Field Data Collected by MMI and FEA
Site Mapping by MMI
Economic Assets by NRPC
Vermont Center for Geographic Information
Bing Maps Aerial Photography

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TYLER BRANCH RIVER CORRIDOR CONSERVATION PROJECT

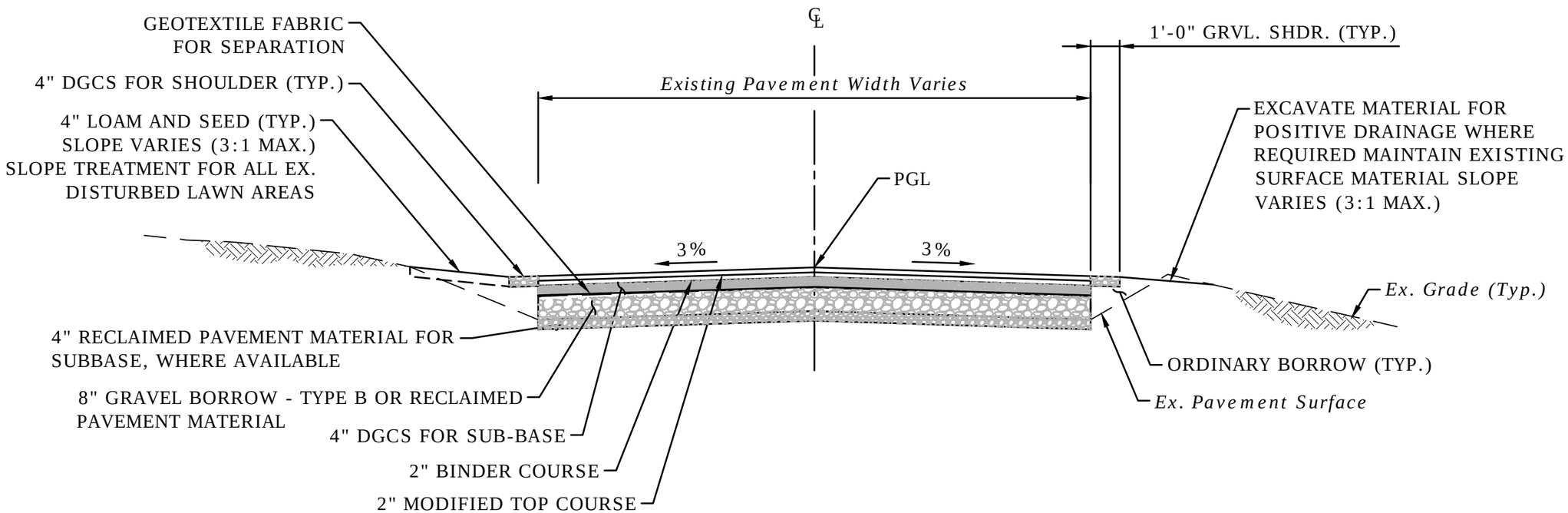
VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

Map By: RKS
MMI#: 5507-01
MXD: VERI_Enosburg_ConservationProject.mxd
1st Version: December 1, 2014
Revision: March 5, 2015
Scale: See scale bar.

Appendix K:

Road Typical Section – Full Depth Reconstruction



ROAD TYPICAL SECTION
FULL DEPTH RECONSTRUCTION

SCALE: 1/4" = 1'

0' 0.5' 1'
0 1/8" 1/4"

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REVISIONS

CONCEPT DESIGN

TYPICAL SECTION- FULL DEPTH RECONSTRUCTION

VERMONT ECONOMIC RESILIENCY INITIATIVE (VERI)

ENOSBURGH, VERMONT

FWW DESIGNED	FWW DRAWN	TC CHECKED

SCALE: 1/4"=1'

DATE: MARCH 6, 2015

PROJECT NO.: 5507-01

SHEET NO.: 01

Appendix L:
Community Forum Meeting Notes

Vermont Economic Resiliency Initiative (VERI)

Community Forum – Town Of Enosburgh and Enosburg Falls

MEETING NOTES

October 29, 2014 – 6:00 – 8:00 PM

Project Overview

With funding from the US Economic Development Administration (EDA), the Vermont Department of Housing and Community Development (DHCD) launched the Vermont Economic Resiliency Initiative (VERI) to help ensure Vermont remains open for business when disaster strikes. DHCD is partnering with the Agencies of Natural Resources (ANR) and Transportation (VTrans) and the Regional Planning Commissions on this effort.

VERI will help the state and local communities by evaluating local flood risk to business and infrastructure, and identify the steps communities and the state can take to minimize rebuilding and recovery costs and ensure businesses stay open -- saving jobs and maintaining our economy.

For More Information

http://accd.vermont.gov/strong_communities/opportunities/planning/resiliency/VERI

Summary

Eight community members, business owners and homeowners from Enosburgh Town and Enosburg Falls attended the Vermont Economic Resiliency Community Forum. The community identified numerous river and flooding problems along the Missisquoi River and Tyler Branch. There is regular flooding of the Missisquoi River along VT Route 105 between the Boston Post Bridge, Dairy Center, and East Berkshire. When VT Route 105 is closed, traffic is diverted onto local roads which are not designed for heavier traffic, especially during mud season. Flooding also occurs on the Tyler Branch near the intersection with Grange Hall Road. Ice jams and excessive sedimentation of the stream bed exacerbate the flooding issues. Successful mitigation projects in Enosburg have included integrating buffer regulations into the bylaws, bridge and culvert resizing, use of conservation easements to dissipate flood waters, and tree planting along the river corridor. Further analysis and technical assistance needs of the community emphasized minimizing flood impacts, particularly scouring, to farm lands, planting and managing trees in the buffer zone, assessing risks to the many recreational vehicles parked along the river, and improving flood detour routes.

Present

- Community Members and Business Owners: Wendy Scott (Enosburg Conservation Commission), Polly Rico (Enosburgh Selectboard), Larry Gervais (Enosburgh Selectboard, Dairy Farmer), Pierre Letourneau (Enosburgh Selectboard), Andre Viens (A.V. Construction), Patrick Hayes (Wood Meadow Market), Jon Elwell (Village Manager), and Wendell R. Bashaw (Poulin Lumber)
- Technical Assistance: Roy Schiff (Milone & MacBroom)
- Regional Planning Commission: Bethany Remmers and Amanda Holland (Northwest Regional Planning Commission)
- State of Vermont: Commissioner Noelle MacKay and Wendy Rice (DHCD) and Staci Pomeroy (ANR- DEC Rivers Program)

Introduction

Larry Gervais, Enosburgh Selectboard Chair, welcomed attendees and introduced Commissioner Mackay from the Vermont Department of Housing and Community Development. Commissioner MacKay welcomed everyone and thanked people for participating in a first round of community forums being held in the five VERI pilot communities. The Commissioner explained that the community forums are examining ways to improve economic resiliency for natural disaster impacted communities in the aftermath of Tropical Storm Irene. Through the Vermont Economic Resiliency Initiative (VERI), the State will analyze risks to public infrastructure, alongside economic activity, river corridor and flood data, to better mitigate future flood hazards and to ensure businesses rebound quickly. The Commissioner provided the audience with a VERI project overview and the findings of the first two phases of the project. After her introductory remarks, the Commissioner explained that the purpose of the meeting was to collect information about risks to infrastructure and economic activity in recent flooding, subsequent risk reduction, and suggested improvements for long-term resiliency. She noted that though Enosburg was not impacted from Irene as towns in southern Vermont, the community has been impacted by past flooding events and the December 2013 ice storm.

Overview of the Study Area

The State has contracted with a team of river scientist and engineers to review the geomorphology (defined as the study of landforms interacting with flowing water), flood hazard risks, sediment deposition potential, and impacts to the built environment of select rivers and tributaries within each targeted VERI community. The scientists presented an overview of their work and initial observations in the river corridors at each of the community forums and provided technical assistance to the

respective community throughout the meeting. The river scientists selected sections of the Tyler Branch and Beaver Meadow Brook in Enosburg to analyze.

Notes

- Roy Schiff described the 5.25 mile study area. It includes the Tyler Branch from the Sheldon/Enosburgh town line, upstream to the confluence with Cold Hollow Brook. It also includes the Beaver Meadow Brook from the confluence with the Tyler Branch, upstream about 1 mile.
- A geomorphic assessment was completed 5-6 years ago in this watershed. The assessment measured the dynamics of the stream and landform (sediment size, deposition areas, broad floodplain or narrow gorge, etc.) to determine where there may be potential issues.
- Overall, there have not been significant changes in the stream since the State's initial geormorphic assessment. Many sections of the stream are armored, especially of the outer banks of meanders.
- Upstream the river gets narrower and there are a couple of rock gorges that influence the river system. This includes the section adjacent to Tyler Branch Road near the Grange Hall Road. Upstream of this gorge area, there is significant armoring and berming. This is creating a potentially hazardous situation.
- Upstream on Beaver Meadow Brook, there is a system of beaver ponds and wetland areas. This area is providing significant sediment and woody debris storage that is protecting agricultural lands downstream.
- Throughout the watershed, many bridges are skewed to the direction of flow and could be vulnerable to erosion. There are also some valley walls with "mass failings."
- Roy Schiff will draft a list of potential project areas based on the field work and identified problem areas. The list will also identify what businesses would be impacted in these problem areas. Damage to the road means good and services are not moving properly- particularly relevant for perishable agricultural goods.
- Community members asked why the river team selected the Tyler Branch for the study rather than other rivers/streams in town (notably the Missisquoi River). It was noted that the Tyler Branch was partly selected because of having past geomorphic assessment which identified vulnerabilities at bridge crossings and failures along the banks.

For more information on past river studies

This area has had a river study completed in the past and the consultants are incorporating this past work in to the VERI project. That study can be found here: https://anrweb.vt.gov/DEC/SGA/finalReports.aspx.

Forum Public Input

Commissioner MacKay solicited input from forum participants with regard to flood risk and mitigation opportunities in Enosburg. Those questions were:

1) What are the hazards and risk areas in the town?
2) What has been done already to mitigate flooding risks?
3) What are the potential projects to address long-term resiliency?
4) What information should the final report include and how should this information be presented?

Identified Natural Disaster Hazards and Business Risks

What are the hazards and risk areas in the town?

Notes: Responses from the Public

- In the **spring** there is regular **flooding**. Significant debris comes down in the flood water including **trees and potential contaminants** from cars parked near the river.
- There are places where **old trees** may need to be cut because they could fall into the river causing **erosion or debris issues**.
- The Missisquoi River along VT Route 105 from the Dairy Center to East Berkshire (2-3 miles) floods regularly (almost every year). This results in **closures on VT Route 105** which diverts traffic onto local roads (Hurley Road and Davis Road). Most of these roads are not designed for heavier traffic, especially during mud season. Ice jams are an issue in this area as well.
- The **Hopkins Bridge Road** floods regularly and has to be repaired by the Town at least once a year. The flooding is exacerbated by recent berming on the Trout River.
- It was asked how many farms have generators. It was felt that most have their own but they may not be sized properly nor are they regularly maintained. A preparedness strategy may be to have generators that are not dependent upon charge from a tractor, as the tractors may be unmovable with felled trees in a disaster.

- The **town garage's** location was identified by the State as a potential area of concern because it is adjacent to the Tyler Branch and partially in the flood plain. The Town noted that they have not had issues with flooding at that location because it is built-up from the stream and the bank is armored. It was unknown if there is flood-proofing at the garage and the winter salt storage in the floodplain may be an issues during a flood event.
- **Ice jams** are an issue on the Tyler Branch particularly near the Boston Post Road and Vaillancourt's Garage.

Effective Hazard Mitigation and Risk Reduction

What worked structurally and what has already been done since Irene to protect infrastructure and to reduce risk to businesses?

Notes: Responses from the Public

- Some CREP projects on the Missisquoi and Trout River have been lost because of flooding.
- The Missisquoi River Basin Association has done a number of **tree plantings** in the area and there is GIS data recording the locations.
- Enosburgh Town integrated **buffer regulations in their bylaws**. The buffers are based on the fluvial erosion hazard data that was collected during the geomorphic assessments. The buffers do not allow new development but the group did not know if fill was allowed.
- There is a **new bridge** on the Boston Post Road near the intersection with Tyler Branch Road. While the bridge may be slightly wider, the original stone abutment was not removed. The bridge was completed under VTrans' accelerated bridge construction program. That could be the reason the abutment was not removed.
- A **conservation easement** bought land from Mr. Welch for a portion of his property along the Tyler Branch. It will allow water to flow more freely and there may be an opportunity to do easements in other places where the riprap has to be replaced regularly.
- A **culvert** is being replaced on Boston Post Road.

Resiliency and Sustainability Planning

What still needs to be addressed in the interests of long-term security and sustainability?

Notes: Responses from the Public

- There are infrastructure issues on Hayes Farm Road in Enosburg Falls. The whole road is in bad shape and needs to be rebuilt along with replacing several culverts. Enosburg Falls had funding

earlier to deal with the culverts but the grant funds had to be redirected to a bridge that was close to being condemned. This is a major detour route when VT Route 105 is closed because of flooding.

- Off of Tyler Branch there is another landslide on the property with a little log cabin near Courser Road.
- The campground on Sand Hill Road is in the flood plain. There are many RVs next to the stream and some a stored there through the winter.
- It was asked how there can be less scouring in the fields? There are some cost sharing for cover cropping, but this was done with a helicopter and has not seeded well due to scheduling issues. There is a narrow window of time where seeding should be done and it has been difficult to get the contractor during that time. Jeff Sanders at UVM agriculture extension is heading up this program.
- It was noted that while trees are good for stream bank stability, it has to be balanced with having adequate visibility on roads.
- It is important to address the berms along Tyler Branch near Grange Hall Road.

Information Sharing and Dissemination

What information should the final report include and how should this information be presented?

Notes: Responses from the Public

- It should be proactive.
- It should outline the emergency response during an event to best protect a business during and after a disaster.
- It should include a list of things to consider such as staffing capacity and the local political climate.
- Identify where conservation easements should be placed and how this would benefit the whole community.
- Include a prioritization of projects and identify potential funding opportunities.

Vermont Economic Resiliency Initiative (VERI)

Community Forum - Enosburgh Town and Enosburg Falls

MEETING NOTES

April 30, 2015 – 6:00 – 8:00 PM

VERI Project Overview

With funding from the US Economic Development Administration (EDA), the Vermont Department of Housing and Community Development, working with the Agencies of Natural Resources and Transportation and the Regional Planning Commissions, launched the Vermont Economic Resiliency Initiative (VERI) to help ensure Vermont remains open for business when disaster strikes.
VERI will help the state and local communities by evaluating local flood risk to business and infrastructure, and identify the steps communities and the state can take to minimize rebuilding and recovery costs and ensure businesses stay open -- saving jobs and maintaining our economy.

For More Information

http://accd.vermont.gov/strong_communities/opportunities/planning/resiliency/VERI/Enosburgh

Summary

Nineteen people were in attendance, including project team members, town officials, state officials, landowners, community members and business owners from the Enosburg community. The forum outlined four high-priority implementation projects and three policy/program recommendations which could significantly decrease flood risk for Enosburgh, if implemented. Community members were given the opportunity to ask questions, provide input, and rank the proposed projects. The projects that the meeting attendees ranked highest included improving the road surface and enlarging undersized culverts on detour routes used when the Missisquoi River floods. This would include the Davis Road, Hayes Farm Road, Perley Road and Longley Bridge Road. Conserving a wetland complex along the Tyler Branch approximately 1,700 feet upstream from the Boston Post Road also ranked high. The policy and program recommendations did not receive as many votes as the implementation projects but adopting river corridor protection bylaws and expanding riparian zones did receive interest from the forum participants.

Welcome and Overview

[Noelle MacKay, Commissioner of the Department of Housing and Community Development]

Noelle MacKay began outlining the agenda for the evening and emphasized the importance of community input on the proposed flood reduction projects. Starting off with the "big picture," Noelle said the Vermont Agency of Commerce and Community Development's role after Irene was post-disaster recovery and noted that while Irene impacted buildings and infrastructure, it was also a tremendous blow to the State's economy. The state applied for and received a grant from the US Economic Development Authority to help five Vermont communities build back stronger and take steps to protect their economy from future floods.

Noelle introduced the project team members and provided background information on a successful project in Bennington that created the model for this project. This project re-established floodplain and resized culverts which made the community more resilient during Irene and saved the town an estimated $700,000 to $800,000 in repair costs.

Noelle explained the process for selecting the five towns – each with high flood risk to economic activity and infrastructure. Enosburgh and Enosburg Falls were selected as a VERI pilot community because of its strong agricultural economy, flood history and past stream geomorphic assessments in the Tyler Branch Watershed.

As part of this project, a team of river scientists and engineers were hired to further assess the Tyler Branch, identify local threats to infrastructure and business and make recommendations to reduce the impacts of future floods. The study area initially included 5.3 miles of Tyler Branch from the confluence of Beaver Meadow Brook and Cold Hollow Brook downstream to the Enosburgh-Sheldon town line. Based on community input, the study was expanded to examine flooding issues along the Missisquoi River upstream from the Boston Post Road.

The first Enosburgh Community Forum was held in October 2014, where Noelle sought input from attendees on three topics: what did they see happen during the 2011 spring flooding and other historical floods, what have they done to prepare for the next flood, and what would they like state government, the town, and other agencies and organizations to do to help the community prepare for the next flood?

The VERI team combined this information and its analysis into a draft report that contains recommended projects and town-wide policy and program options to reduce flood risks. The projects were ranked by the consultants on whether they are effective, limited, or ineffective at reducing erosion risk, flood risk, and damage to businesses, infrastructure, and property. The ease of implementation, cost, and potential partners are also a factor.

Noelle stressed that this is a draft report, and that the team is eager to get comments from the public. The report will be up on the project web site until May 14th. She believes the report can serve as a road map for the community and provide a menu of options for what can be done to help protect the community. The Agency of Commerce and Community Development will work with partners to help identify funding sources once priority projects are identified.

Overview of Municipal Policies and Programs to Reduce Future Floods

[Bethany Remmers, Northwest Regional Planning Commission]

Before presenting policy and program recommendations for the community, Bethany Remmers noted some of the Town's and Village's accomplishment regarding flood resiliency. Both municipalities participate in the National Flood Insurance Program (NFIP) and have flood hazard bylaws. Both communities have also integrated stream buffers/setbacks into their zoning bylaws. Enosburgh Town has completed 11 of the 15 high priority projects in its 2008 Local Hazard Mitigation Plan and is almost done with a comprehensive update of that plan.

Bethany also presented information on the Emergency Relief Assistance Program (EFAF). ERAF is a state program that covers part of the required 25% local match needed for FEMA Public Assistance (PA) projects. Enosburgh Town qualifies for 12.5% state match because they have taken the required flood resiliency steps: adopted *2013 Town Road and Bridge Standards*, participate in the National Flood Insurance Program (NFIP), submitted an annual Local Emergency Operations Plan (LEOP) and have prepared a Local Hazard Mitigation Plan (LHMP) that is being submitted to FEMA. Enosburg Falls currently qualifies for 7.5% state match because the community does not have a LHMP though the other three requirements have been met. Bethany noted that the communities could increase their state match to 17.5% if they adopted river corridor protection bylaws that prohibited new development in the corridor or participate in the Community Rating System (CRS).

Bethany outlined specific policy and program recommendations that were developed by the team. Three recommendations were considered high-priority by the team.

- Update policies to prohibit fill in flood hazard areas
- Develop a Local Hazard Mitigation Plan for the Village of Enosburg Falls
- Document road, sewer, and water infrastructure vulnerabilities in municipal plan and develop capital plans pay for improvements

Overview of Project Recommendations and Conceptual Designs

[Roy Schiff, Milone & MacBroom]

The team identified 11 site-specific projects and divided them into three categories: Building and Site Improvements, Channel and Floodplain Management and Infrastructure Improvements. There were no projects identified in the Public Safety Improvements category. Five high priory projects were presented to the group. The team completed conceptual plans on a portion of these projects to help secure future grants and funding for implementation.

1. **Remove berm along the Missisquoi River** (Channel and Floodplain Management)

Project would include removing berm along the Missisquoi River about a mile west of the intersection of VT 118 and VT 105 to restore access to the flood plain and reduce flooding downstream. The berm is one to two ft. tall in some spots and up to six ft. tall and twenty ft. wide in other areas. There are trees and other vegetation growing on the berm. The team estimated that 3,000 yards of soil would be removed from the berm at a cost of $120,000.

> Notes and Responses from the Public: There was discussion of whether the berm was man-made or a natural feature created by the river. Roy reasoned that it was probably constructed to protect the adjacent fields. River flooding could have deposited additional sediment onto the berm. There was some concern that removing the berm would cause flooding and erosion of the farm fields. Because VT 105 regularly floods in that area, VTrans may be interested in contributing to the project. The Hazard Mitigation Grant Program and the Ecosystem Restoration Program may be potential funding sources.

2. **Conserve land along Tyler Branch upstream of Boston Post Road** (Channel and Floodplain Management)

The project would conserve land along the Tyler Branch that includes a nice complex of beaver ponds and stores significant woody debris and sediment. It is a critical storage area that protects infrastructure downstream. There are some high slope failures in the area but they appear to be re-vegetating. The team estimated that the cost of conserving the river corridor through an easement on three parcels would be $40,000.

> Notes and Responses from the Public: It was asked if the easement would be town funds or a grant. It could be both. A participant asked if the project would include a road and bank

stabilization. Roy noted it is currently not an issue but it could be a problem in the future and the project could include protecting the roadway.

3. **Improve Hayes Farm Road and Davis Road** (Infrastructure Improvements)
   The team evaluated detour routes that are used when there is flooding and evaluated what roads could be upgraded to accommodate the detoured heavy truck traffic. The Hayes Farm Road and Davis Road corridor is one of those important detour routes. The culverts along with route are undersized, with their widths about 40-50% of the stream's width. There are visible signs that the stream has jumped the road in certain locations. The project would include installing properly sized culverts, paving the dirt/gravel sections and repaving the other sections. The project would cost about $1 million but could be broken into smaller sections and done over time.

   Notes and Responses from the Public: Joey Clark was asked if ice and debris jams were an issue along this corridor. He said they were not.

4. **Install overflow bridge on Boston Post Road at the Missisquoi River and elevate low spots along Vermont Route 105** (Infrastructure Improvements)
   The overflow bridge would be installed on the low portion of Boston Post Road where there is regular flooding and ice jam issues. The team identified sections of VT 105 that would have reduced flooding if they were raised.

   Notes and Responses from the Public: The group discussed whether it would be better to wait until the bridge needs to be replaced and make sure the new bridge has a longer span. A new bridge could have two sections with a center pier. The current bridge might have floated down the river in the 1927 flood and pulled back to the original site in 1928. Roy noted that the slope of the river is almost flat in this area and there might be influenced by the dam downstream.

   It was reported that when there is an ice jam at this location, the barn on the right side near the bridge can get flooded in 20 minutes. Noelle noted that the Department of Agriculture might be able to help develop strategies for evacuate costs from this barn during flooding. Noelle also recommended the area farm and businesses have a continuity of operations plan to help prepare for potential flooding. The team will recommend flood-proofing this barn and store as a potential strategy in the project report.

Where to Get Help

[Noelle MacKay, Commissioner of the Department of Housing and Community Development]

Noelle highlighted next steps for the project and additional resources for the community. She noted the Enosburgh VERI webpage, ACCD's Flood Resilience webpage and the Vermont Flood Ready site are great resources . She explained that Vermont's Small Business Development Center is a resource for helping businesses plan for disaster including continuity of operations planning. FEMA is also planning to hold a training on small business recovery in September, and the upcoming Vermont downtown conference will feature a session on flood-proofing.

Noelle explained there could be multiple pots of money to implement the project recommendations because they cross many areas including water quality, transportation and emergency management/flood resiliency. A funding directory was available for forum participates to take home along with many other guides and resources. Noelle reported that after May 15th, she will be meeting with state agencies to strategize on how to fund some of these projects. She also suggested the community reach out directly to VTrans and legislators for support.

Project, and Policy and Program Prioritization

Sticky dots were handed out to forum participants (six each) to place on the charts to prioritize project recommendations, and policy and program recommendations. Before ending the presentation, Noelle thanked everyone for coming, especially those who participated in the VERI forum for the second time.

The results of the project prioritization are below, in order of popularity - with number of sticky dots received in parenthesis.

1. Improve road surfaces and enlarge undersized culverts on detour routes used when the Missisquoi River floods. (12)
2. Corridor conservation about 1,700 feet upstream of Boston Post Road. (8)
3. Berm removal along the south bank of the Missisquoi River about 1 mile west of intersection of VT 105 and VT 118. (6, tie)

3. Install overflow structure on Boston Post Road at the approach to the bridge over the Missisquoi River-Changed to install new bridge with longer span. (6, tie)

4. Improve road and river stability and realign channel upstream of bedrock gorge near intersection of Tyler Branch Road and Grange Hall Road. (2, tie)

4. Expand cover crossing and other best practices on valley bottom farmland along the Missisquoi River and Tyler Branch. (2, tie)

5. Improve bridge alignment over Tyler Branch about 3,500 feet upstream of Duffy Hill Road. (1, tie)

5. Berm removal about 1,000 feet upstream of the intersection of Tyler Branch Road and Grand Hall Road to spread flood flows. (1, tie)

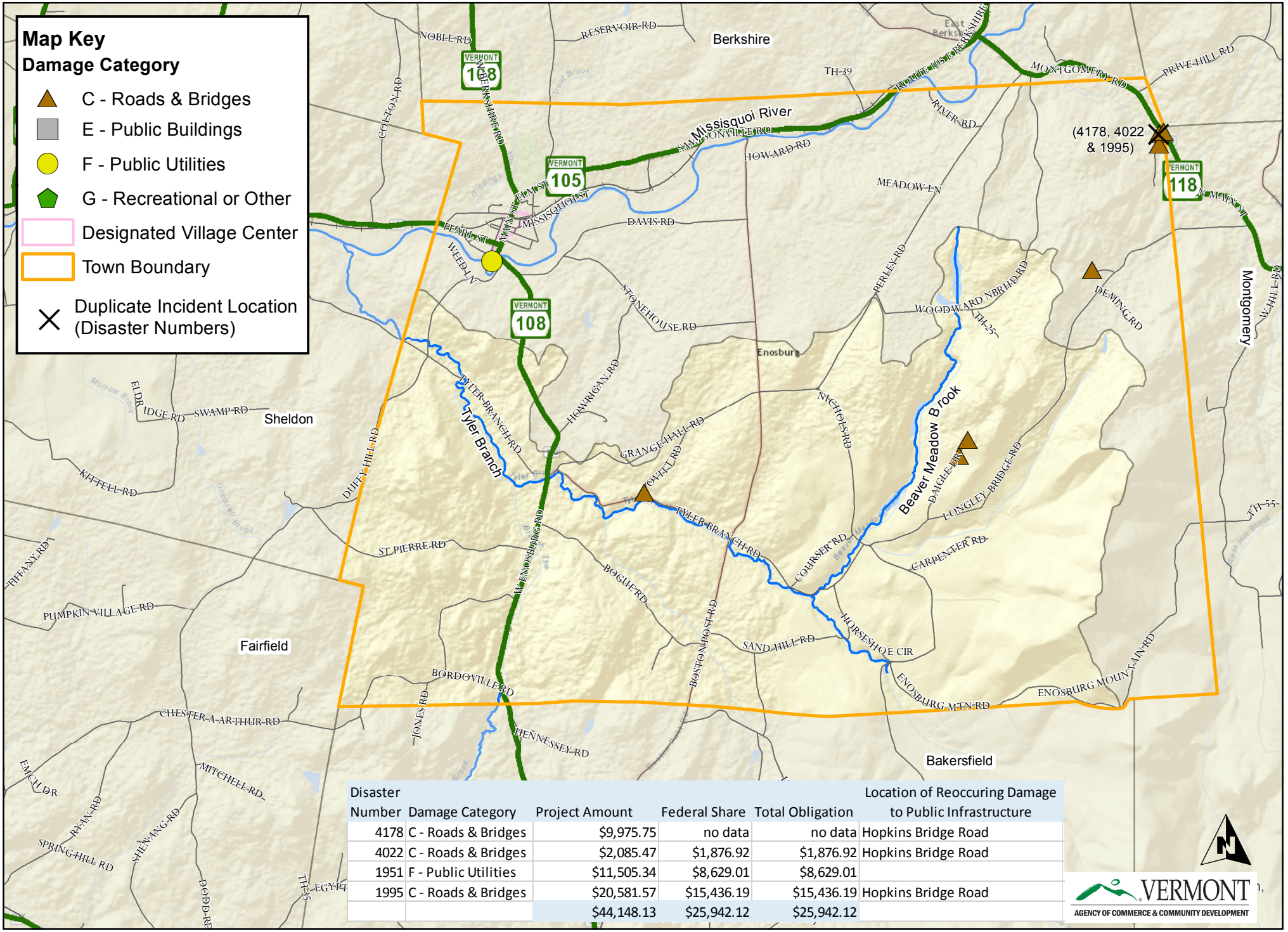
The results of the policy and program prioritization are below, in order of popularity - with number of sticky dots received in parenthesis.

1. Adopt river corridor protection bylaws. (3)
2. Maintain and expand riparian zone protection to reduce bank erosion potential and conflicts. (2)
3. Update flood hazard regulations to further limit floodplain development. (1)

Appendix M:

Map of Repetitive Damage in Enosburg

Tyler Branch, Enosburg Town & Village, VT



Disaster Number	Damage Category	Project Amount	Federal Share	Total Obligation	Location of Reoccuring Damage to Public Infrastructure
4178	C - Roads & Bridges	$9,975.75	no data	no data	Hopkins Bridge Road
4022	C - Roads & Bridges	$2,085.47	$1,876.92	$1,876.92	Hopkins Bridge Road
1951	F - Public Utilities	$11,505.34	$8,629.01	$8,629.01	
1995	C - Roads & Bridges	$20,581.57	$15,436.19	$15,436.19	Hopkins Bridge Road
		$44,148.13	$25,942.12	$25,942.12	

VERMONT
AGENCY OF COMMERCE & COMMUNITY DEVELOPMENT

Author: Map provided by the Department of Housing & Community Development (DHCD). FEMA Data.Gov & Project Work Sheets. Map created 1/22/2015.

Vermont Economic Resiliency Initiative [VERI]

Consultant Team

DuBois & King inc.

Landslide
Linking people to their landscape
Natural Resource Planning
Community Involvement
Watershed Assessment
Project Coordination
GIS Mapping
Facilitation

Bear Creek Environmental

Fitzgerald Environmental Associates, LLC.
Applied Watershed Science & Ecology

Engineering, Planning, Landscape Architecture and Environmental Science
MILONE & MACBROOM

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