

TOWN of GLOVER, VERMONT

ALL HAZARDS MITIGATION PLAN



Sand Hill Road – a Class 4 road in Glover
after an intense summer rain event
June, 2014

**Glover Planning Commission
Glover Selectboard
October 21, 2014**

**Town Of Glover
51 Bean Hill Rd
Glover, VT 05839**

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1. INTRODUCTION

Hazard mitigation planning identifies actions that a community can take to reduce or eliminate long term risk to people and property from natural and manmade hazards. The Federal Emergency Management Agency (FEMA) further describes it as a process state and local governments can use to identify risks and vulnerabilities associated with natural disasters, in order to develop long-term strategies to protect people and property from future hazard events (www.fema.gov/plan/mitplanning).

Purpose. The purpose of this hazard mitigation plan is to identify and plan for hazards facing the town, including the development of strategies intended to reduce long-term risks from known hazards. Hazards cannot be eliminated, but it is possible through planning to determine what hazards are most frequent, where they may be most severe, and what actions can be taken to reduce their impact on the community.

Benefits of hazard mitigation planning include:

1. Increased public awareness and understanding of natural and manmade hazards, associated risks, and community vulnerabilities,
2. Reduced physical, financial, and emotional losses caused by disasters,
3. Improved understanding of potential risks and possible risk reduction measures associated with future development,
4. Increased community and voter support for specific actions the town may take to reduce future losses,
5. Strengthened partnerships and lines of communication among diverse interests, including opportunities to leverage and share resources, and
6. Community eligibility for federal hazard mitigation grants and aid prior to and following federally declared disasters.

2. PROCESS

The Glover Selectboard recruited new members to the Planning Commission for the purpose of hazard mitigation planning.

The Planning Commission now includes: Ann Lindner, chairperson; Liz Nelson, secretary; Skip Borrell; Hope Coburn; Ann Creaven; Vicki Plaster; and Peter Letzelter-Smith. Selectboard members Brian Carroll and Jack Sumberg participated in the hazard mitigation planning process.

This group includes: a former employee of the VT Dept of Health as an Emergency Preparedness Specialist and of VT Emergency Management as part of the Hurricane Irene Recovery Team, current employee of VEM in the EOC (Emergency Operations Center) during emergencies and exercises, former Emergency Management Director for the Town of Woodbury, member of the Waterbury Ambulance and a member of the Waterbury Backcountry Rescue Team; a retired US Navy submariner; a retired dairy farmer/artist; a retired district office Director, VT Dept. of Health; a local bank branch manager; a nurse; a home-schooling parent; an education administrator; and a contractor.

The following were the main topics discussed at Glover Planning Commission meetings on the dates indicated:

5/15/2014

- Hazard Mitigation Plans in general
- Previous Glover All Hazard Mitigation Plan
- Review of planning process
- Division of work among commission members

5/19/2014

- Report from Harvey Dunbar, Glover road foreman
- Review of town bridges, culverts, and dams
- Collection of weather data

6/5/2014

- Review of planning process and need for plan
- Hazards identification
- Plan for Glover Day survey

7/31/2014

- Risk assessment
- New emergency generator
- Review of Glover Day survey results

9/4/2014

- Review of Flood Resilience Plan proposals
- Shadow Lake Dam Emergency Action Plan

10/16/2014

- Agencies and utilities contacted for information
- FEMA Mitigation Plan Review Guide
- Plan to submit draft

10/21/2014

- Review of draft Town of Glover All Hazards Mitigation Plan
- Submission of draft plan
- Creation of Glover Energy Committee

12/18/2014

- Review of comments from VEMS on draft plan
- next steps to revise plan

1/15/2015

- Final steps in plan revision

To encourage public participation, we advertised in the Barton Chronicle and posted notices in town that at the June 12 regular Selectboard meeting we would solicit input from Glover residents on the topic of hazard mitigation planning. We also posted notices prior to the July 17 Planning Commission meeting that we would be soliciting public comment on hazard mitigation planning at that meeting, and that the meeting was open to the public. These meetings all had opportunities for public comment and open discussion on hazard mitigation, and specifically discussed the development of the hazard mitigation plan.

We received input from Allen Matthews, Chief of the Glover Volunteer Fire Department at the June 12 Selectboard meeting, but received no response from Glover residents at either the June 12 or July 17 meetings. Chief Mathew's input was used in the *Community Profile* section of this plan.

To further solicit public comment, since the public meeting format had marginal success, Planning Commission members developed a questionnaire for Glover residents on hazard history and areas of concern. On July 26, 2014, Glover Day, we talked with approximately 36 residents and were able to collect 16 completed questionnaires. This information was utilized in the *Hazards Identification* and *Vulnerability and Risk Assessment* sections of this plan.

The Glover Planning Commission members reviewed the 2005 *Town of Glover, Vermont All-Hazards Mitigation Plan* as well as the FEMA *Local Mitigation Planning Handbook 2013* and the *Local Mitigation Plan Review Guide* as well as the *State of VT Hazard Mitigation Plan 2013*. Commission members gathered new data from the sources listed below to update the *Community Profile* and *Hazards Identification* portions of the existing plan. We reviewed the new data and, based on that review and our own experiences as residents of Glover, refined the *Vulnerability and Risk Assessment* sections of this plan.

- A. FEMA (Federal Emergency Management Administration) data.
- B. SHELDES (Spatial Hazard Events & Losses Database for the United States) data
- C. NOAA (National Oceanic and Atmospheric Administration) data

In the planning process, Ann Lindner, Planning Commission Chairperson, has corresponded with the following individuals to collect specific information, and request their feedback throughout plan development: Adam Heuslein of the Glover Volunteer Ambulance Squad; Allen Matthews, Chief of the Glover Volunteer Fire Department; Harvey Dunbar, Glover Road Foreman; Job Breitmeyer, Glover First Constable; Donna Sweeney, Glover Town Clerk & Treasurer; Alison Low, Senior Planner at Northeast Vermont Development Association (NVDA), Bruce Melendy, Emergency Management Coordinator at NVDA; Kateri Stokes, VT Department of Health; Dale Perron, VTrans District 9 Transportation Administrator; Liz Gamosh, VT Electric Cooperative; Denise Bouchard, FairPoint Communications; and Mark Breen, Fairbanks Museum Meteorologist.

3. COMMUNITY PROFILE

Topography and Drainage. The Town of Glover, covering an area of 36 square miles, contains the headwaters of the Barton River, which rises in the southeast corner of the town and flows north through a narrow valley. The village of Glover straddles the river near the north edge of town. There are two dozen hills with elevations of 1,700 feet or higher and five lakes and ponds within the town.

Streams tributary to the Barton River drain most of the town, but a small section of south Glover drains to the Lamoille River, the southwest corner drains to the Black River, and a small part of the east edge of town drains to the Passumpsic River. Lake Parker, at 239 acres and with a maximum depth of 45 feet, is the largest lake. Its watershed is the northwest quarter of the town and its waters flow north through Roaring Brook across the town line to the Barton River.

Shadow Lake, covering 199 acres and with a maximum depth of 139 feet, receives drainage from Daniels Pond and flows east to the Barton River. Daniels Pond, covering 66 acres, flows to Shadow Lake. Tildy's Pond, covering 31 acres, is part of the headwaters of the Barton River. An unnamed pond (the "Beaver Pond") west of Daniels Pond flows southwest to the Black River in Craftsbury.

The Black Hills and Pepin Hill, in the south part of town are the highest hills at 2,258 and 2,260 feet in elevation. The Barton River drops 412 feet from 1,357 feet in elevation at the south edge of town to 945 feet in Glover Village 5.75 miles to the north.

Route 16, a state highway, follows the Barton River up the east side of town, and is joined by Route 122 coming west from Sheffield. Shadow Lake Road and Bean Hill Road are the main east-west town roads. Shadow Lake Road carries traffic from Route 16 across the south part of town to Greensboro, Craftsbury and Albany. Bean Hill Road connects Glover Village to West Glover Village in the north part of town. In West Glover it intersects Roaring Brook Road to Barton, the Irasburg Road, and County Road which, with Andersonville Road, travels down the west edge of town and connects with Albany and Craftsbury.

There are 14 miles of Class 2 road, 37 miles of Class 3, and 7 miles of Class 4 road in Glover. Many of the Class 3 roads are dead ends serving one or a few residences.

Development Pattern. The Town of Glover is a familiar example of Vermont's tradition of compact village centers surrounded by open land of working farms, forests, streams and lakes. Many outlying farms have been abandoned over the years and once-cleared land has reverted to woods. Some new residential development has occurred along major roads and some along the less traveled roads, but relatively little in the village centers.

Seasonal homes, mainly on the lakes and ponds, were first built as camps in the years around 1900, and have continued to be built and upgraded. Today most of the developable shoreland has structures in place and some seasonal camps are being converted to year-round homes.

In the 19th century, waterpower from the Barton River and other streams was used to power sawmills and gristmills in the village centers and outlying areas. Other local industries included a tannery, box factory, potato starch factory, furniture and wagon shops, and blacksmith shops. Most were small operations, but several of the sawmills did considerable business over the years, some converting from waterpower to steam. There were creameries, general stores, and two hotels. The present Route 16 once carried stagecoach traffic and railroad access was in Barton.

Glover Village has a general store, a small diner, and a nursing home plus a few home-based businesses. West Glover Village has a pizza restaurant and store. There are a few businesses along Route 16 and home-based businesses scattered around the town. Since the villages of Glover and West Glover are no longer incorporated, this plan includes the village areas and residents.

Population. The town of Glover has a population of 1,122 people according to the latest statistics from the U.S. Census Bureau. Growth of population has been slow in the past five years amounting to less than two tenths of one percent.

Housing. There are 773 housing units in the town of Glover with 89.5% being single units, 6% mobile homes and 2.5% two units or more. Owner occupied units are at 90.2% and rental units are 9.8%. The town of Glover is second to Westmore (in the county) for second home ownership.

Local Economy.

- According to Sperling's (<http://www.bestplaces.net/economy/city/vermont/glover>), the following data was obtained in 2012
 - i. Unemployment Rate- 6.9%
 - ii. Recent job growth- -0.78%
 - iii. Future job growth – 31.54%- projected for the next 10 years.
 - iv. Income
 1. < 15K- 14.48%
 2. 15K to 25K -12.92%
 3. 25K to 35K- 10.91%
 4. 35K to 50K – 23.16%
 5. 50K to 75K - 24.05%
 6. 75K to 100K- 8.46%
 7. 150K to 250K – 1.34%
 8. Income per capita- \$19,971
 9. Median household income- \$41,832
 9. Estimated Median Housing Value- \$153, 317 (City-DATA.com)
 - v. Occupations (City-DATA.com)
 10. Agriculture, forestry, fishing and hunting- (24%)
 11. Construction (16%)
 12. Educational Services (13%)
 13. Furniture and product manufacturing (10%)
 14. Accommodations and Food Services (3%)
 15. Wood Products (3%)
 16. Building material and equipment dealers (3%)

Town Government.

- Glover is governed by an elected 3 member selectboard who meet twice a month.
- Has limited staff consisting of
 - i. Town Clerk/Treasurer,
 - ii. Assistant Clerk/Treasurer
 - iii. Road Foremen
 - iv. (2) Road Crew.
 - v. (2) Library Staff
 - vi. (3) Listers
 - vii. (4) Auditors
 - viii. (2) Constables
 - ix. Health Officer
 - x. Planning Commission
 - xi. Flood Hazard Area Administrative Officer
 - xii. Emergency Manager
 - xiii. Cemetery Commissioners
 - xiv. Dog Warden
 - xv. Fire Warden
 - xvi. Law Enforcement is by contract with the County Sheriff
- Town Volunteer Organizations
 - i. Fire Department- volunteer
 - FY 2014 budget of \$40,000
 - 18 trained firefighters
 - 3,200 gallon tanker and 3 pumper trucks
 - 5 dry hydrants in town
 - fire station equipped as Emergency Operations Center
 - fire station certified Red Cross Shelter
 - PA system on 3 trucks for emergency notification of residents
 - ii. Volunteer Ambulance Squad
 - 6 Advanced Providers
 - 7 EMTs
 - 2 support staff
 - 3 ambulances and a command/treatment trailer
 - iii. Recreation Committee
 - iv. Historical Society
 - v. Library Trustees and Friends of the Glover Library
 - vi. Recycling Committee
- Glover's latest Town Plan was adopted in June of 2006.
- Glover has no zoning, however relies on Vermont's ACT 250 to regulate growth and development. Additionally, Glover participates in the National Flood Insurance Program (NFIP) and thus maintains and enforces the NFIP required regulations governing development restrictions in flood vulnerable locations. See Section 7 below for more information.
- There are (9) Town Ordinances:
 - Ordinance for Licensing and Control of Domestic Dogs or Wolf-hybrids
 - Sewer Ordinance
 - Private Roads and Driveways Ordinance
 - Municipal Parks, Beaches and Forests Ordinance

- Parking Ordinance
- All-Terrain Vehicle Ordinance
- Mass gathering ordinance
- Regulation of Solid Waste by Dumping Ordinance
- Open Burning of Solid Waste Ordinance

Glover Community. The Town of Glover is located at the approximate “heart” of the Northeast Kingdom, about thirty (30) miles south of the Canadian border; 25 miles west of the New Hampshire border and northwest of the Town of St. Johnsbury; at Exit 25 off Vermont Interstate Highway 91. The unincorporated Village of Glover concentrates housing, town offices, Currier’s General Store and the Glover Fire Station on VT State Route 16, along the valley path of the Barton River. Another population “settlement”, West Glover, is located about two and one-half miles west of Glover’s Town center near Lake Parker. West Glover is a hilltop community, with a small store and pizza restaurant and the Glover Ambulance Bay.

The Town of Glover is a familiar example of Vermont’s tradition of compact village centers surrounded by open land of working farms, forests, streams and lakes. Glover is one of the 19 towns in Orleans County.

With the exception of village centers in Glover and West Glover, the predominant land uses in the rest of Glover are forestry, recreation, and agriculture. Timber harvesting, woodlots, maple sugaring, Christmas tree farms and recreational use of forest lands are all evident in the Town of Glover.

There is municipal sewer service in Glover Village and West Glover Village. Glover’s sewage is pumped to the sewage treatment plant in neighboring Barton. Located along the Barton River, the system could be vulnerable during severe flooding.

There is a private water company in Glover Village with 11 connections. The water source is well outside the flood plain and the system does not depend on electricity.

Emergency services in Glover are volunteer and responders are well trained. The Glover Fire Department, Ambulance Service, two Town Constables, and County Sheriff contracted services constitute public safety services for the town. Emergency communication is difficult in town due to hills and valleys, and the same is true with cell phone service. There is a small back-up generator for the ambulance in West Glover.

There is a K-8 school with approximately 100 children. Students in grades 9-12 go to the Lake Region High School in nearby Barton. The fire department building doubles as one shelter and the school acts as the second shelter and has a generator. The Town Hall can also serve as a backup shelter. The fire station and the school are outside the flood plain.

Special needs populations in Glover include two daycares, a 40-bed nursing home, and 12 unit senior housing. The nursing home could be vulnerable to severe flooding.

4. Risk Assessment

4.1 Hazard Identification and Analysis

Hazard Type	Probability ¹	Vulnerability ²	Impact ³
Tornado	Low	No	Low
Flood/Fluvial Erosion	Medium to High	Yes	Highest
Winter Storm/Ice Storm/ Extreme Cold with Power Failure	High	Yes	Highest
High Wind	Medium	No	Moderate
Earthquake	Low	No	Low
Dam Failures	Low	Yes	Highest
Drought	Low	No	Low

¹ High – near 100%probability in the next year.

Medium - 4% to 100% probability in the next year or once in the next 25 years.

Low – 1% to 4% probability in the next year or at least once in the next 100 years.

² Yes - hazard presents the threat of a disaster. No - hazard presents a routine emergency.

³ Hazards with a Low level impact are not considered in this plan.

4.2 Highest Threat Hazards

- Flood/Fluvial Erosion

Flooding and fluvial erosion are commonly occurring hazards in Glover. Flooding is the overflowing of rivers, streams and lakes due to excessive rain from a severe storm or hurricane, rapid snow melt, and ice dams in rivers. Low lying sections of Glover Village along the Barton River are most susceptible to flooding. Fluvial erosion, often due to intense, short duration summer storms, can cause excessive damage to ditches, culverts and roads on steeper slopes in many areas outside the villages.

Glover’s worst experience with flooding was in 1927 when damage in the villages was significant, but roads and bridges were affected throughout the town. There have been numerous smaller incidents of flooding since then, ranging from wet lawns and cellars to damage to a few buildings.

Glover is a participant in the FEMA National Flood Insurance Program (NFIP) and development in identified Special Flood Hazard Areas is regulated by a Flood hazard Area Regulation first adopted by the Glover selectboard on April 16, 1987 and amended on June 27, 1991. There are no repetitive loss properties in Glover.

The number and steepness of Glover’s hills combined with the scattered pattern of development and the “casual” nature of early road layout has left the town with numerous sections of gravel road vulnerable to fluvial erosion. Quick, intense summer storms or too rapid snow melt can overflow roadside ditching, washout undersized or blocked culverts, and cut into or across road surfaces and base materials.

Glover has adopted the most recent VTrans Town Road and Bridge Standards and has made real progress in improving ditching and upsizing culverts. New culvert size is determined by hydraulic studies where required and ditches are stone lined and check dams installed where required. The town can provide high quality crusher-run road gravel and dense grade fill from its own pit resulting in road surfaces that are less prone to erosion. Glover will continue to improve town roads, ditches, and culverts resulting in a more resilient town road system.

Flooding Summary

Location: low lying areas of Glover Village along the Barton River.

Extent: a few wet cellars to significant damage to buildings and roads/bridges.

Previous Occurrences: flood of 1927 caused significant damage to buildings and roads/bridges; a few minor to moderate events since then.

Probability of Future events: medium (4%) to high (100%).

Impact: potential for significant losses.

Vulnerability: village residences and businesses, nursing home, town office.

Fluvial Erosion Summary

Location: roads on steeper hills throughout town.

Extent: Significant damage possible, but usually restricted to certain areas, not entire town.

Previous Occurrences: numerous, but not every year.

Probability of Future Events: medium (4%) to high (100%).

Impact: potential for significant losses, although new road maintenance practices are leading to a more resilient town road system.

Vulnerability: can result in temporarily closed roads.

- Winter Storm/Ice Storm/ Extreme Cold with Power Failure

A winter storm is defined as a storm that generates sufficient quantities of snow, ice or sleet to result in hazardous conditions and/or property damage. Ice storms are the result of cold rain that freezes on contact with the surfaces coating the ground, trees, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage and dangerous travel conditions. Periods of extreme cold can occur with or just after these events.

Heavy snow generally affects the entire town, although especially deep drifts are usually confined to certain areas depending on the prevailing winds during a particular storm. Ice storm damage can be confined to certain elevations or exposures or can be more generally spread throughout the town.

Glover maintains a fleet of road maintenance vehicles suitable for all aspects of summer and winter road maintenance. We have a skilled, well supervised road crew with some backup help

available as needed. The road crew stockpiles a generous quantity of sand for winter use on the 8 miles of paved and 43 miles of gravel road. Winter weather patterns of the last few years have required more use of sand than in past years. Sand is also made available for Glover residents to use on dangerous icy driveways and walks.

Glover relies on the VT Electric Cooperative, which supplies electricity to almost the entire town, to contract for the necessary power line right-of-way maintenance that helps insure against excessive winter storm power outages. The town road crew does respond after a storm to remove trees from the road as long as they are a safe distance from power lines. Timely work by the town crew helps utility crews get access to areas where tree removal from power lines and/or power line repairs are necessary.

The Glover Ambulance Squad maintains a list of town residents who are particularly vulnerable in conditions of limited road travel or winter power outages. Squad members are prepared to check on residents, provide some back-up generator capacity, clear heater vents of snow and ice and, in general, do what needs to be done.

Winter Storm/ Ice Storm Summary

Location: entire town, though heavy drifts or heaviest ice accumulation may be scattered according to exposure or elevation.

Extent: Significant damage possible, but often restricted to certain areas, not entire town.

Previous Occurrences: numerous, but not every year.

Probability of Future Events: medium (4%) to high (100%).

Impact: potential for significant damage to electric lines and increased workload for town road crew.

Vulnerability: can result in temporarily closed roads. Extended power outage may require shelters for at risk residents.

- Dam Failure

The dam at the outlet of Shadow Lake in Glover is rated as a Class 2, “significant hazard” dam based on a Dam-break Flood Analysis done in April 1991 done by Dubois & King of Randolph, VT for the U.S. Army Corps of Engineers and the VT Department of Environmental Conservation Dam Safety Program. The significant hazard rating is based on:

1. Loss of Life (few) and Extent of Development (no urban developments and no more than a small number of inhabitable structures).
2. Potential Economic Loss (appreciable) and Extent of Development (notable agriculture, industry or structures).

The general description given of the dam is:

“The dam is an earthen embankment with masonry headwalls and is approximately 129 feet in length. The maximum height is 11.5 feet and the crest width is 16 feet. The principal spillway is a gatehouse with stop logs and a three (3) foot diameter drain pipe. The emergency spillway is located to the left of the gatehouse and is a 33.5 ft. long, 15 ft. wide concrete chute. The

control section is set at an elevation of approximately 1392.6 National Geodetic Vertical Datum (NGVD). At normal water level the lake's surface area is 188 acres. The actual date of construction is unknown, however, the year 1929 is cast in the side of the spillway. The current primary purpose of the dam is recreational.”

The watershed for Shadow Lake is approximately 3,300 acres.

The most recent inspection of the dam, in September, 2012, by Stephen Bushman, P.E., Dam Safety Engineer, rates the overall condition of the dam as “poor” but notes that “commendable efforts are being made to clear the dam of trees and perform other maintenance items.” These maintenance items have since been completed and an updated *Emergency Action Plan for Shadow Lake Dam, Glover, VT* was adopted by the Glover selectboard on January 22, 2015.

Under *Spillway Hydraulic Capacity* the report states: “Shadow Lake Dam does appear to have adequate storage and hydraulic spillway capacity to route and pass the 100-year and ¼ PMF storm events without overtopping the dam; no resulting failure was assumed.”

The dam break analysis is limited to the area within 3 miles downstream of the dam. Within this area, in the event of a dam failure, 3 bridges on town roads and one private driveway bridge would be overtopped and one residence would be threatened with flooding. Glover Village is 1½ miles further downstream and the river valley is fairly confined so a dam failure at Shadow Lake would certainly impact Glover Village. The Barton river valley flattens and widens considerably between Glover Village and Barton Village.

The Emergency Action Plan calls for monitoring of the dam during normal conditions and during periods of heavy precipitation, flooding, or any unusual hydrologic events that might cause structural damage to the dam. The plan names a monitor and alternate monitor, provides an assessment checklist, specifies preventative action, and lists officials and downstream residents to contact in the event of imminent possible failure.

Dam Failure Summary

Location: along outlet stream of Shadow Lake and Barton River valley north through town and village.

Extent: Significant damage possible to bridges crossing the outlet stream and Barton River. Possible flooding of buildings closest to Barton River.

Previous Occurrences: none. The dam was cause for concern in the flood of 1927, was sandbagged, and survived. Upgrades were made in 1929.

Probability of Future Events: low (1% to 4%).

Impact: potential for significant damage to roads/bridges and buildings.

Vulnerability: could result in temporarily closed roads and evacuation of residents in flood prone areas.

Lake Parker

The Lake Parker dam is a Class 3 “low hazard” dam and, as such, is not considered in this Mitigation Plan.

4.3 Moderate Threat Hazards

- High Wind

High wind is defined as an event with sustained wind speeds of 40 m.p.h. or greater lasting for 1 hour or longer or an event with winds of 58 m.p.h. or greater for any duration. Thunderstorms can generate high winds and down hundreds of large trees within a few minutes.

Vermont can also experience tornadoes, which are capable of damaging or destroying structures, downing trees and power lines and creating injuries and death from collapsing buildings and flying objects. Tornadoes are less common than hail storms and high winds, but have occurred throughout Vermont. Across the State, however, 34 tornadoes have been recorded between 1950 and 1999, injuring 10 people and causing over \$8.4 million dollars in estimated property damage. Nearly all of these incidents occurred from May through August with most of occurring in the afternoon.

High Wind Summary

Location: throughout town, although usually restricted to certain exposures.

Extent: Significant damage possible to trees, power lines, building roofs.

Previous Occurrences: Glover sustained damage from high winds in 2004, 2006 and 2013 and a confirmed tornado touched down in West Glover in 2012.

Probability of Future Events: medium (4% to 100%).

Impact: usually limited, could be significant.

Vulnerability: possible road closings, power outage, personal injuries.

County Level Data. Information gathered from national level data banks on declared hazard events is predominantly county level data. When available data specific to Glover has been included.

FEMA DATA. (Federal Emergency Management Agency)

In the time period between 1973 and 2013 there were 15 major events declared disasters by FEMA for Orleans County. 10 of the 15 (67%) were due to severe storm activity with only 1 being a winter storm. 13 of the 15 (87%) involved extensive flooding damage. There were 2 emergency events declared: Hurricane Irene (also declared a major disaster) and the March 5 - 7, 2001 snowstorm.

MAJOR DISASTER DECLARATIONS: ORLEANS COUNTY

Declaration/Disaster #	DATE	TYPE
4163	12/20-26/2013	Severe winter storm
4140	6/25/2013-7/11/2013	Severe storm & flooding
4066	5/29/2012	Severe storm & flooding
4022	8/27/2011-9/2/2011	Tropical storm Irene
1995	4/23/2011-5/8/2011	Severe storm & flooding
1715	7/9/2007-7/11/2007	Severe storm & flooding
1559	8/12/2004-9/12/2004	Severe storm & flooding
1428	6/5/2002-6/13/2002	Severe storm & flooding
1307	9/16/1999-9/21/1999	Tropical storm Floyd

1228	6/17/1998-8/17/1998	Severe storm & flooding
1184	7/15/1997-7/17/1997	Excessive rainfall, high winds & flooding
1101	1/19/1996-2/2/1996	Storms & flooding
1063	8/4/1995-8/6/1995	Heavy rain & flooding
518	8/5/1976	Severe storm, high winds, flooding
397	7/6/1973	Severe storm, flooding, landslides

EMERGENCY DECLARATIONS: ORLEANS COUNTY

EM#	DATE	TYPE
8338	8/26/2011-9/2/2011	Hurricane Irene
3167	3/5/2001-3/7/2001	snowstorm

SHELDUS DATA. (Spatial Hazard Events & Losses Database for the United States)
 SHELDUS is a national hazard events database that gathers information from the National Climatic Data Center, the Storm Prediction Center, and the National Geophysical Data Center. The data set is county-level data for 18 different natural hazard events such as thunderstorms, hurricanes, floods, wildfires and tornadoes. It includes only those events that cause more than \$50,000 in damages or at least one death. As with the above FEMA data, SHELDUS shows that flooding and high winds stand out as the natural hazard type that causes the most damage for Orleans County.

STORM EVENTS - GLOVER 1998 - 2013

DATE	DETAILS
8/3/2004	Thunderstorm winds, trees blown down blocking some roads
6/10/2005	Locally very heavy rainfall, numerous roads washed out, flooding of farm fields
8/7/2006	Strong damaging winds, penny-size hail, knocked down trees & powerlines blocking access to Barton on RT 16
5/29/2012	Confirmed EFO (gale) tornado in W. Glover, hale greater than an inch in diameter, damaging winds, flash flooding, total rainfall of 3-5 inches
7/20/2013	Localized microburst, numerous trees down & shingle & roof damage

NOAA DATA. (National Oceanic & Atmospheric Administration)

NOAA documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce." For the Orleans County Zone (one of the National Weather Service forecast

zones) the majority of recorded regional events are due to winter storms and winter weather. However, the local Glover events are due to thunder storms, high winds, and flooding. Based on local and national data flooding and high winds account for the most damaging of all the natural hazards.

While the NOAA database contains data from January 1950 to October 2014, from 1950 through 1954 only tornado events were recorded. From 1955 through 1992 only tornados, thunderstorm wind and hail events were put into the digital database. And from 1993 through 1995 only tornado and thunderstorm wind and hail events were extracted from the unformatted text files. For Orleans County from 1958 through 1993 there were 16 listed thunderstorm and wind events, 6 hail events, and 3 tornado events.

The following chart shows the storms that were recorded as county-wide events.

DATE	EVENT TYPE
1-8-1998	Flash flood
3-29-1998	Flash flood
4-1-1998	Flash flood
4-4-2000	Flash flood
4-22-2001	Flash flood
9-27-2002	Heavy rain
10-26-2003	Heavy rain
8-12-2004	Heavy rain
7-8-2005	Heavy rain
8-30-2005	Heavy rain
5-19-2006	Flood

NOAA STORM EVENTS – GLOVER, VT, 2001 THROUGH 2013

DATE	EVENT TYPE	PROPERTY DAMAGE
8/3/2004	Thunder, wind	\$5,000
6/10/2005	Flash flood	\$50,000
8/7/2006	Thunder storm, wind	\$10,000
8/25/2007	Thunder storm, wind	\$5,000
5/29/20012	Thunder, wind, hail	\$5,000
5/29/20012	Flash flood	\$50,000
7/20/2013	Thunder, wind	\$15,000

NOAA SUMMARY INFO 2001 through 2013:

	GLOVER REGION	GLOVER
# of days with events	258	7
# of days with events & death	0	0

# of days with events & death or injury	0	0
# of days with events & property damage	218	7
# of days with events & crop damage	5	0
# of event types reported	17	5

CLIMATE CHANGE.

“Climate change, once considered an issue for a distant future, has moved firmly into the present. Corn producers in Iowa, oyster growers in Washington State, and maple syrup producers in Vermont are all observing climate-related changes that are outside our recent experience.”
National Climate Assessment Report 2014

Vermont experienced the warmest year on record in 2012. The year 2011 was the second wettest with extensive flooding in the spring and from Tropical Storm Irene in the fall. According to the Agency of Natural Resources Vt.’s average temperature has increased by 1.8 degrees F since 1970 with the winter temperature increasing faster than the summer temperature. Precipitation has increased by 15 - 20% over the past 50 years with 67% of this falling in heavy precipitation events. In 2006 the Northeast Kingdom went from a USDA Hardiness Zone 3 to a Zone 4 with the growing season increasing by 2 weeks. According to one model areas of the northeast near the Canadian border are projected to shift from having less than 5 to more than 15 days per year over 90 degrees F by the 2050s. Alan Betts, an independent atmospheric scientist living in Pittsford, Vt. describes what we can expect to see in the coming decades from the warming trend in our climate. Some of the changes include:

- Warmer winters with increased precipitation including more wet snow and freezing rain
- More overwintering pests
- Shortened ski, snowmobile, ice-fishing season
- Multiple melt events in winter with possible flooding
- Reduced productivity of sugar maples
- Hotter summers with more heat waves
- Summer/fall heavy rain events with more frequent floods
- Increased warm-weather pests – mosquitoes, ticks, and algae

These climate changes will impact agriculture, water, human health, energy, transportation, forests and our ecosystems and pose a growing challenge to the region’s environmental, social, and economic systems. As with other hazards it is important to take steps that will support the town and community to adapt to these changes. The Planning Commission will explore local interest in forming a town Energy Committee in order to support an increase in energy efficiency and conservation.

5. MITIGATION STRATEGY

Hazard Mitigation Strategies and Measures **avoid** the hazard by stopping or limiting new exposures in known hazard areas, **alter** the hazard by eliminating or reducing the frequency of occurrence, **avert** the hazard by redirecting the impact by means of a structure or land treatment, and **adapt** to the hazard by modifying structures or standards.

Existing authorities, policies, programs, and resources that support Town of Glover mitigation efforts:

- **Town Plan** - this document contains goals and objectives for community growth, health, safety and welfare for public and private interests. The Town Plan is drafted by the Planning Commission and adopted by the Selectboard.
- **NFIP** – National Flood Hazard Insurance Program – Glover is a member of the NFIP program. The NFIP is administered by FEMA.
- **Flood Regulations** – Glover adopted Flood Hazard Area Regulations in 1987, amended in 1991, to prevent increases in flooding caused by uncontrolled development of lands in areas of special flood hazards and to minimize losses to floods by restricting or prohibiting uses that are dangerous to health, safety or property in times of flood or cause excessive increase in flood heights or velocities; and requiring that uses vulnerable to floods, including public facilities that serve such uses, shall be protected against flood damage at the time of initial construction. Permits are issued by the Flood Hazard Area Administrative Officer. Appeals would be heard by a Board of Adjustment appointed by the Selectboard.
- **Town Road and Bridge Standards** – Glover has adopted the Vermont Transportation Agency’s new Town Road and Bridge Standards in 2014. This is perhaps the one of the most beneficial mitigation programs in Vermont. By adopting these codes, all maintenance and new construction on roads, highways, bridges and culverts must be enhanced to meet the new standards to withstand large flood events. Town road maintenance is the responsibility of the Glover Selectboard. Day-to-day operations are under the supervision of the Road Foreman. The road crew is comprised of the foreman and 2 additional full-time employees.
- **Bridge and Culvert Inventory** - Glover has performed a bridge and culvert inventory to assess the condition of its bridges and culverts. Maintenance of the inventory is the responsibility of the Road Foreman.
- **VTRC** - Vermont Red Cross has a Shelter Pre-Agreement with the community. Local representatives are trained to open a shelter if needed. This will allow for a more efficient use of the VT Red Cross if and when needed. The current Fire Chief is also the Emergency Manager.
- **Emergency Operation Plan (EOP)** – Glover, assisted by a grant and the Northeastern Vermont Development Association (NVDA) updated its EOP in 2005 to include all-hazards.
- **Local Emergency Operations Plan (LEOP)** – Glover has updated its LEOP as of April 10, 2014. The plan is kept up to date annually by the Emergency Manager and the Selectboard Chairman.
- **Emergency Training** - Fire and rescue personnel continue to participate in training.
- **Flood Resilience Planning** - A new Flood Resilience Plan is being prepared by Northwoods Stewardship Center as part of the Barton Hydro Study Municipal Planning Grant. Applicable elements of this plan will be incorporated into the Glover LHMP.

6. GLOVER'S GOALS

The goals of this Hazard Mitigation Plan are:

A. To take actions over the next five years to reduce the long-term risk to human life and property from flooding and fluvial erosion. After due consideration and consultation with the Selectboard and Road Foreman the Planning Commission has identified the mitigation actions listed below in Section 7 A as the most cost-effective means of mitigating the risk to life and property from flooding and fluvial erosion in the Town of Glover.

B. To take actions over the next five years to reduce the long-term risk to human life and property from winter storms and ice storms. After due consideration and consultation with the Selectboard and Road Foreman the Planning Commission has identified the mitigation actions listed below in Section 7 B as the most cost-effective means of mitigating the risk to life and property from winter storms and ice storms in the Town of Glover.

C. To take actions over the next five years to reduce the long term risk to human life and property due to dam failure. After due consideration and consultation with the Selectboard the Planning Commission has identified the mitigation actions listed below in Section 7 C as the most cost-effective means of mitigating the risk to life and property from dam failure in the Town of Glover.

These actions will be taken to help protect existing development in Glover. At this time there is relatively little development pressure in Glover and the development that is occurring is not occurring in the villages but in the rural sections of town. Since the adoption of the Flood Hazard Area Regulation for the Town of Glover in 1991 there has been very little change in the built environment of the Special Flood Hazard Area. The Planning Commission does not recommend changes to these regulations at this time.

The *Glover Town Plan* was adopted in 2006, renewed in 2011, and is scheduled to be updated for 2016. In the section on Emergency Services the following goals are listed on page 19:

“- Support current disaster mitigation planning to identify gaps in disaster planning such as increased flood resistance and drought protection, and work to eliminate gaps (in cooperation with federal and state agencies and surrounding communities).”

“- Update rapid response plans annually and send copies to Vermont emergency management.”

“- Continue active participation in Local Emergency Planning Commission District 10.”

Reconsideration of the Town Plan during 2015 & 2016 will offer an opportunity to integrate goals from the town's new Local Hazard mitigation Plan.

7. MITIGATION PROJECTS BY HAZARD TYPE

A. Hazard: Flooding and Fluvial Erosion

1. Mitigation Action: Identify and schedule bridge and culvert maintenance and upgrades, giving priority to those most vulnerable to washout or other damage during storm events or other periods of high flows

Local Leadership: Selectboard and Road Foreman

Prioritization: highest priority

Funding Resources: annual roads budget and state structures grants as available

Time Frame: 2015 – 2020

2. Mitigation Action: Utilize the Vermont Stream Alteration Permit process when replacing or installing new culverts and bridges as required by State Statute

Local Leadership: Selectboard and Road Foreman

Prioritization: Highest Priority

Funding Resources: annual roads budget and state structures grants as available

Time Frame: 2015 - 2020

3. Mitigation Action: Maximize use of FEMA Public Assistance 406 mitigation opportunities

Local Leadership: Selectboard and Road Foreman

Prioritization: highest priority

Funding Resources: FEMA and town funds

Time Frame: as available following declared disasters

4. Mitigation Action: Upgrade and maintain ditching along town roads, following state standards, to better protect roads and culverts from fluvial erosion

Local Leadership: Selectboard and Road Foreman

Prioritization: Highest Priority

Funding Resources: annual roads budget and Better Backroads grants as available

Time Frame: 2015 – 2020

B. Hazard: Winter Storm or Ice Storm

1. Mitigation Action: Maintain town equipment including plow trucks, grader, loader, emergency generator and chainsaws in top condition and ready to be used in winter emergencies

Local Leadership: Road Foreman and Selectboard

Prioritization: Highest Priority

Funding Resources: annual roads budget

Time Frame: 2015 – 2020

2. Mitigation Action: Maintain an adequate supply of diesel fuel and road sand for use in winter emergencies

Local Leadership: Road Foreman

Prioritization: Highest Priority

Funding Resources: annual roads budget

Time Frame: 2015 – 2020

3. Mitigation Action: Identify and remove hazard trees from Glover roadsides

Local Leadership: Tree Warden

Prioritization: Medium Priority

Funding Resources: annual budget

Time Frame: 2015 – 2020

C. Hazard: Dam Failure

1. Mitigation Action: Perform maintenance and upgrades of the Shadow lake Dam as recommended by the Dam safety Engineers of the Vermont department of Environmental Conservation

Local Leadership: Selectboard

Prioritization: Highest Priority

Funding Resources: annual budget

Time Frame: 2015 – 2020

2. Mitigation Action: Review and update the Emergency Action Plan for Shadow Lake Dam, Glover, VT

Local Leadership: Selectboard

Prioritization: Highest Priority

Funding Resources: not applicable

Time Frame: annually

7. Plan Maintenance Process

This Local Hazards Mitigation Plan will be reviewed by the Glover Planning Commission and Glover selectboard annually. The Selectboard will monitor the implementation of the Plan and the Planning Commission and Selectboard together will evaluate the effectiveness of the Plan.

As stated in the mitigation actions section above, funding will be provided by the annual budget which is recommended by the Selectboard to be considered the voters of the town at Town Meeting each year in early March. When available, funding will also be derived from state structures grants, Better back Roads grants, FEMA disaster recovery funding or any other appropriate funding source.

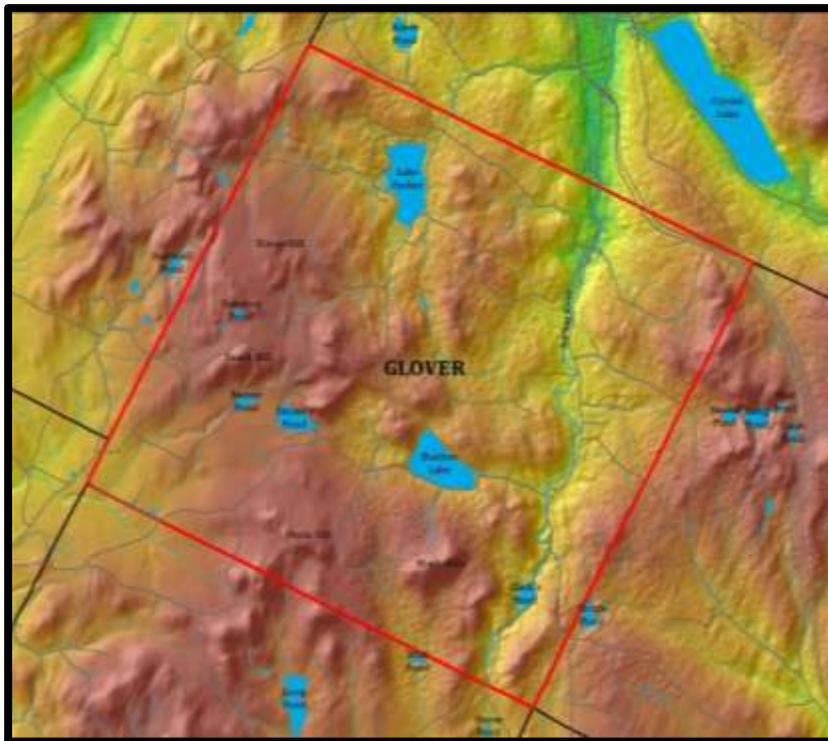
Consequent updates will be made if there have been significant events or changes that would trigger the need for new mitigation measures. The plan will be updated at least every five years, with the full update process beginning at least 1 year before the plan expires, to allow time for public involvement, comprehensive updates, and review by the State and FEMA.

1. Any changes will involve a draft update to be prepared and available for public comment.
2. Input from local officials, community members, and neighboring communities will be incorporated into the Plan.
3. The Glover Planning Commission and Selectboard will review the draft update and any comments and submit a copy to the Vermont Division of Emergency Management and Homeland Security (DEMHS) and FEMA Region 1 prior to plan expiration.
4. Any changes or recommendations from DEMHS or FEMA Region 1 will be considered for incorporation into the draft and the Selectboard will approve the updated report and make it available to the public.

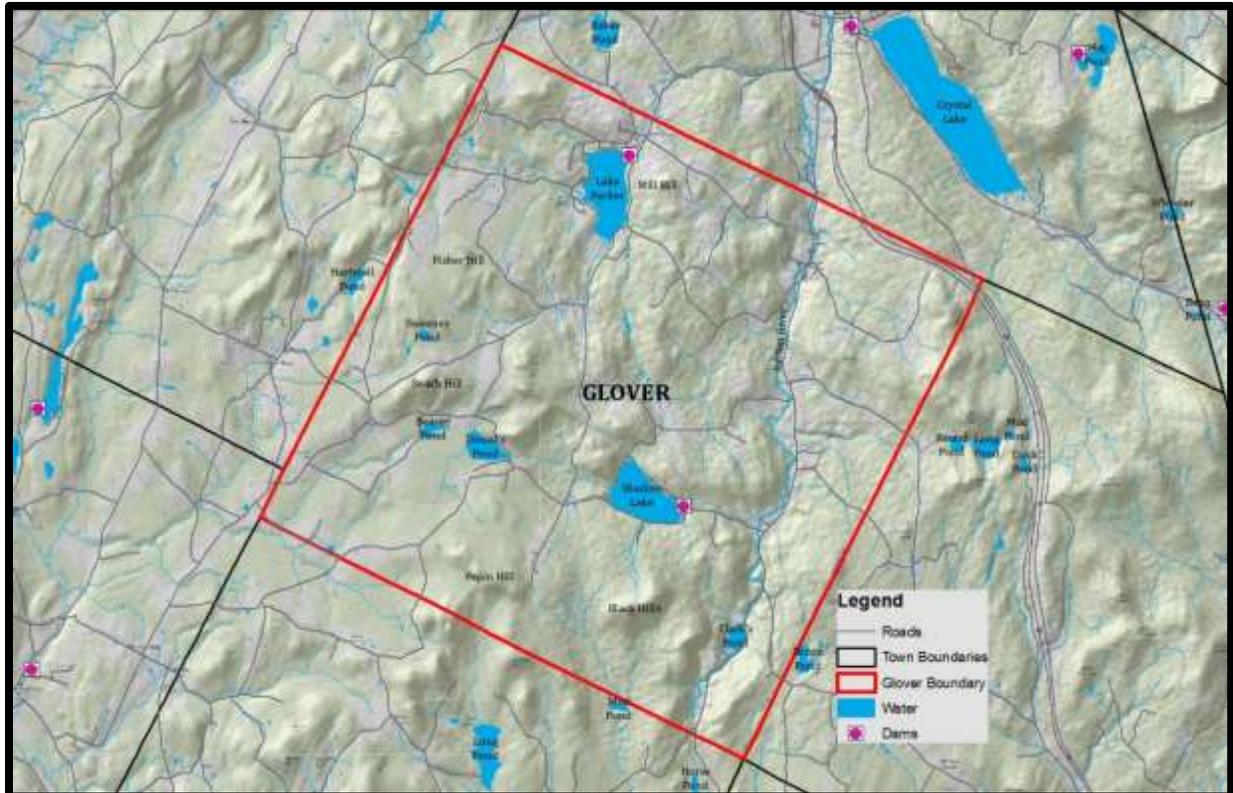
Appendix A: MAPS (Courtesy of Meghann Carter, NorthWoods Stewardship Center)



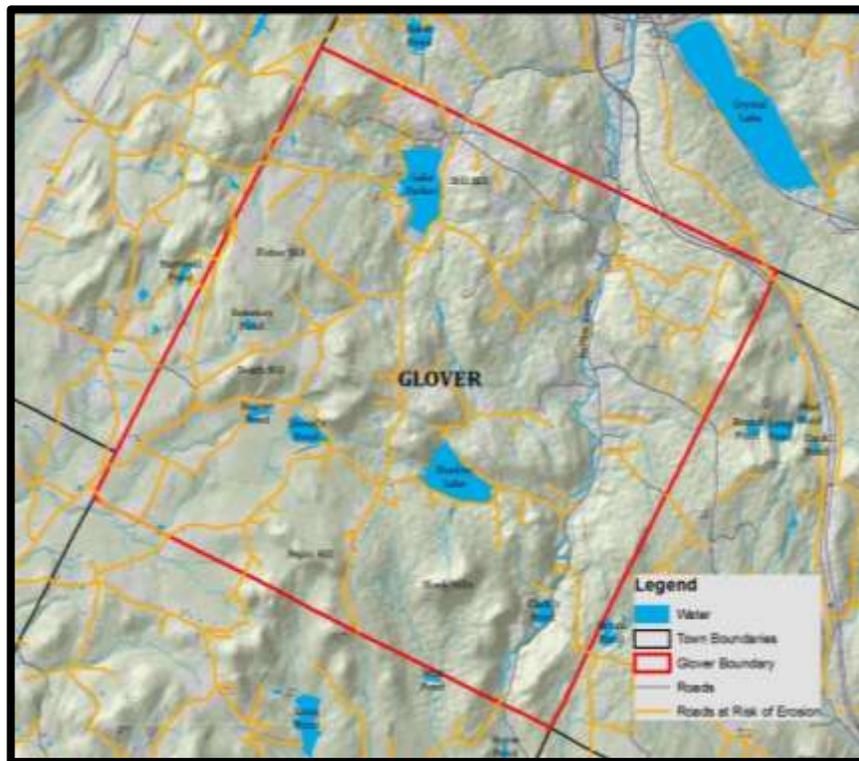
Glover Watersheds



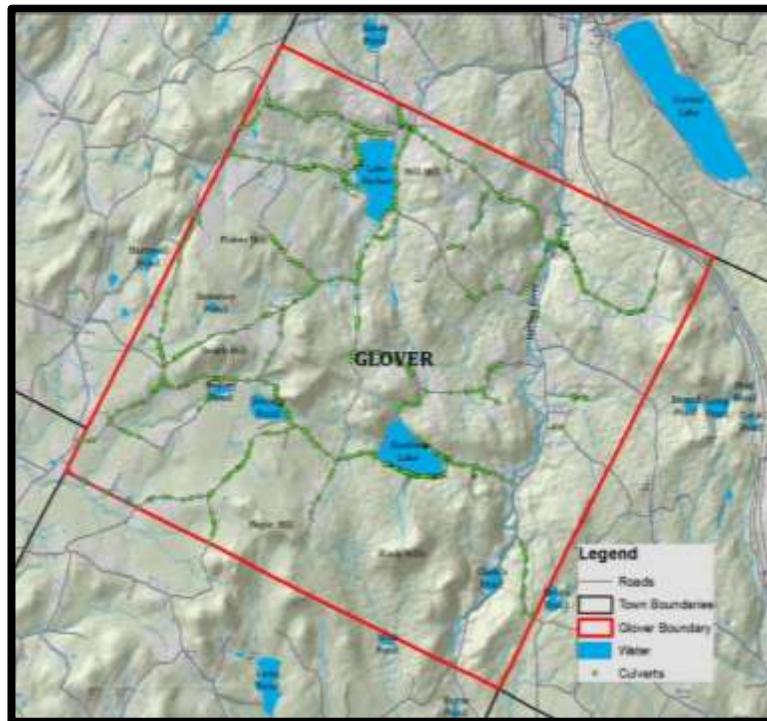
Glover Elevations



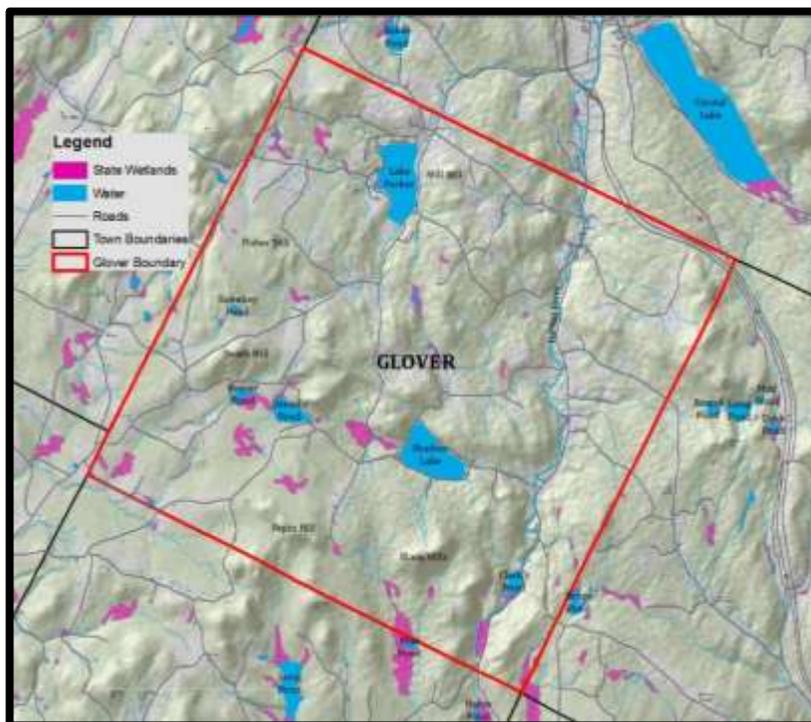
Lakes & Dams in Glover



Roads in Glover



Streams & Culverts in Glover



Uplands and Wetlands in Glover

Appendix B: SURVEY FORM

SURVEY
TOWN OF GLOVER MITIGATION PLAN

Do you know of any homes or businesses accessed by a private bridge?

Yes No Location:

Do you know of road sections that could be particularly at risk to washout?

Yes No Location:

Do you know of areas of steep slope and unstable rock or soil that might be subject to slope failure?

Yes No Location:

Do you know of any storm water run off rapidly causing a hazard?

Yes No Location:

Do you know any road sections where gravel runs off noticeably quickly and directly into ditches and streams?

Yes No Location:

Do you know of any homes or structures in particularly vulnerable locations?

Yes No Location:

Do you know of any home businesses or storage buildings in particularly vulnerable locations?

Yes No Location:

Do you know of any hazardous materials stored in particularly vulnerable locations?

Yes No Location:

Would you be interested in volunteering during an emergency situation?

Yes No Name:

Physical Address:

Phone Numbers:

Thank you for taking the time to complete this survey. The information you have provided is appreciated by the Town of Glover.

The Town of Glover Planning Commission