5.4.4 LANDSLIDE

This section provides a profile and vulnerability assessment for the landslide hazard.

HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

A landslide is the process that results in the downward and outward movement of slope-forming materials (NYS Geological Survey, Date Unknown). Landslide materials can be composed of natural rock, soil, artificial fill or any combination of these materials (NYS HMP, 2011). The materials move by falling, toppling, sliding, spreading, or flowing (NYS Geological Survey, Date Unknown).

Landslides are caused by one or a combination of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. Landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 33-percent
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel.

Landslides are typically triggered by other natural hazards, such as earthquakes, heavy rain, floods or wildfires. Frequency of landslides is often related to the frequency of these other hazards. They can occur suddenly or slowly. Assessing the geology, vegetation, and amount of predicted precipitation for an area can assist in predicting landslides. Warning signs for landslide activity include:

- Springs, seeps or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavement or sidewalk
- Soil moving away from foundations
- Ancillary structures, such as decks and patios, tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees retaining walls or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity
- Sudden increase in crook water levels though rain is still failing or just recently ended
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears

- Unusual sounds, such as trees cracking or boulders knocking together (USGS, 2009).

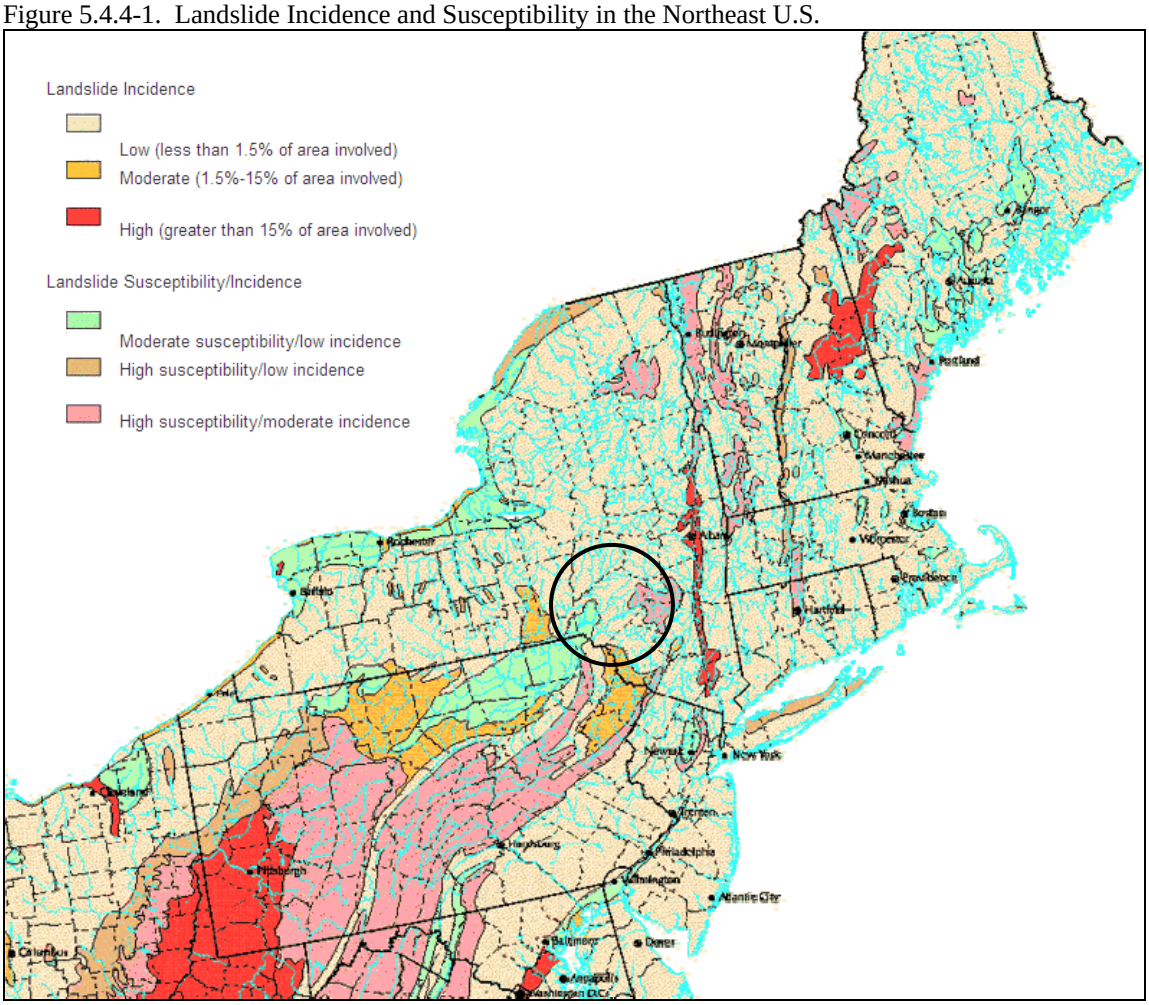
Extent

To determine the extent of a landslide hazard, the affected areas need to be identified and the probability of the landslide occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, the landslide hazard is often represented by landslide incidence and/or susceptibility, defined below:

- Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15-percent of a given area has been involved in landsliding; medium incidence means that 1.5 to 15-percent of an area has been involved; and low incidence means that less than 1.5-percent of an area has been involved. (Geological Hazards Program, Date Unknown).
- Landslide susceptibility is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of landsliding (Geological Hazards Program, Date Unknown).

Figure 5.4.4-1 depicts the landslide incidence and susceptibility of the northeastern U.S., identifying areas that have the potential for landslides. These areas are determined by correlating some of the principal factors that contribute to landsliding, such as steep slopes, weak geologic units that lose strength when saturated, and poorly drained rock or soil, with the past distribution of landslides.

Figure 5.4.4-1. Landslide Incidence and Susceptibility in the Northeast U.S.



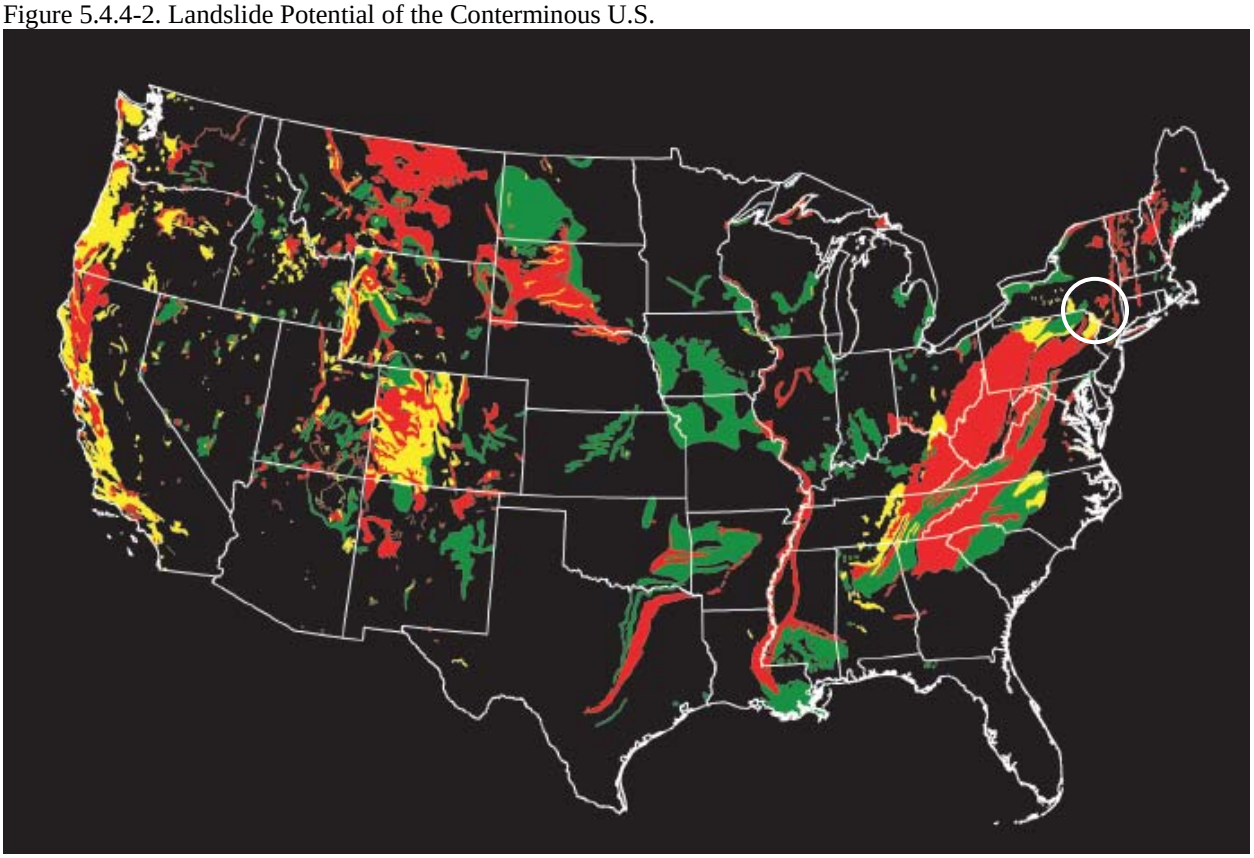
Source: USGS, 1982
Note: The circle indicates the approximate location of Delaware County.

Figure 5.4.4-1 was created by including two primary characteristics that define landslide probability: terrain slopes and soil makeup or type. Most of New York State's soils consist of dense glacial till which stands up well to landslide tendency. However, certain types of soil exist throughout the State that has a risk of landslide susceptibility and incidence. For example, glacial lake clay soils which are abundant throughout New York State have a higher risk for landslide occurrence. As for the terrain, typically, the steeper the slope, the higher the risk for landslide occurrence, assuming other conditions that lead to landslides are present. However, according to the New York State Geological Survey, landslides can occur with very little slope. Delaware County has an overall low landslide incidence; however, some parts of the County have moderate susceptibility/low incidence and high susceptibility/moderate incidence (NYS HMP, 2011).

Location

The entire U.S. experiences landslides, with 36 states having moderate to highly severe landslide hazards. Expansion of urban and recreational developments into hillside areas leads to more people being threatened by landslides each year (USGS, 2011). Figure 5.4.4-2 illustrates the potential for landslides in the U.S.

Figure 5.4.4-2. Landslide Potential of the Conterminous U.S.

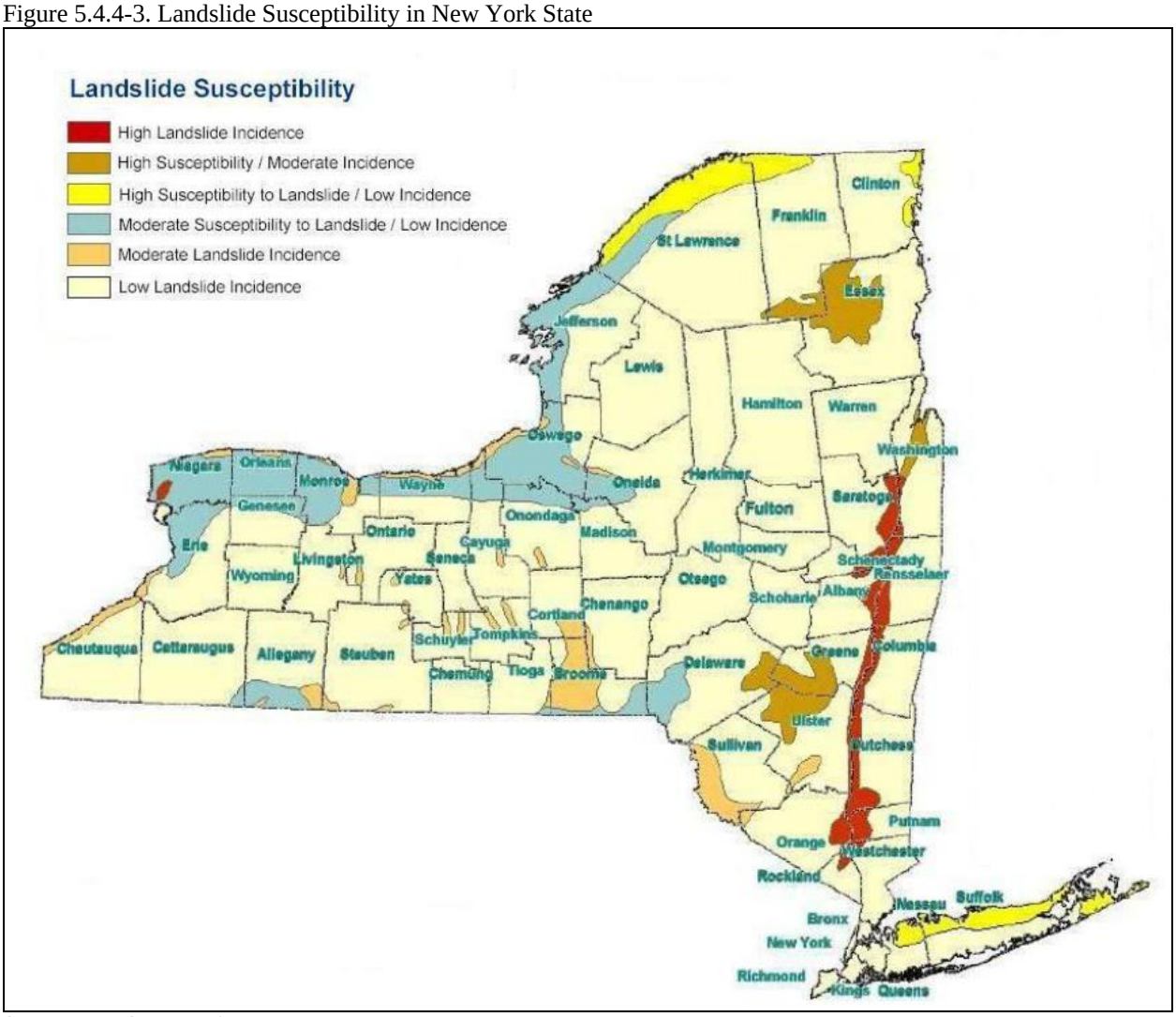


Source: USGS, 2005

Note: Red areas have very high potential, yellow areas have high potential, and green areas have moderate potential. Landslides can and do occur in the black areas, but the potential is low. Map not to scale. Circle indicates the approximate location of Delaware County.

The potential for landslides does exist throughout the entire northeast U.S., which includes New York State. Scientific and historical landslide data indicate that some areas of northern and eastern New York State have a substantial landslide risk. However, compared to other states, New York State is not identified as a state with having a serious landslide threat. According to information provided by USGS and NYSGS, it is estimated that 80-percent of New York State has a low susceptibility to landslide hazard. In general, the highest potential for landslides can be found along major rivers and lake valleys that were formerly occupied by glacial lakes resulting in glacial lake deposits (glacial lake clays) and usually associated with steeper slopes. A good example of this is the Hudson and Mohawk River Valley (NYS HMP, 2011). Figure 5.4.4-3 shows the landslide susceptibility overview map of New York State. Overall, Delaware County has a low landslide incidence; however, the southwestern portion has a moderate susceptibility/low incidence and the eastern portion has a high susceptibility/moderate incidence (NYS HMP, 2011).

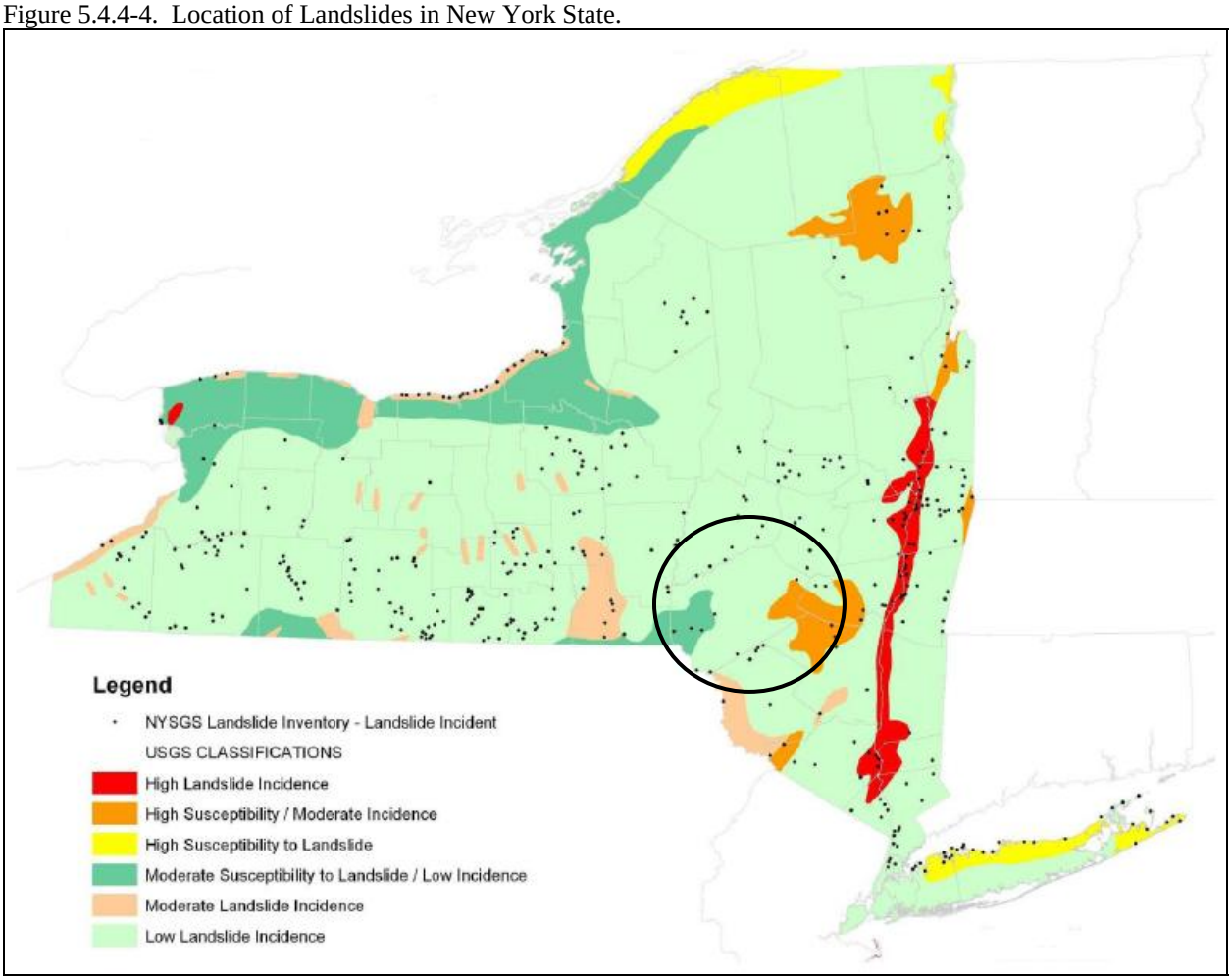
Figure 5.4.4-3. Landslide Susceptibility in New York State



Source: NYS HMP, 2011

Figure 5.4.4-4 shows the location of landslide incidents in New York State.

Figure 5.4.4-4. Location of Landslides in New York State.



Source: NYS HMP, 2011
Note: The circle indicates the approximate location of Delaware County. Delaware County has had approximately seven landslide incidents.

As previously stated, areas with steep slopes are more prone to landslide occurrences. Within Delaware County, the Town of Walton has portions of steep slopes, in excess of 15-percent. These areas are located near the Town/Village boundary (Town of Walton Comprehensive Plan, 2006). In the Town of Tompkins, steep slopes of over 15-percent dominate much of the Town (Town of Tompkins Comprehensive Plan, 2004). The Town of Middletown has large areas of steep slopes of greater than 25-percent, cut by valleys. To the east of the East Branch of the Delaware River, there are large areas of steep slopes and ridges. To the west, the topography of the Town is less steep (less than 15-percent) (Town of Middletown Comprehensive Plan, 2010). In the Town of Harpersfield, the ridgelines are made up of glacial tills on slopes greater than 15-percent. Approximately two-percent of the total land area in the Town contains slopes that would pose moderate to severe building limitations. Approximately 11.5 acres of the total land area has slopes of greater than 25-percent (Town of Harpersfield Comprehensive Plan, 2003).

Previous Occurrences and Losses

Between 1837 and 2008, 326 landslides occurred and were reported in New York State. During this time frame, Delaware County experienced six landslides. However, no other information has been provided regarding these six incidences.

Probability of Future Events

As indicated in the NYS HMP, given the history of landslide occurrences in New York State, it is certain that future landslides will occur. Therefore, the probability of future landslides in New York State is considered high. However, the severity of landslides cannot be determined. Using documented historical occurrences from the New York State Geological Survey (NYSGS)'s Landslide Inventory Study to estimate the probability of future landslides, New York State can expect on average approximately two major landslides each year, a greater number of smaller but still significant slides/slumps/flows each year and at least one landslide causing a fatality, is expected once every 12 years. Although historical data indicates a high frequency of landslide occurrence, the NYSGS estimates that 80-percent of the State has a low susceptibility to landslides. The frequency of damaging landslides within and adjacent to New York State has been and can be classified, relative to other higher risk states, as low. However, the fact that high landslide susceptibility exists and landslides have occurred in the past suggests that the states infrastructure and many people are at risk from damaging landslide hazards in New York State.

In Section 5.3, the identified hazards of concern for Delaware County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for landslides in the County is considered 'Frequent' (likely to occur more than once every 25 years, as presented in Table 5.3-3).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following section discusses the potential impact of the landslide hazard on Delaware County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of County residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Vulnerability to ground failure hazards is a function of location, soil type, geology, type of human activity, use, and frequency of events. The effects of landslides on people and structures can be lessened by total avoidance of hazard areas or by restricting, prohibiting, or imposing conditions on hazard-zone activity. Local governments can reduce landslide effects through land use policies and regulations. Individuals can reduce their exposure to hazards by educating themselves on past hazard history of the site and by making inquiries to planning and engineering departments of local governments (National Atlas, 2007).

Data and Methodology

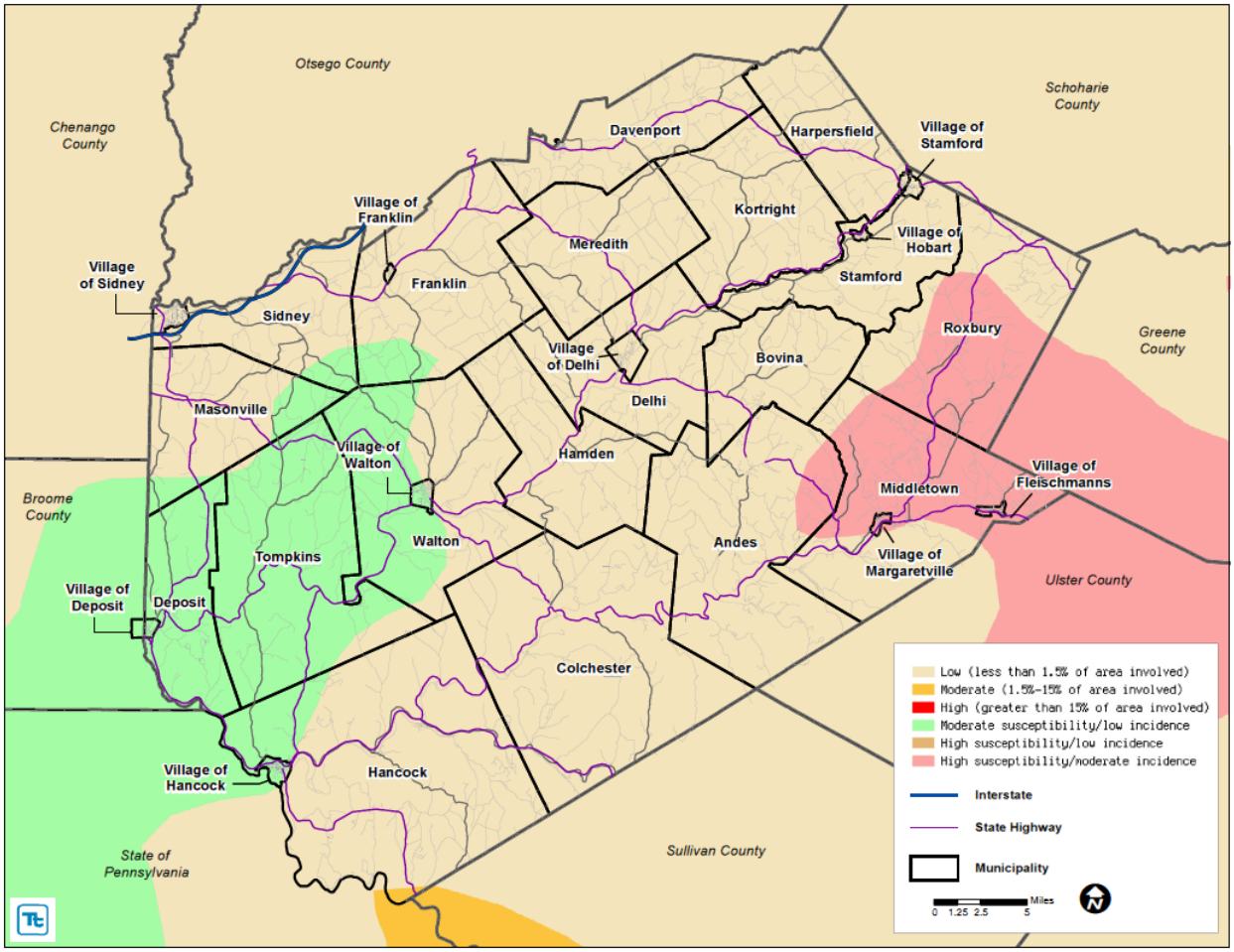
Unlike the flood, wind and earthquake hazards, there are not any standard loss estimation models or methodologies for the landslide hazard. In an attempt to estimate the County's vulnerability to this hazard of concern, two different sets of data were used 1) the Geology - Landslide Incidence and Susceptibility GIS layer from National Atlas to coarsely define the general ground failure susceptible area (herein "approximate hazard area") in Delaware County (Figure 5.4.4-X) and 2) a landslide susceptibility map generated for Delaware County following the pilot study outlined in the Draft 2011 NYS HMP for Schenectady County, New York to identify more specific landslide vulnerable areas in each community.

According to Radbruch-Hall et.al., the Landslide Incidence and Susceptibility GIS layer from National Atlas '….was prepared by evaluating formations or groups of formations shown on the geologic map of the United States (King and Beikman, 1974) and classifying them as having high, medium, or low landslide incidence (number of landslides) and being of high, medium, or low susceptibility to landsliding. Thus, those map units or parts of units with more than 15 percent of their area involved in landsliding were classified as having high incidence; those with 1.5 to 15 percent of their area involved in landsliding, as having medium incidence; and those with less than 1.5 percent of their area involved, as having low incidence. This classification scheme was modified where particular lithofacies are known to have variable landslide incidence or susceptibility. In continental glaciated areas, additional data were used to identify surficial deposits that are susceptible to slope movement. Susceptibility to landsliding was defined as the probable degree of response of the areal rocks and soils to natural or artificial cutting or loading of slopes or to anomalously high precipitation. High, medium, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. For example, it was estimated that a rock or soil unit characterized by high landslide susceptibility would respond to widespread artificial cutting by some movement in 15 percent or more of the affected area. We did not evaluate the effect of earthquakes on slope stability, although many catastrophic landslides have been

generated by ground shaking during earthquakes. Areas susceptible to ground failure under static conditions would probably also be susceptible to failure during earthquakes' (Radbruch-Hall, 1982).

As noted in the 2011 NYS HMP, the GIS layer of the approximate hazard area was overlaid upon the 2010 Census population and general building stock data available in HAZUS-MH 2.0 and the County's critical facility inventory. The Census blocks with their center within the hazard area were used to estimate the population and building stock exposed to this hazard. The limitations of this analysis are recognized and are only used to provide a general estimate. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

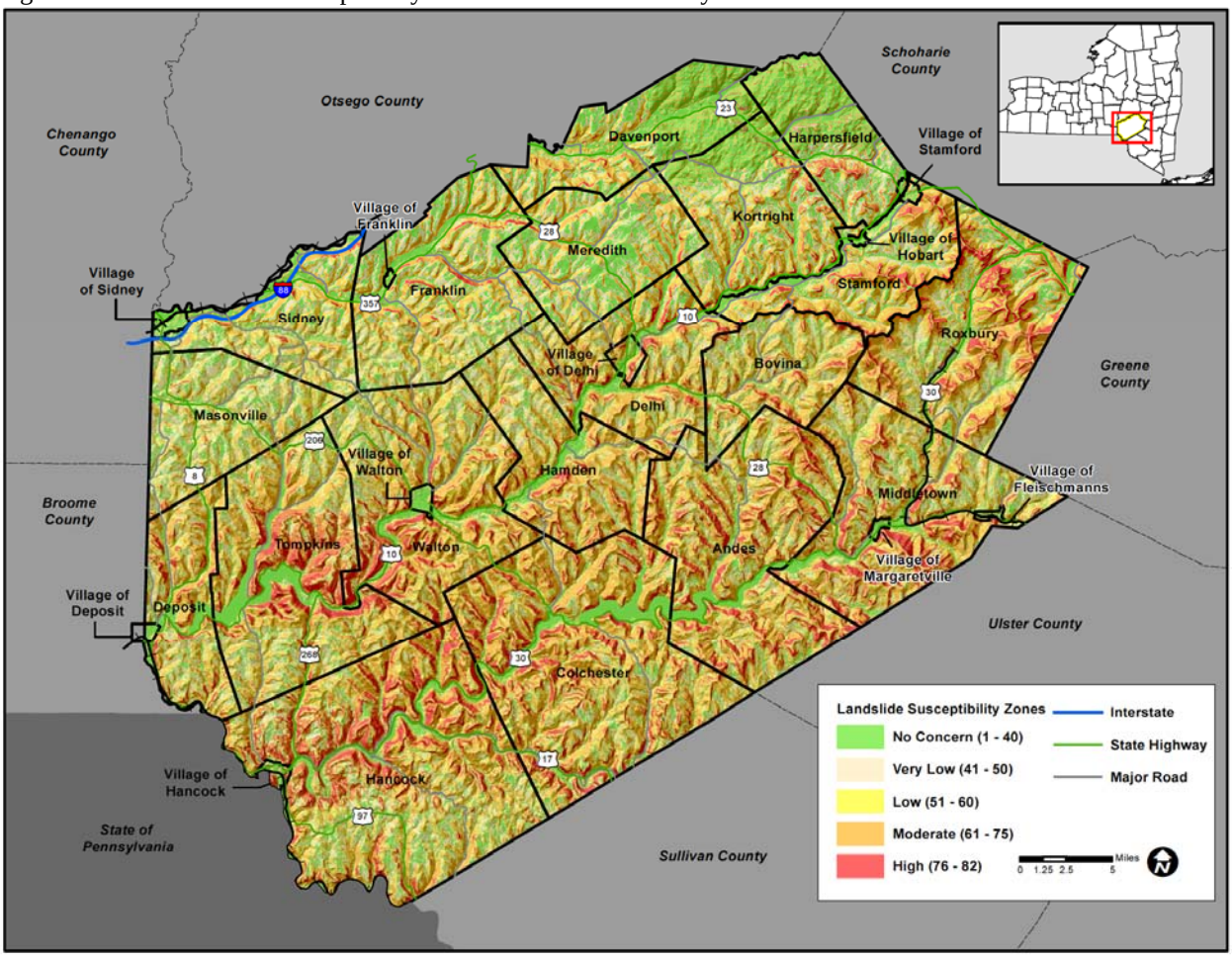
Figure 5.4.4-5. Landslide Hazard Area in Delaware County



Source: Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)

To assist Delaware County in identifying more specific vulnerable areas in each municipality, a landslide susceptibility map was generated following the pilot study outlined in the Draft 2011 NYS HMP for Schenectady County. Soil properties in Delaware County from the U.S. Department of Agriculture Natural Resource Conservation Service's SSURGO Digital Soil Survey were used along with slope calculated using the best available digital elevation models for the County. A landslide vulnerability map for each municipality is located in their respective annex (refer to Section 9) displaying the landslide susceptible zones calculated as part of this analysis along with the locations of critical facilities. Figure 5.4.4-6 illustrates the detailed landslide susceptibility zones in Delaware County using this methodology.

Figure 5.4.4-6. Landslide Susceptibility Zones in Delaware County



Source: Tetra Tech, 2012

Impact on Life, Health and Safety

To estimate the population located within the landslide hazard areas, the approximate hazard area boundaries were overlaid upon the 2010 Census population data (U.S. Census, 2010). As seen in Figure 5.4.4-6, the majority of the County is located in the 'low' risk hazard area. The Census blocks with their center (centroid) within the boundary within the high or moderate susceptibility hazard areas were used to calculate the estimated population exposed to this hazard. In summary, approximately 8,469 people are located within the moderate susceptibility to landslides/low incidence hazard area which includes areas in the Towns of Deposit, Franklin, Hancock, Masonville, Sidney, Tompkins and Walton and the Villages of Deposit, Hancock and Walton. There are approximately 5,191 people located within the high susceptibility to landslides/moderate incidence hazard area within the Towns of Andes, Middletown, Roxbury and Stamford and the Villages of Fleischmanns and Margaretville. Table 5.4.4-1 summarizes the Delaware County population exposed to this hazard by municipality (U.S. Census 2000).

Impact on General Building Stock

As noted above, there are no standard loss estimation models for the landslide hazard. In general, the built environment located in the high susceptibility zones and the population, structures and infrastructure located downslope are vulnerable to this hazard. In an attempt to estimate the general building stock vulnerable to this hazard, the associated building replacement values (buildings and contents) were

determined for the identified Census blocks within the approximate hazard area. In summary, nearly 30% of the general building stock is vulnerable. Table 5.4.4-2 lists the replacement value (structure and contents) of general building stock exposed to this hazard.

Table 5.4.4-1. Estimated Population Exposed and Vulnerable to Landslides in Delaware County

Municipality	Total Population (Census 2000)	Estimated Population Exposed	% of Total	Hazard Area*
Andes (T)	1,356	127	9.4	High Susceptibility/ Moderate Incidence
Bovina (T)	664	0	0.0	Low (less than 1.5% of the area)
Colchester (T)	2,046	0	0.0	Low (less than 1.5% of the area)
Davenport (T)	2,774	0	0.0	Low (less than 1.5% of the area)
Delhi (T)	2,046	0	0.0	Low (less than 1.5% of the area)
Delhi (V)	2,583	0	0.0	Low (less than 1.5% of the area)
Deposit (T)	803	803	100	Moderate Susceptibility/ Low Incidence
Deposit (V)	1,939	1,939	100	Moderate Susceptibility/ Low Incidence
Fleischmanns (V)	308	308	100	High Susceptibility/ Moderate Incidence
Franklin (T)	2,219	250	11.3	Moderate Susceptibility/ Low Incidence
Franklin (V)	402	0	0.0	Low (less than 1.5% of the area)
Hamden (T)	1,280	0	0.0	Low (less than 1.5% of the area)
Hancock (T)	2,216	421	19.0	Moderate Susceptibility/ Low Incidence
Hancock (V)	1,217	925	76.0	Moderate Susceptibility/ Low Incidence
Harpersfield (T)	1,045	0	0.0	Low (less than 1.5% of the area)
Hobart (V)	291	0	0.0	Low (less than 1.5% of the area)
Kortright (T)	1,633	0	0.0	Low (less than 1.5% of the area)
Margaretville (V)	536	536	100	High Susceptibility/ Moderate Incidence
Masonville (T)	1,405	149	10.6	Moderate Susceptibility/ Low Incidence
Meredith (T)	1,588	0	0.0	Low (less than 1.5% of the area)
Middletown (T)	3,207	2,758	86.0	High Susceptibility/ Moderate Incidence
Roxbury (T)	2,509	1,539	61.3	High Susceptibility/ Moderate Incidence
Sidney (T)	2,073	104	5.0	Moderate Susceptibility/ Low Incidence
Sidney (V)	4,068	0	0.0	Low (less than 1.5% of the area)
Stamford (T)	1,652	0	0.0	Low (less than 1.5% of the area)
Stamford (V)	558	0	0.0	Low (less than 1.5% of the area)
Tompkins (T)	1,109	1,077	97.1	Moderate Susceptibility/ Low Incidence
Walton (T)	2,533	1,699	67.1	Moderate Susceptibility/ Low Incidence
Walton (V)	3,070	1,202	39.2	Moderate Susceptibility/ Low Incidence
Delaware County	**49,130**	13,801	28.1	--

Source: HAZUS-MH 2.0; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)
Note: * If multiple hazard areas are present in the municipality, the highest ranked area is listed.

Table 5.4.4-2. General Building Stock Exposed and Vulnerable to Landslides in Delaware County

Municipality	Total GBS RV in Municipality	Total GBS RV Exposed	% of Total	Residential GBS RV Exposed	Commercial GBS RV Exposed
Andes (T)	$252,234,000	$17,809,000	7.1	$17,083,000	$338,000
Bovina (T)	$123,665,000	$0	0.0	$0	$0
Colchester (T)	$311,970,000	$0	0.0	$0	$0
Davenport (T)	$258,713,000	$0	0.0	$0	$0
Delhi (T)	$255,930,000	$0	0.0	$0	$0
Delhi (V)	$421,060,000	$0	0.0	$0	$0
Deposit (T)	$87,244,000	$86,844,000	99.5	$79,124,000	$7,158,000
Deposit (V)	$282,948,000	$282,948,000	100	$129,848,000	$106,122,000
Fleischmanns (V)	$67,135,000	$67,135,000	100	$43,008,000	$19,662,000
Franklin (T)	$228,869,000	$27,607,000	12.1	$23,521,000	$3,072,000
Franklin (V)	$44,114,000	$0	0.0	$0	$0
Hamden (T)	$169,106,000	$0	0.0	$0	$0
Hancock (T)	$287,811,000	$45,804,000	15.9	$29,658,000	$11,992,000
Hancock (V)	$175,325,000	$151,768,000	86.6	$65,563,000	$55,479,000
Harpersfield (T)	$100,244,000	$0	0.0	$0	$0
Hobart (V)	$34,768,000	$0	0.0	$0	$0
Kortright (T)	$191,923,000	$0	0.0	$0	$0
Margaretville (V)	$92,097,000	$92,097,000	100	$47,318,000	$27,223,000
Masonville (T)	$139,908,000	$23,388,000	16.7	$16,605,000	$1,642,000
Meredith (T)	$178,080,000	$0	0.0	$0	$0
Middletown (T)	$476,361,000	$417,361,000	87.6	$346,742,000	$42,173,000
Roxbury (T)	$424,341,000	$289,397,000	68.2	$218,874,000	$49,277,000
Sidney (T)	$204,357,000	$11,625,000	5.7	$11,625,000	$0
Sidney (V)	$577,306,000	$0	0.0	$0	$0
Stamford (T)	$299,277,000	$0	0.0	$0	$0
Stamford (V)	$91,808,000	$0	0.0	$0	$0
Tompkins (T)	$126,345,000	$120,717,000	95.5	$98,516,000	$13,160,000
Walton (T)	$230,761,000	$138,695,000	60.1	$122,086,000	$13,062,000
Walton (V)	$416,797,000	$185,542,000	44.5	$73,011,000	$52,432,000
Delaware County	**$6,550,497,000**	**$1,958,571,000**	**29.9**	**$1,322,582,000**	**$402,792,000**

Source: HAZUS-MH 2.0; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)
Note (1): GBS = General Building Stock. RV = Replacement Value.
Note (2): The total building count and total replacement values are the sum of all seven general occupancy classifications (residential, commercial, industrial, agricultural, religious, government and educational) for that jurisdiction.
Note (3): The valuation of general building stock and loss estimates determined in Delaware County were based on the default general building stock database provided in HAZUS-MH 2.0.

Due to a lack of data regarding past losses specific to Delaware County or its municipalities, it is not possible at this time to estimate potential future losses to landslide events.

Impact on Critical Facilities

The approximate landslide hazard area was used to identify the essential and municipal facilities located in within the identified susceptible areas to landslides. Table 5.4.4-3 lists these essential and municipal facilities (i.e., police, fire, EOCs and hospitals).

Table 5.4.4-3. Emergency Critical Facilities Susceptible to Landslides in Delaware County

Type	Name	Municipality
Police	(Future) NYS Trooper	Deposit (T)
Municipal	Town of Deposit Town Garage	Deposit (T)
School	DEPOSIT CENTRAL SCHOOL	Deposit (V)
Police	Deposit Village PD	Deposit (V)
EOC	EOC	Deposit (V)
Fire/EMS	Deposit VFD and EMS	Deposit (V)
Senior	Meadow Park Apartments	Deposit (V)
Municipal	Town of Deposit Town Hall	Deposit (V)
School	School Building	Fleischmanns (V)
Fire	Fleischmanns VFD	Fleischmanns (V)
Municipal	Village Hall and Library	Fleischmanns (V)
Municipal	DPW Garage	Fleischmanns (V)
School	HANCOCK CENTRAL SCHOOL	Hancock (V)
Police	Hancock Village PD	Hancock (V)
Senior	Read Senior Housing	Hancock (V)
Municipal	New Highway Garage	Hancock (V)
Shelter	Shelter - Hancock Central School Messenger Hall	Hancock (V)
Municipal	Town of Hancock Muni Hall	Hancock (V)
Municipal	Village Municipal Hall	Hancock (V)
School	MARGARETVILLE CENTRAL SCHOOL	Margaretville (V)
EMS	Margaretville Memorial Hospital (Ambu)	Margaretville (V)
Fire	Arkville VFD	Margaretville (V)
Fire	Margaretville VFD	Margaretville (V)
Senior	Mountainside Residential Care Center	Margaretville (V)
Municipal	Fairview Library	Margaretville (V)
Municipal	DPW Garage	Margaretville (V)
Municipal	Municipal Hall	Margaretville (V)
Fire	Halcottsville VFD	Middletown (T)
Senior	Arkville Senior Apartments	Middletown (T)
Municipal	Patrol Garage	Middletown (T)
School	MANHATTAN COUNTRY SCHOOL	Roxbury (T)
School	ROXBURY CENTRAL SCHOOL	Roxbury (T)
Fire	Roxbury VFD	Roxbury (T)
Senior	Kirkside Adult Home	Roxbury (T)
Municipal	Old Highway Garage	Roxbury (T)
Municipal	New Highway Garage	Roxbury (T)

Type	Name	Municipality
Fire	Trout Creek VFD	Tompkins (T)
Police	DEP (Beerston)	Walton (T)
School	WALTON CENTRAL SCHOOL	Walton (V)
Police	NYS Armory	Walton (V)
Fire	Walton VFD	Walton (V)
Senior	Mountainview Estates	Walton (V)

Source: Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)

Impact on the Economy

Landslide's impact on the economy and estimated dollar losses are difficult to measure. As stated earlier, landslides can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, ground failure threatens transportation corridors, fuel and energy conduits and communication lines (USGS, 2003). Estimated potential damages to general building stock can be quantified as discussed above. For the purposes of this analysis, general building stock damages are discussed further.

Direct building losses are the estimated costs to repair or replace the damage caused to the building. The estimated replacement value of general building stock located in landslide susceptible areas is nearly $2 billion. This estimate represents 30% of the total building stock value inventory in the County. These dollar value losses to the County's total building inventory replacement value would impact Delaware County's tax base and the local economy.

Future Growth and Development

As discussed in Section 4 and Volume II, Section 9, areas targeted for future growth and development have been identified across the County. It is anticipated that new development within the identified hazard area will be exposed to such risks.

Additional Data and Next Steps

Obtaining historic damages to buildings and infrastructure incurred due to landslides will help with loss estimates and future modeling efforts, given a margin of uncertainty. A validation of the landslide vulnerability model generated for this plan can be performed by comparing locations of past events to the model to see if the model predicts these areas as high or highest susceptibility.

Overall Vulnerability Assessment

Landslides can significantly impact the County's population health and safety, general building stock and economy. The overall hazard ranking determined for this Plan for the landslide hazard is "High", (see Table 5.3-6).