**4-13: Hail**

Hail is a form of precipitation composed of spherical lumps of ice. Known as hailstones, these ice balls typically range from 5-50 mm in diameter on average, with much larger hailstones forming in severe thunderstorms (see: Wind). The size of hailstones is a direct function of the severity and size of the thunderstorm by which it is produced. No matter the size, hail can damage property, young and tender plants, and cause bodily harm to those unfortunate enough to be caught outside.

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| --- | --- | --- | --- | --- |
| **Table 39: TORRO Hailstorm Intensity Scale** | | | | |
|  | **Intensity Category** | **Typical Hail**  **Diameter (mm)** | **Probable Kinetic**  **Energy (J/m2)** | **Typical Damage Impacts** |
| **H0** | Hard Hail | 5 | 0-20 | No damage |
| **H1** | Potentially Damaging | 5-15 | >20 | Slight general damage to plants, crops |
| **H2** | Significant | 10-20 | >100 | Significant damage to fruit, crops, vegetation |
| **H3** | Severe | 20-30 | >300 | Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored |
| **H4** | Destructive | 25-40 | >500 | Widespread glass damage, vehicle bodywork damage |
| **H5** | Destructive | 30-50 | >800 | Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries |
| **H6** | Destructive | 40-60 |  | Bodywork of grounded aircraft dented, brick walls pitted |
| **H7** | Destructive | 50-75 |  | Severe roof damage, risk of serious injuries |
| **H8** | Destructive | 60-90 |  | Severe damage to aircraft bodywork |
| **H9** | Super Hailstorm | 75-100 |  | Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open |
| **H10** | Super Hailstorm | >100 |  | Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open |
| *Source:* [*https://www.torro.org.uk/research/hail/hscale*](https://www.torro.org.uk/research/hail/hscale) | | | | |

Hailstorms usually occur in Vermont during the summer months and generally accompany passing thunderstorms. While local in nature, these storms can be significant to area farmers, who can lose entire fields of crops in a single hailstorm. Large hail is also capable of property damage, including both structures and vehicles. Hailstone size can range from the size of a pea to the size of a melon (Table 40).

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| **Table 40: Hail Size and Diameter in Relation to TORRO Scale** | | |
| **Size Code** | **Maximum Diameter (mm)** | **Description** |
| **0** | 5-9 | Pea |
| **1** | 10-15 | Mothball |
| **2** | 16-20 | Marble, grape |
| **3** | 21-30 | Walnut |
| **4** | 31-40 | Pigeon’s egg > squash ball |
| **5** | 41-50 | Golf ball > Pullet’s egg |
| **6** | 51-60 | Hen’s egg |
| **7** | 61-75 | Tennis ball > cricket ball |
| **8** | 76-90 | Large orange > Soft ball |
| **9** | 91-100 | Grapefruit |
| **10** | >100 | Melon |
| *Source:* [*https://www.torro.org.uk/research/hail/hscale*](https://www.torro.org.uk/research/hail/hscale) | | |

Location

Hail can occur anywhere in Vermont. See hail history below for details on locations of previous occurrences.

Hail History

There have been 626 hail events in Vermont since 2000, causing over $585,000 in property damage and $261,000 in documented crop damage[[1]](#footnote-2). The largest recorded hail was 3.3” in Westford in July 2009, with an estimated $100,000 in damages. The second largest hail event was in June 2011, with recorded hail of 3.25” in Shaftsbury.

Hail is considered a relatively infrequent occurrence in Vermont. Those hail events that do occur tend to be highly localized and limited to a relatively small area. Table 41 is a summary of all hail events between 2000 and 2022.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 41: Hail Events Summary: 2000-2022** | | | | |
| **Hail Size** | **Days with an Event** | **Impacted Jurisdictions** | **Property Damage** | **Crop Damage** |
| 3-3.5” | 2 | Shaftsbury, Westford | $50,000 | $50,000 |
| 2.5-2.99” | 3 | Duxbury, Moretown, Westford | $40,000 | $20,000 |
| 2.0-2.49” | 7 | Bellows Falls, East Brookfield, Fairfax Falls, (MPV)-Montpelier ARPT, New Haven Mills, Swanton  West Dover | $45,000 | $20,000 |
| 1.75-1.99” | 26 | Alburg, Bellows Falls, Bethel, Brandon, Brookfield, Castleton, Center Rutland, Danville, East Barnard, East Burke, East Dover, Enosburg Center, Fayston, Franklin, Irasburg, Irasville, Jonesville, Lower Waterford, Lunenburg, Mill VLG, Morgan Center, New Haven, Newfane, North Hero, Orleans, Passumpsic, Peru, Pittsfield, Proctor, Richford, Shaftsbury, South Wallingford, St. Johnsbury, St. Johnsbury Center, Waitsfield, Warren, West Barnet, West Waterford, Westford, Westminster | $286,000 | $1,000 |
| 1.5-1.74” | 21 | Bowman Corners, Bradford, Burlington, Charlotte, Chittenden, East Montpelier Center, Egypt, Essex JCT, Fair Haven, Greensboro, Ira, Johnson, Lyndonville, Milton, Moretown, New Haven Mills, Newark Hollow, Northfield, Peacham, Richford, Rutland, Shaftsbury, Shelburne, South Starksboro, Underhill, Underhill Center, West Addison, West Fairlee Center, Weybridge | $105,000 | $0 |
| 1.25-1.49” | 22 | Albany, Benson, Bethel, Bridport, Bristol, Burlington, East Arlington, East Burke, Fayston, Halifax, Highgate Spgs, Lowell, Middlebury ARPT, Milton, Newport, Passumpsic, Pittsfield, Richford, Richmond, Riverside, Sheldon, Shoreham, South Richford, South Starksboro, St. Johnsbury, St. Johnsbury Center, Sunderland, Taftsville, West Lincoln, West Waterford, Westford | $0 | $20,000 |
| 1.0-1.24” | 96 | Addison County, Bennington County,  Caledonia County, Chittenden County, Essex County, Franklin County, Grand Isle County, Lamoille County, Orange County, Orleans County,  Rutland County, Washington County, Windham County, Windsor County | $46,000 | $150,000 |
| 0.87-0.99” | 62 | Addison County, Bennington County, Caledonia County, Chittenden County, Essex County, Franklin County, Grand Isle County, Lamoille County, Orange County, Orleans County, Rutland County, Washington County, Windham County, Windsor County | $6,000 | $0 |
| 0.75-0.86” | 63 | Addison County, Bennington County, Caledonia County, Chittenden County, Essex County, Franklin County, Grand Isle County, Lamoille County, Orange County, Orleans County, Rutland County, Washington County, Windham County, Windsor County | $2,000 | $0 |
| *Source: https://www.ncdc.noaa.gov/stormevents/* | | | | |

Hail Trends

The Steering Committee considers the probability of hail to be Likely, given the frequency with which Vermont has some form of hail event. Relative to Vermont’s other hazards, the impact from hail is considered to be negligible to infrastructure, life, the economy and the environment. Overall hail ranked lowest compared to all other natural hazards that can impact Vermont in the 2023 hazard assessment.

According to the 2018 National Climate Assessment, though there is an observable increase in severity of winter storms, changes in the frequency or severity of hail events are still uncertain but are being extensively studied[[2]](#footnote-3).

**Vulnerability**

**People**

With an average hail size of 5-50 mm in Vermont, there is a chance that residents could be injured on impact. The largest recorded hail size in Vermont history was about 84 mm, and although no one was injured or killed, it is possible that another future event could produce similarly damaging hail. People without access to shelter during hailstorms are particularly vulnerable to potential injury or death, which includes unhoused populations. Farmers may also be more vulnerable to hailstorms than other groups of people. Loss of crops or livestock during such events can significantly impact farmers’ financially and overall well-being.

**Built Environment**

Since 2000, hailstorms in Vermont have caused about $585,000 in property damage. Buildings, homes, and cars can be significantly damaged by hailstorms as hail size increases, depending on the material with which they were built. For instance, vinyl siding on homes is popular due to its ability to withstand wind, but it can be damaged easily by large hailstones[[3]](#footnote-4). Cars are subject to body damage such as scratches and dents, as well as shattered glass if hailstones are large enough.

**Natural Environment**

Hail has the potential to damage tender vegetation. Hail can tear through leaves, destroy seedlings, impact stems and bark, and cause damage to fruits[[4]](#footnote-5). Hail damage to vegetation affects their ability to create energy necessary to maintain life and can increase chances of infection[[5]](#footnote-6).

**Economy**

Although significant hailstorms occur relatively infrequently, they are still important to consider, given Vermont’s primarily agrarian economy. As mentioned above, significant hail events can lead to extensive crop damage, which can negatively impact Vermont’s many farms. Since 2000, hailstorms have caused $261,000 in crop damage, a majority of which is attributed to hail size between 1.0-1.24” and 3-3.5” respectively. Larger hailstones have a greater chance of destroying crop fields, but it is evident with the hailstones sized 1.0-1.24” causing $150,000 in damage since 2000 that it depends on the severity of the storm.

While hail can directly damage these crops, other aspects of Vermont’s economy may be indirectly affected. There have been reports of hailstorms destroying entire hay fields and cornfields. These crops are usually used to feed animals, thus dairy farms and other farms that breed livestock can also be affected. This can cause a domino effect increasing prices of feed for livestock, which in turn increases the price of milk and other dairy products, further impacting the economy.

Hail Current Capabilities and Mitigation

Due to the unpredictability of hailstorms and the negligible impacts to infrastructure, life, the economy and the environment, there is little in the way of hail mitigation in Vermont. Most efforts related to hail are in the response and recovery sectors, not mitigation.

However, implementation of certain actions within the Plan will address hail (see: Mitigation Strategy), such as the strategy an assessment to better understand the impacts from hazard events on the unhoused and a review of nationwide building codes (to include residential and energy codes) to determine what codes could be best suited to Vermont, including standards for new construction and best practices for existing buildings (e.g., weatherization, retrofit - tied into manufactured housing) - integration into existing Vermont codes, including impacts to frontline communties.

1. <https://www.ncdc.noaa.gov/stormevents/> [↑](#footnote-ref-2)
2. <https://nca2018.globalchange.gov/chapter/2/> [↑](#footnote-ref-3)
3. <https://www.hanover.com/resources/tips-individuals-and-businesses/prepare-now-learn-how/understanding-effects-hailstorms> [↑](#footnote-ref-4)
4. <https://www.fdacs.gov/content/download/11354/file/pp347.pdf> [↑](#footnote-ref-5)
5. <https://myswingle.com/hail-damage-tree-shrubs/> [↑](#footnote-ref-6)